IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

DAINGEAN TECHNOLOGIES LTD. *Plaintiff*, v. T-MOBILE USA, INC., T-MOBILE US, INC., and SPRINT CORP. *Defendants*.	§ § § § § § § § § § § §	CIVIL ACTION NO. 2:23-CV-00347 JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Daingean Technologies Ltd. ("Daingean" or "Plaintiff") hereby submits this Complaint for patent infringement against Defendants T-Mobile USA, Inc. ("TUSA"), T-Mobile US, Inc. ("TUS"), and Sprint Corp. ("Sprint") (collectively, "TMO" or "Defendants") and states as follows:

THE PARTIES

1. Daingean Technologies Ltd., ("Daingean" or "Plaintiff") is a company duly organized and existing under the laws of Ireland with its principal place of business at The Hyde Building, Suite 23, The Park, Carrickmines, Dublin 18, Ireland.

2. On information and belief, TUSA is a Delaware corporation with a principal place of business at 12920 Southeast 38th Street, Bellevue, Washington 98006. On information and belief, TUSA may be served through its registered agent, Corporation Service Company, 211 E. 7th Street, Suite 620, Austin, Texas 78701.

3. On information and belief, TUS is a Delaware corporation with its principal place of business at 12920 Southeast 38th Street, Bellevue, Washington 98006. On information and belief, TUS may be served through its registered agent for service, Corporation Service Company, 251 Little Falls Drive, Wilmington, Delaware 19808.

4. On information and belief, Sprint is a Delaware corporation with its principal place of business at 6391 Sprint Parkway, Overland Park, Kansas 66251. On information and belief, Sprint may be served through its registered agent for service, Corporation Service Company, 251 Little Falls Drive, Wilmington, DE 19808.

5. On information and belief, TUSA is a wholly owned subsidiary of TUS.

6. On information and belief, Sprint is a wholly owned subsidiary of TUSA.

7. TMO operates one or more wireless telecommunications networks to provide wireless telecommunications services in the United States under brand names including, but not limited to, "T-Mobile" and "Sprint."

NATURE OF THE ACTION

8. This is a civil action for infringement of U.S. Patent No. 8,576,803 ("the '803 Patent"), U.S. Patent No. 10,484,976 ("the '976 Patent"), U.S. Patent No. 10,841,958 ("the '958 Patent"), U.S. Patent No. 10,932,207 ("the '207 Patent"), U.S. Patent No. 11,134,400 ("the '400 Patent") and U.S. Patent No. 11,196,509 ("the '509 Patent") (collectively, the "Asserted Patents"), arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq*.

JURISDICTION AND VENUE

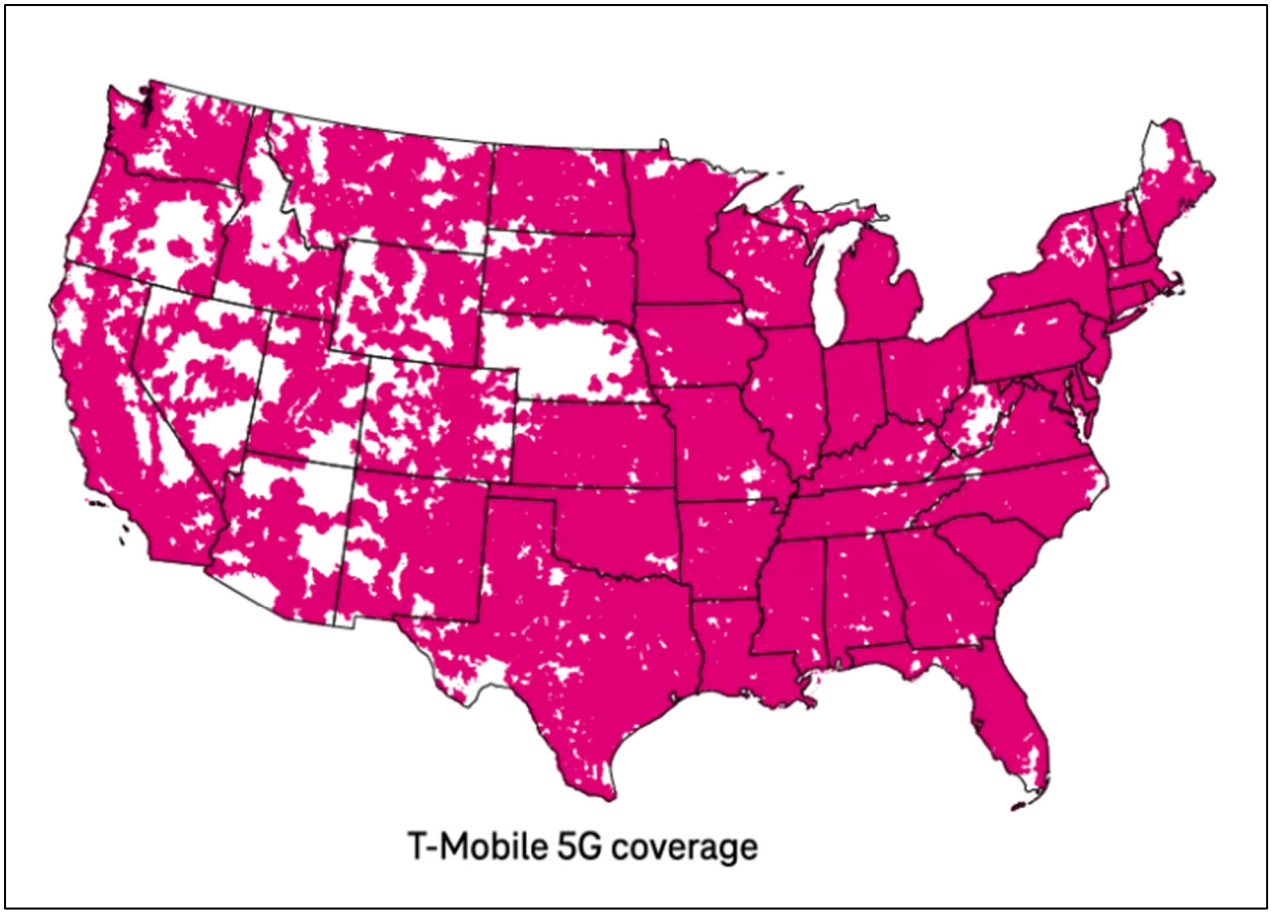
9. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 101 *et seq.*

10. On information and belief, TMO's operations in the Eastern District of Texas are substantial and varied.

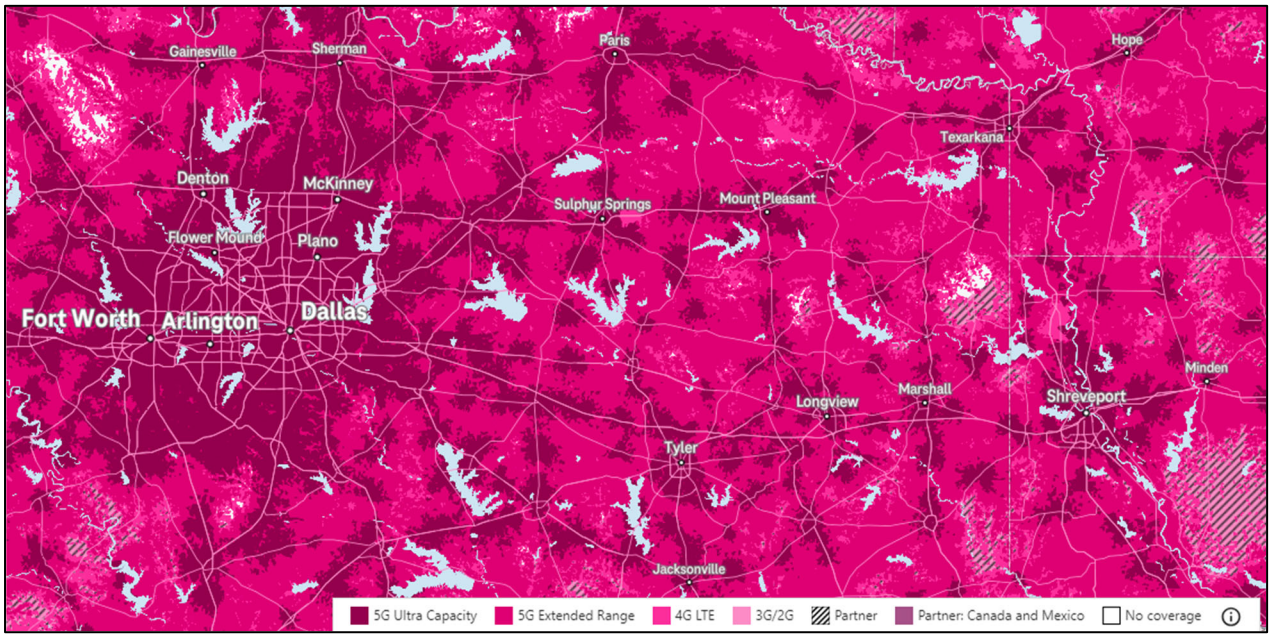
11. TMO operates one or more wireless telecommunications networks to provide wireless telecommunications services in Texas, including within the Eastern District of Texas under the brand name "T-Mobile" and previously "Sprint."

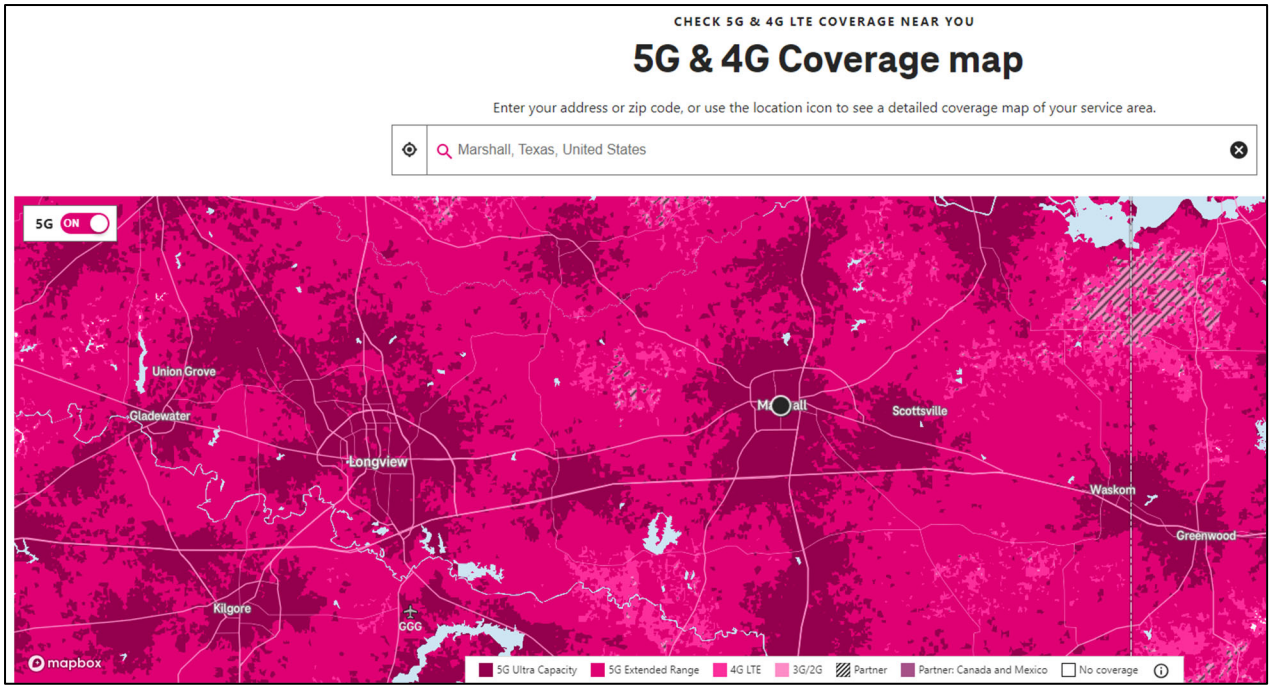
12. TMO advertises that it has "America's largest and fastest 5G network."[1] TMO advertises that its 5G wireless network (including both 5G Ultra Capacity and 5G Extended Range) is available in the United States and within the Eastern District of Texas.[2]

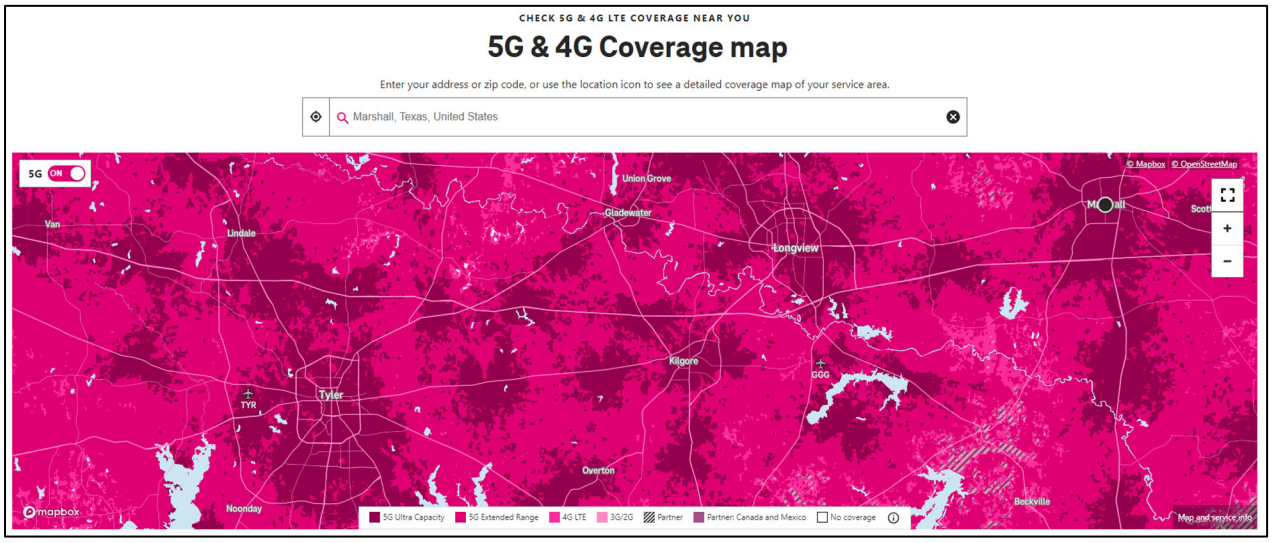
[1] *See, e.g.*, https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).
[2] *See, e.g.*, https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).



T-Mobile 5G coverage







13. Numerous T-Mobile retail stores are located within this judicial district, including in Allen, Athens, Beaumont, Denton, Frisco, Kilgore, Longview, Lufkin, Marshall, McKinney, Nacogdoches, Sulphur Springs, Texarkana, and Tyler.[3] TMO uses these stores to sell telecommunications services provided via the TMO networks and that infringe the Asserted Patents

[3] *See, e.g.*, https://www.t-mobile.com/stores/locator (last visited July 11, 2023).

(as discussed below). These stores are physically located within the district, are regular and established places of business of TMO with signage of TMO, and actively market TMO's wireless services.

14. On information and belief, TMO maintains and operates research and development facilities at 7668 Warren Parkway, Frisco, TX 75034.[4]

BUSINESS › REAL ESTATE

Hundreds of Metro by T-Mobile workers moving to new Frisco headquarters

Workers from T-Mobile marketing, IT, engineering, human resources and finance will also be relocated from Richardson.

Metro by T-Mobile is moving its headquarters to the Duke Bridges VII building on the Dallas North Tollway at Warren Parkway. (T-Mobile)

TMO has admitted that T-Mobile USA, Inc. maintains an office building at that address.[5]

15. TMO has numerous employees who work in the State of Texas and in this judicial district.

[4] https://www.dallasnews.com/business/real-estate/2020/03/18/hundreds-of-t-mobile-workers-moving-to-new-frisco-headquarters/ (last visited July 11, 2023).
[5] *Telecom Network Solutions, LLC v. T-Mobile USA, Inc., et. al*, 2:21-CV-418, Dkt. 27 at ¶13 (E.D. Tex.).

16. TMO has solicited business in the State of Texas, transacted business within the State of Texas and attempted to derive financial benefit from residents of the State of Texas, including benefits directly related to the instant patent infringement cause of action set forth herein.

17. TMO has manufactured, used, sold, and/or offered for sale the T-Mobile and Sprint Networks, including 5G Ultra Capacity and 5G Extended Range, in the State of Texas and this judicial district.

18. At the time of filing of this Complaint, the T-Mobile Networks, including 5G Ultra Capacity and 5G Extended Range, are available to consumers in Texas, including within this judicial district.

19. The T-Mobile Networks, which are available in this judicial district, are accused of infringement in this Complaint.

20. T-Mobile derives benefits from its presence in this federal judicial district, including, but not limited to, sales revenue. For example, T-Mobile receives revenue from its corporate stores in this district, by selling network access, products (*e.g.*, phones, tablets, smart watches, etc.), and services and by receiving payment for its network access, products, and services.

21. TMO's commission of acts of infringement and the presence of TMO retail stores in the Eastern District of Texas establishes venue over TMO under 28 U.S.C. § 1400(b). *See, e.g.*, *Intellectual Ventures II LLC v. FedEx Corp.*, Case No. 16-cv-980-JRG, 2017 WL 5630023, at *6–7 (E.D. Tex. Nov. 22, 2017) (Gilstrap, J.) (venue proper based on defendant's "physical retail and service locations").

22. In other recent actions, TMO has either admitted or not contested that this federal judicial district is a proper venue for patent infringement actions against it. *See, e.g.,* Answer to First Amended Complaint, at 2-3, ¶¶ 7-10, *Fractus, S.A. v. AT&T Mobility LLC et al.*, No. 2:18-cv-

00135-JRG (E.D. Tex. Dec. 13, 2018), ECF No. 116; Answer at 2, ¶¶ 4, 5, *Preferential Networks IP, LLC v. T-Mobile US, Inc. et al.*, No. 2:17-cv-00626 (E.D. Tex. Nov. 01, 2017), ECF No. 17; Answer ¶¶ 4, 5, *Traxcell Techs., LLC v. T-Mobile, USA, Inc.*, No. 2:17-cv-00720 (E.D. Tex. Jan. 23, 2018), ECF No. 8; Answer ¶¶ 5, 6, *Kevique Tech., LLC v. T-Mobile USA, Inc.*, No. 2:17-cv-00095 (E.D. Tex. Apr. 11, 2017), ECF No. 10; Answer to Amended Complaint ¶ 14, *Barkan Wireless IP Holdings, L.P. v. T-Mobile US, Inc. et al.*, No. 2:21-cv-00034 (E.D. Tex. Apr. 12, 2021), ECF No. 36. Defendant TUSA has also admitted or failed to contest that it has transacted business in this district. *See Preferential Networks* at Answer at 2, ¶ 4; *Traxcell Techs.* at Answer ¶ 2; *Kevique Tech.* at Answer ¶¶ 5, 6. *See also* Answer to First Amended Complaint ¶¶ 19, 20, *Mobile Synergy Sols., LLC v. T-Mobile US, Inc. et al.,* No. 6:16-cv-01223 (E.D. Tex. Feb. 13, 2017), ECF No. 47.

23. Venue as to TMO is proper in this judicial district under 28 U.S.C. §§1391(b)-(c) and 1400(b) at least because TMO has committed acts of infringement in this judicial district and has a regular and established place of business in this judicial district. Each Defendant makes, uses, sells, offers to sell, and/or imports products and/or services accused of infringement in this case into and/or within this judicial district and maintains a permanent and/or continuing presence within this judicial district. On information and belief, each Defendant has transacted and, at the time of the filing of the Complaint, is continuing to transact business within this judicial district.

24. TMO is subject to personal jurisdiction under the provisions of the Texas Long Arm Statute, TX CIV. PRAC. & REM CODE § 17.041 *et seq.*, by virtue of the fact that, upon information and belief, TMO has availed itself of the privilege of conducting and soliciting business within this State, including engaging in at least some of the infringing activities in this State, as well as by others acting as TMO's agents and/or representatives, such that it would be reasonable

for this Court to exercise jurisdiction consistent with principles underlying the U.S. Constitution, and the exercise of jurisdiction by this Court would not offend traditional notions of fair play and substantial justice.

25. On information and belief, TMO has also established minimum contacts with this judicial district and regularly transacts and does business within this district, including advertising, promoting and selling products and/or services in its stores, over the internet, through intermediaries, representatives and/or agents located within this judicial district, that infringe the asserted patents. On further information and belief, TMO has purposefully directed activities at citizens of this State including those located within this judicial district. On information and belief, TMO derives substantial revenue from the goods and services it provides to individuals in the state of Texas and in this judicial district.

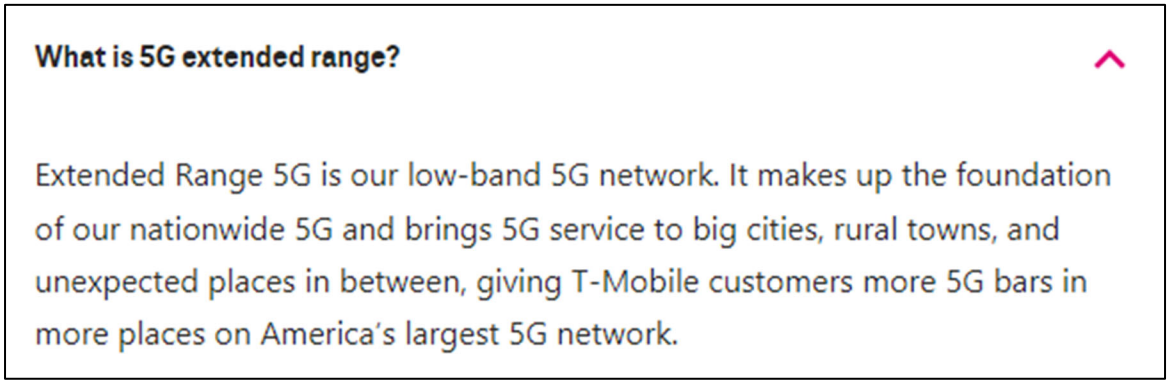
26. On information and belief, TMO has purposefully and voluntarily placed its products and/or services into the stream of commerce with the expectation that they will be purchased and used by customers located in the State of Texas and the Eastern District of Texas. On information and belief, TMO's customers in the Eastern District of Texas have purchased and used and continue to purchase and use TMO's products and/or services.

27. Defendants are properly joined under 35 U.S.C. § 299(a)(1) because, as set forth in greater detail below, on information and belief, Defendants commonly and/or jointly make, use, sell, offer to sell, and/or import infringing instrumentalities, such that at least one right to relief is asserted against Defendants jointly, severally, and in the alternative with respect to the same transactions, occurrences, or series of transactions or occurrences relating to the making, using, selling, offering to sell, and/or importing into the United States the same accused instrumentalities, as set forth in greater detail herein.

28. Defendants are properly joined under 35 U.S.C. § 299(a)(2) because, as set forth in greater detail below, on information and belief, Defendants make, use, sell, offer to sell in, and/or import into the United States the same or similar accused instrumentalities, such that questions of fact that are common to all Defendants will arise in this action.

BACKGROUND

29. TMO advertises that it operates "America's largest and fastest 5G network."[6] TMO states that "our powerful Extended Range 5G covers 325 million Americans nationwide—including over 90% of US highway miles."[7] Extended Range 5G is TMO's low-band 5G network.[8]



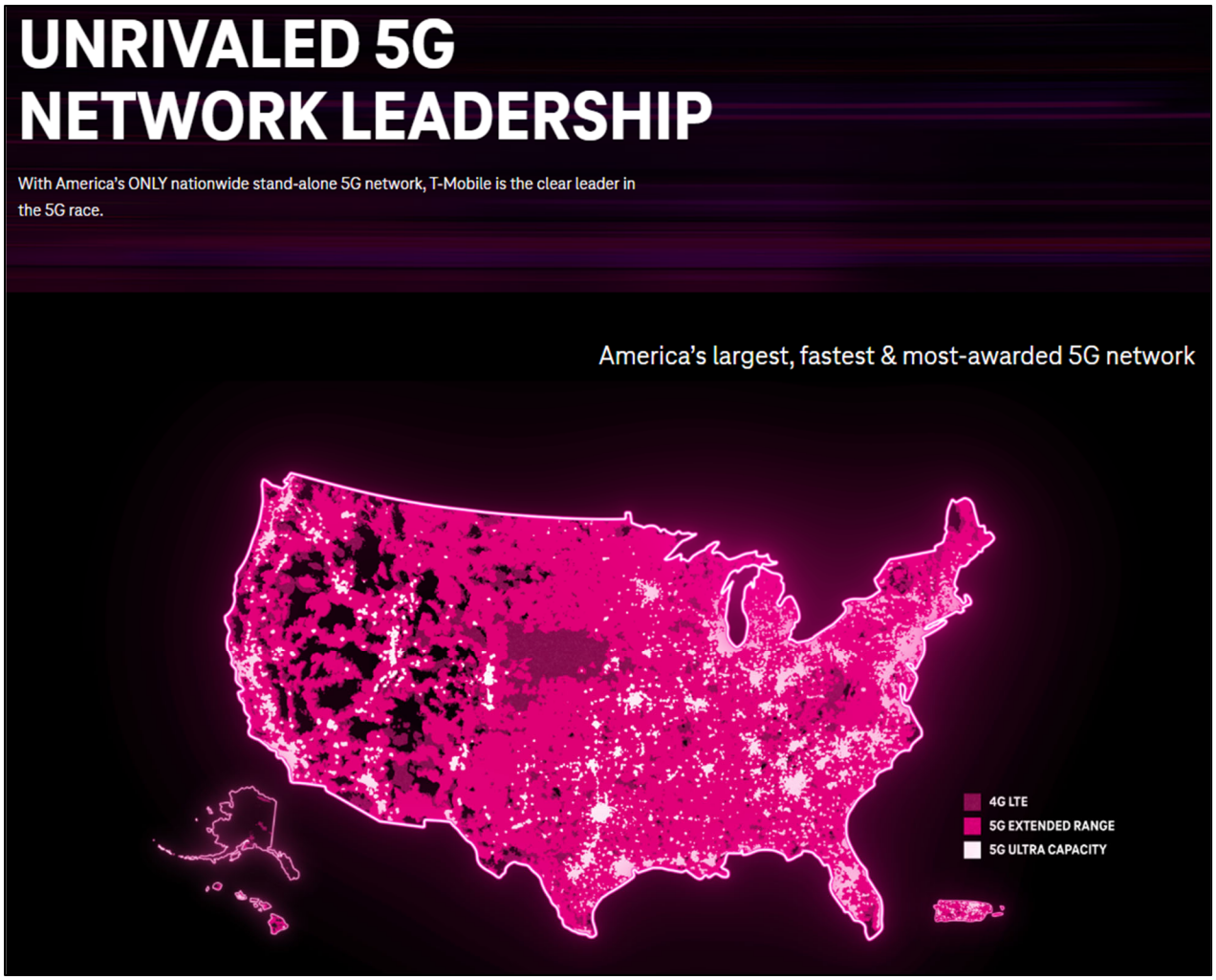
30. TMO states that "with high-performance Ultra Capacity 5G we're rolling out our fastest 5G speeds, covering 265 million Americans and counting."[9] Ultra Capacity 5G is TMO's mid-band and/or mmWave 5G.[10]

[6] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).
[7] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).
[8] https://www.t-mobile.com/5g#FAQ (last visited July 11, 2023).
[9] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).
[10] https://www.t-mobile.com/5g#FAQ (last visited July 11, 2023).

What is 5G Ultra Capacity?

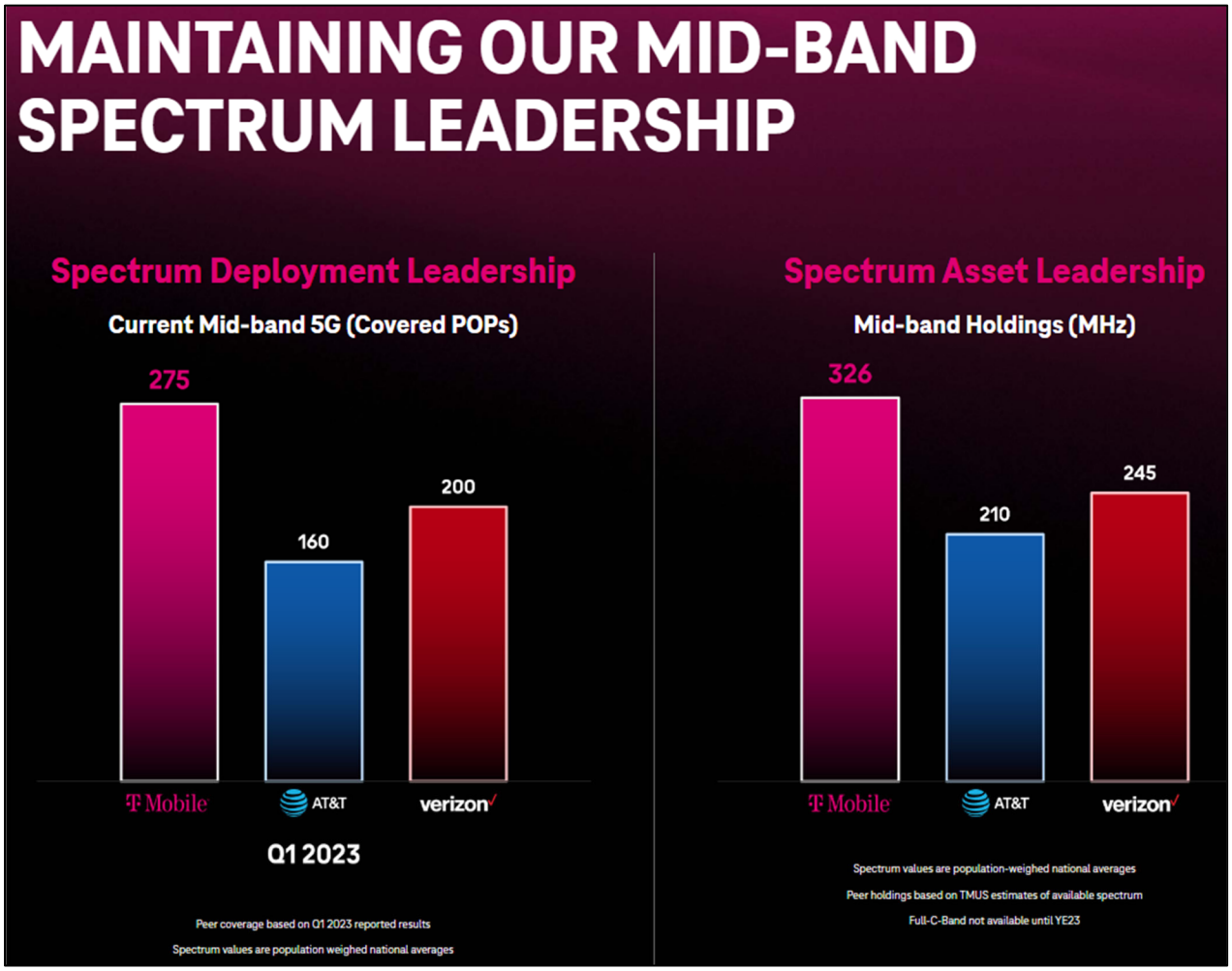
Ultra Capacity 5G includes our mid-band and/or mmWave 5G. It can give you a perfect balance of far-reaching coverage and super-fast speeds, and we have this available in more places than anyone else! Ultra Capacity 5G can deliver speeds as fast as wi-fi right to your phone.

31. TMO advertises that it has "Unrivaled 5G Network Leadership" and "America's ONLY nationwide stand-alone 5G network."[11]



[11] https://investor.t-mobile.com/why-invest/default.aspx (last visited July 11, 2023).

32. TMO states that it maintains "Mid-Band Spectrum Leadership."[12]



33. TMO states that it aims to "invest to complete integration and 5G network build while funding growth."[13]

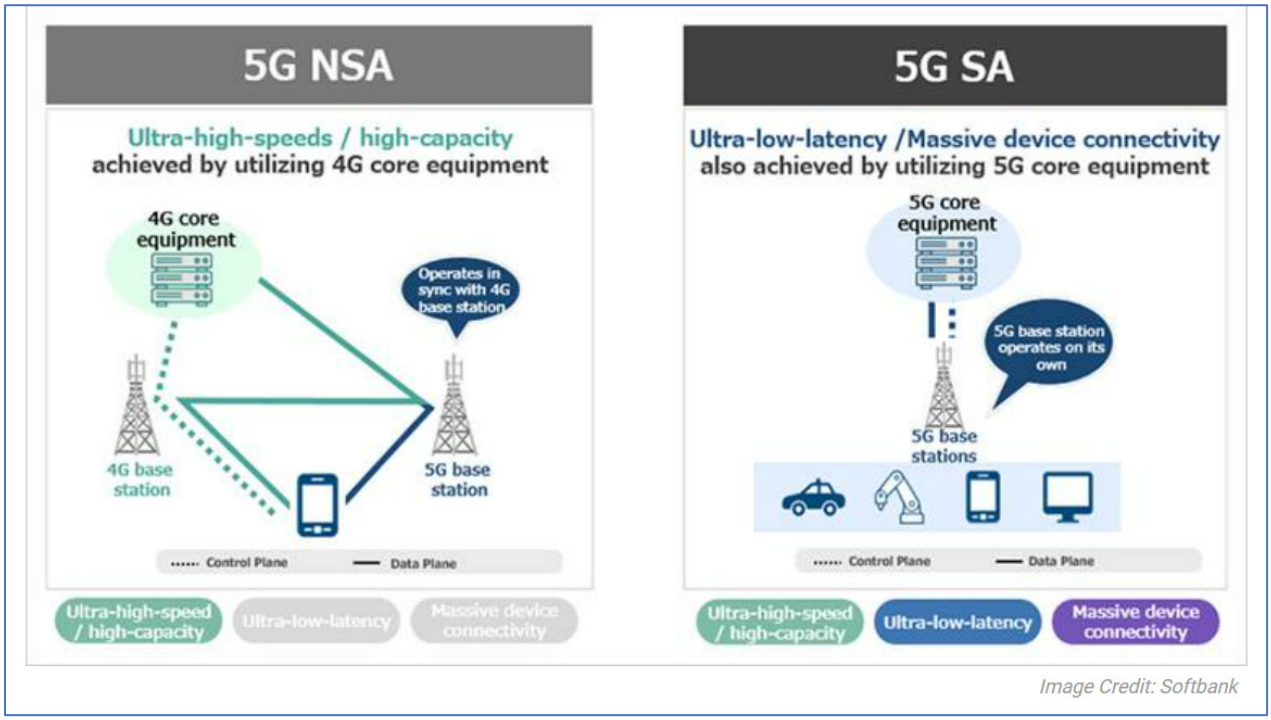
[12] https://investor.t-mobile.com/why-invest/default.aspx (last visited July 11, 2023).
[13] https://investor.t-mobile.com/why-invest/default.aspx (last visited July 11, 2023).

34. TMO states that its 5G Network provides coverage to 98% of Americans.[14]

35. 5G is the telephony system defined by the 3rd Generation Partnership Project ("3GPP") standards setting organization from Release 15.[15] 3GPP defines "not only the air interface but also the entire mobile system: call and session control, mobility management, service provisioning, etc."[16] 5G is further defined in several phases, with Release 15 specifying "5G phase 1, which introduces a new radio transmission technique and other key concepts such as an industry-grade reliability, an extended modularity, or a faster response time."[17]

[14] https://investor.t-mobile.com/financials/quarterly-results/default.aspx (last visited July 11, 2023).
[15] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).
[16] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).
[17] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).

36. Two deployment options are defined for 5G: 5G Non-Standalone ("5G NSA") and 5G Standalone ("5G SA").[18] Exemplary diagrams of a 5G NSA and a 5G SA network architecture are shown below.[19] In the 5G NSA architecture, the 5G Radio Access Network (AN) and its New Radio (NR) interface are used in conjunction with the existing LTE and EPC infrastructure Core Network (i.e., 4G Radio and 4G Core).[20] This makes the NR technology available to network providers and allows them to enjoy the capacities and lower latency offered by 5G NR without network replacement.[21] On information and belief, TMO operates a 5G NSA and a 5G SA network.



37. On information and belief, the TMO 5G networks comply with 3GPP 5G standards (e.g., 38 Series, see https://www.3gpp.org/dynareport?code=38-series.htm), 3GPP E-UTRA standards that have been updated to be 5G-aware (e.g., 36 Series, see

[18] *See, e.g.*, https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).
[19] *See, e.g.*, https://www.thefastmode.com/services-and-innovations/21166-softbank-launches-5g-sa-commercial-services-in-japan (last visited July 11, 2023).
[20] *See, e.g.*, https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).
[21] *See, e.g.*, https://www.3gpp.org/technologies/5g-system-overview (last visited July 11, 2023).

https://www.3gpp.org/dynareport?code=37-series.htm), and 3GPP standards regarding multi-radio operation (e.g., 37 Series, see https://www.3gpp.org/dynareport?code=37-series.htm) including, for example: TS 38.211, TS 38.212, TS 38.213, TS 38.214, TS 38.321, TS 38.300, TS 38.331, TS 36.300, TS 36.331, and TS 37.340.

COUNT I: INFRINGEMENT OF U.S. PATENT NO. 8,576,803

38. Daingean hereby incorporates and re-alleges paragraphs 1 through 37 as if fully set forth herein.

39. On November 5, 2013, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 8,576,803 ("the '803 Patent"), titled "Communication System."

40. The '803 Patent was assigned to Daingean by Mitsubishi Electric Corporation on August 23, 2022.

41. The '803 Patent is generally directed toward the use of a directed transmission beam that transmits data from a base station to a mobile subscriber station on the basis of channel estimation signals received from mobile subscriber stations and an interference amount at the mobile subscriber stations in adjacent areas contiguous to the base station. As stated in the '803 Patent, "[t]he present invention is made to provide a communication system that can avoid interference from the contiguous areas." *See* '803 Patent at 2:1-2.

42. Daingean holds all rights, title, and interest in and to the '803 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '803 Patent. TMO is not licensed to the '803 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '803 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

43. On information and belief, TMO has infringed directly and continues to infringe directly the '803 Patent in its implementation of TMO's 5G Networks. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO for operation on its 5G Networks that are capable of receiving channel estimation signals, including the Sounding Reference Signal ("SRS"), and directing a transmission beam that is capable of transmitting data from a base station on the basis of SRSs received from mobile subscriber stations and an interference amount at the mobile subscriber stations in adjacent areas of TMO's 5G Networks (collectively, "Accused Instrumentalities").

44. For example, the Accused Instrumentalities infringe representative claim 12 of the '803 Patent, which is directed to a base station for a communication system that includes a plurality of base stations and mobile subscriber stations, such as those provided by TMO in establishing and operating its 5G Networks. The following paragraphs provide details regarding one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

45. Claim 12 of the '803 Patent states:

> 12. A base station for a communication system that includes a plurality of said base stations and mobile subscriber stations located respectively in areas corresponding to the plurality of said base stations, each mobile subscriber station in each area transmitting a channel estimation signal to each said base station corresponding to the area and to base stations corresponding to areas contiguous to the area, wherein:
>
> said base station transmits data to the mobile subscriber stations using a transmission beam that is directed to the mobile subscriber stations in the corresponding area and is not directed to adjacent mobile subscriber stations in the areas contiguous to the corresponding area, the data being transmitted by the base station to the mobile subscriber stations on the basis of

> the channel estimation signal received from the mobile subscriber station in an area corresponding to said base station,
> the channel estimation signals received from the adjacent mobile subscriber stations in the areas contiguous to the area corresponding to said base station that are outside of the area corresponding to said base stations, and
> an interference amount at the adjacent mobile subscriber stations in the areas contiguous to the area corresponding to the base station.

'803 Patent at 10:7-33.

46. The Accused Instrumentalities implement at least Claim 12 of the '803 Patent.

47. TMO provides multiple data plans for its 5G networks, as the marketing materials from TMO make clear. These data plans include providing access to TMO's 5G networks.[22]

48. On information and belief, the products implemented by TMO and used in its 5G networks include hardware and/or software that is configured to be capable of transmitting/receiving channel estimation signals, including the Sounding Reference Signal ("SRS"), and directing a transmission beam that is capable of transmitting data from a base station on the basis of SRSs received from mobile subscriber stations and an interference amount at the mobile subscriber stations in adjacent areas of TMO's 5G network. On information and belief, the products implemented by TMO and used in its 5G networks conform to and implement the technical specifications of the 3GPP 5G Standard, including the portions of the specifications referenced below.

49. The Accused Instrumentalities comprise "[a] base station for a communication system that includes a plurality of said base stations and mobile subscriber stations located respectively in areas corresponding to the plurality of said base stations." TMO states that it has

[22] https://www.t-mobile.com/cell-phone-plans (last visited July 11, 2023).

"America's largest and fastest 5G network" and that "T-Mobile's 5G coverage area is bigger than AT&T and Verizon's combined."[23] TMO's 5G networks comprise "a communication system that includes a plurality of said base stations and mobile subscriber stations."

50. The Accused Instrumentalities comprise "[a] base station," such as gNodeBs or gNBs, which operate as base stations within a 5G or New Radio (NR) network architecture. The RAN (radio access network) architecture of a 5G network is shown below:[24]

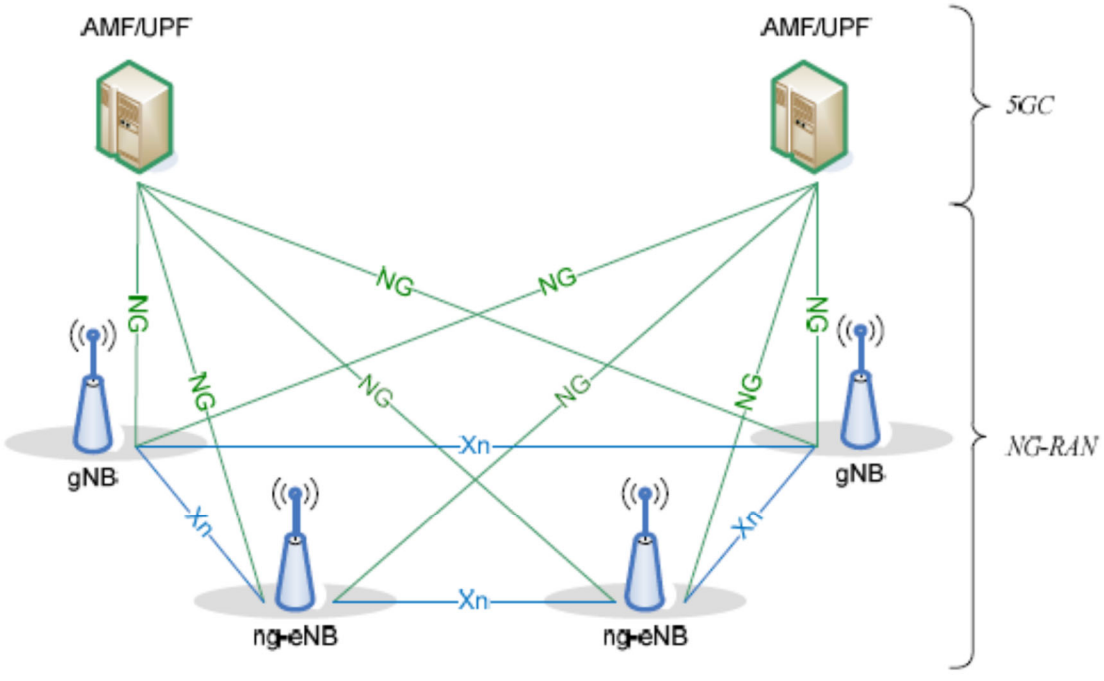
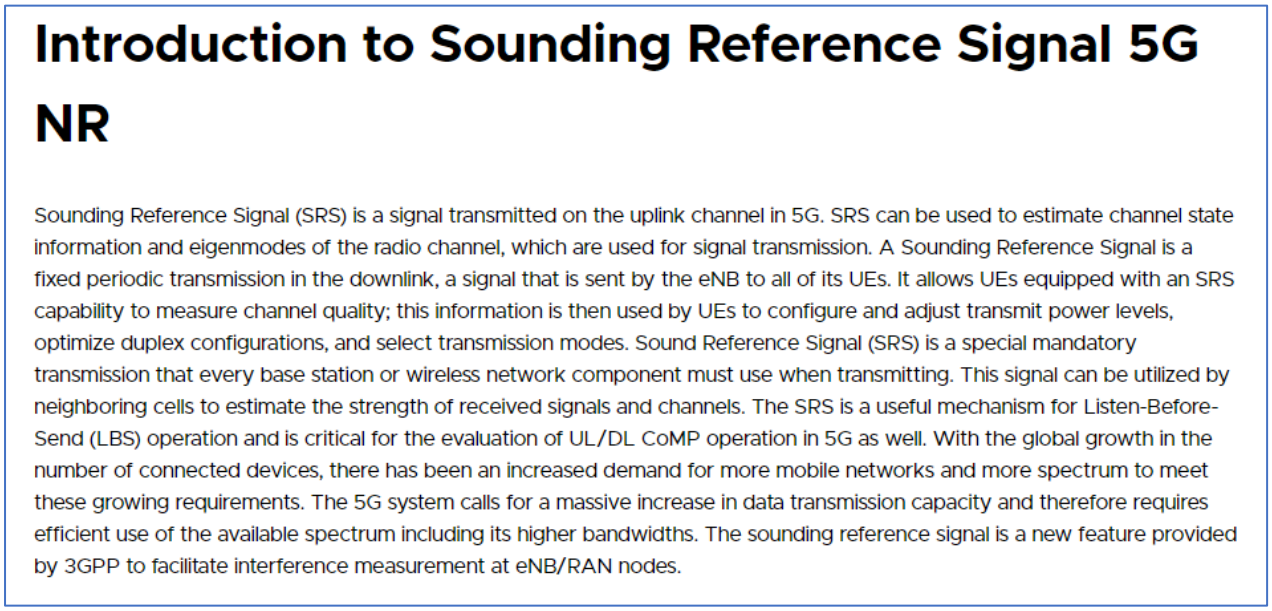


Figure 4.1-1: Overall Architecture

51. TMO's 5G Networks comprise "mobile subscriber stations located respectively in areas corresponding to the plurality of base stations," such as smartphones and handsets that are compatible with and operable on TMO's 5G Networks.

[23] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 11, 2023).
[24] *See, e.g.,* TS 38.300 at 14, 16.

52. TMO's 5G Networks comprise "each mobile subscriber station in each area transmitting a channel estimation signal to each said base station corresponding to the area and to base stations corresponding to areas contiguous to the area." The Sounding Reference Signal is a signal transmitted on the uplink channel in 5G. SRS resources can be used to estimate channel state information and eigenmodes of the radio channel, which are used for signal transmission. The signal can be utilized by neighboring cells to estimate the strength of received signals and channels.[25]



Introduction to Sounding Reference Signal 5G NR

Sounding Reference Signal (SRS) is a signal transmitted on the uplink channel in 5G. SRS can be used to estimate channel state information and eigenmodes of the radio channel, which are used for signal transmission. A Sounding Reference Signal is a fixed periodic transmission in the downlink, a signal that is sent by the eNB to all of its UEs. It allows UEs equipped with an SRS capability to measure channel quality; this information is then used by UEs to configure and adjust transmit power levels, optimize duplex configurations, and select transmission modes. Sound Reference Signal (SRS) is a special mandatory transmission that every base station or wireless network component must use when transmitting. This signal can be utilized by neighboring cells to estimate the strength of received signals and channels. The SRS is a useful mechanism for Listen-Before-Send (LBS) operation and is critical for the evaluation of UL/DL CoMP operation in 5G as well. With the global growth in the number of connected devices, there has been an increased demand for more mobile networks and more spectrum to meet these growing requirements. The 5G system calls for a massive increase in data transmission capacity and therefore requires efficient use of the available spectrum including its higher bandwidths. The sounding reference signal is a new feature provided by 3GPP to facilitate interference measurement at eNB/RAN nodes.

[25] *See, e.g.,* https://telcomaglobal.com/p/sounding-reference-signal-5g-new-radio (last visited March 21, 2023).

5G SRS NR

The SRS 5G is a key component of the 5G standard, which features a massive increase in bandwidth, flexibility, and speed over current 4G technology. It will enable low latency and interference-free connectivity, support for massive numbers of devices, bigger data transfer rates, and higher quality streaming. Sounding Reference Signal 5G (SRS 5G) is a frequency-division duplex (FDD) uplink sounding reference signal for the 5G technology. It is used for mobile device measurements, with the related primary SC4 basic radio performance test emission measure (BPM) featured in TS38.101. SRS 5G is the most advanced sounding reference signal for 5G mobile communications. It is designed to provide a consistent user experience across all 3GPP bands and mode types. SRS 5G features a wide-bandwidth waveform, allowing it to be transmitted simultaneously with other signals and channels at different frequency bands. The Sounding Reference Signal (SRS) is a reference signal which is transmitted in the 5G mobile radio interface, to facilitate measurements of the channel quality of a 5G base station. The SRS uses 3GPP LTE-like standards, to enable compatibility with earlier LTE deployments and allow for early adoption. The SRS 5G is a sounding reference signal that is transmitted by cellular phones. The SRS transmission occurs periodically on a non-primary set of carriers and at appropriate power levels, such that an eNodeB can measure the quality of its synchronization to the User Equipment (UE) that it is serving. SRS for 5G is the signal that helps to build blocks to get ready for 5G. It contains information about signal characteristics like downlink (DL) and uplink (UL) clusters, subframe number, eNodeB identifier, and channel bandwidth. The SRS 5G is a sounding reference signal that is used in conjunction with the Extended Measurement Period.

53. The SRS is further described in TS 38.211, which specifies the physical channels and modulation in TMO's 5G Networks.

6.4.1.4 Sounding reference signal

6.4.1.4.1 SRS resource

An SRS resource is configured by the *SRS-Resource* IE or the *SRS-PosResource* IE and consists of

- $N_{ap}^{SRS} \in \{1,2,4\}$ antenna ports $\{p_i\}_{i=0}^{N_{ap}^{SRS}-1}$, where the number of antenna ports is given by the higher layer parameter *nrofSRS-Ports* if configured, otherwise $N_{ap}^{SRS} = 1$, and $p_i = 1000 + i$ when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* not set to 'nonCodebook', or determined according to [6, TS 38.214] when the SRS resource is in a SRS resource set with higher-layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook'
- $N_{symb}^{SRS} \in \{1,2,4,8,10,12,14\}$ consecutive OFDM symbols given by the field *nrofSymbols* contained in the higher layer parameter *resourceMapping*
- l_0, the starting position in the time domain given by $l_0 = N_{symb}^{slot} - 1 - l_{offset}$ where the offset $l_{offset} \in \{0,1,\dots,13\}$ counts symbols backwards from the end of the slot and is given by the field *startPosition* contained in the higher layer parameter *resourceMapping* and $l_{offset} \geq N_{symb}^{SRS} - 1$
- k_0, the frequency-domain starting position of the sounding reference signal

TS 38.211, Section 6.4.1.4 (highlighting added).

54. The Accused Instrumentalities comprise "said base station transmits data to the mobile subscriber stations using a transmission beam that is directed to the mobile subscriber stations in the corresponding area and is not directed to adjacent mobile subscriber stations in the areas contiguous to the corresponding area." In TMO's 5G Networks, the 5G base stations (gNB)

direct a beam to maximize energy to a given mobile subscriber station. For example, in the image below, the base station is directing one beam to one user device and a second beam to a second user device.[26]

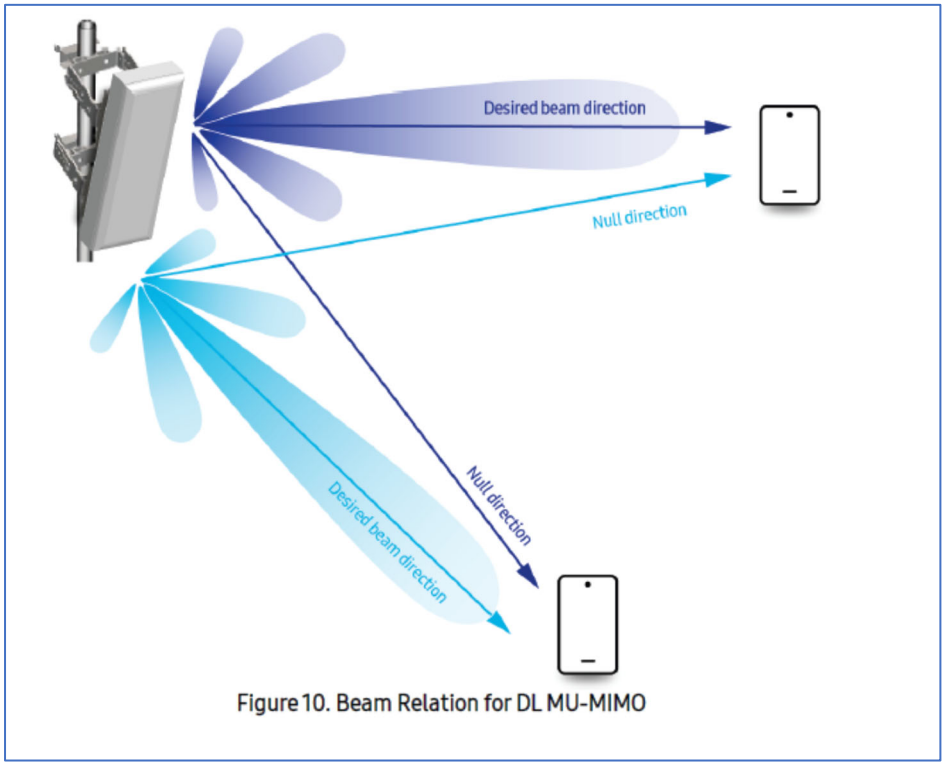
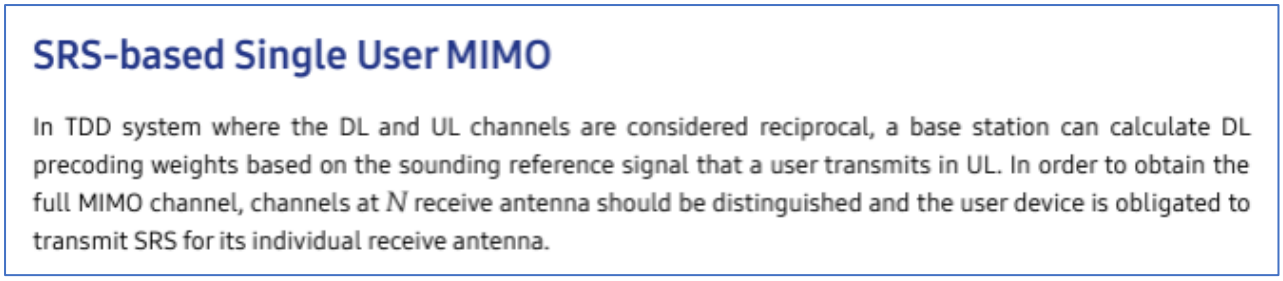


Figure 10. Beam Relation for DL MU-MIMO

55. The Accused Instrumentalities further satisfy the claim element: "the data being transmitted by the base station to the mobile subscriber stations on the basis of the channel estimation signal received from the mobile subscriber station in an area corresponding to the base station." For example, a base station can calculate downlink precoding weights based on the SRS that a user transmits in the uplink.[27]

[26] *See, e.g.*, https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf (last visited July 12, 2023).
[27] *See, e.g.*, https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf (last visited July 12, 2023).



56. By using SRS-based MIMO, beamforming can be implemented on the downlink using measurements from the uplink, resulting in the use of fewer resources and less delay than waiting for CSI-RS feedback reports from mobile stations.

57. The Accused Instrumentalities further satisfy the claim element: "the data being transmitted by the base station to the mobile subscriber stations on the basis of . . . the channel estimation signals received from the adjacent mobile subscriber stations in the areas contiguous to the area corresponding to said base station that are outside of the area corresponding to the base stations." For example, the number of uplink SRSs for a given bandwidth is limited and are reused across cells, resulting in pilot contamination as SRSs from neighboring cells are received by a given base station. The base stations comprising the TMO 5G Networks assess this pilot contamination when scheduling resources. On information and belief, the TMO base stations comprising the TMO 5G Networks are capable of performing channel estimation for mobile stations in neighboring cells, for example, based on receiving and identifying transmissions of orthogonal SRSs that have been distributed for use by neighboring cells and then generating appropriate nulling for both the uplink (combining weights) and the downlink (precoding weights) for those mobile stations.

58. The Accused Instrumentalities further satisfy the claim element: "the data being transmitted by the base station to the mobile subscriber stations on the basis of . . . an interference amount at the adjacent mobile subscriber stations in the areas contiguous to the area corresponding to the base station." In TMO's 5G Networks, an interference level can be determined from

measurements on Channel State Information – Interference Measurement ("CSI-IM") resources. A CSI-IM resource typically corresponds to resource elements where nothing is transmitted within the current cell while the activity within the CSI-IM resource in neighboring cells is normal. By measuring the receiver power within a CSI-IM resource, a device can determine an interference level due to transmissions from adjacent cells. Additionally, Channel State Information – Reference Signal ("CSI-RS") resources can be used to determine an interference level by subtracting the expected received signal from what is actually received on the CSI-RS resource, allowing the mobile stations to measure interference on the downlink indirectly. When Zero Power CSI-RS is configured for CSI-IM, the network configured the CSI-IM resources such that they collide with PDSCH resources of neighboring cells.

> 5.2.2.4 Channel State Information – Interference Measurement (CSI-IM)
>
> The UE can be configured with one or more CSI-IM resource set configuration(s) as indicated by the higher layer parameter *CSI-IM-ResourceSet*. Each CSI-IM resource set consists of $K \geq 1$ CSI-IM resource(s).
>
> The following parameters are configured via higher layer parameter *CSI-IM-Resource* for each CSI-IM resource configuration:
>
> - *csi-IM-ResourceId* determines CSI-IM resource configuration identity
> - *subcarrierLocation-p0* or *subcarrierLocation-p1* defines subcarrier occupancy of the CSI-IM resource within a slot for *csi-IM-ResourceElementPattern* set to 'pattern0' or 'pattern1', respectively.
> - *symbolLocation-p0* or *symbolLocation-p1* defines OFDM symbol location of the CSI-IM resource within a slot for *csi-IM-ResourceElementPattern* set to 'pattern0' or 'pattern1', respectively.
> - *periodicityAndOffset* defines the CSI-IM periodicity and slot offset for periodic/semi-persistent CSI-IM.
> - *freqBand* includes parameters to enable configuration of frequency-occupancy of CSI-IM
>
> In each of the PRBs configured by *freqBand,* the UE shall assume each CSI-IM resource is located in,
>
> - resource elements (k_{CSI-IM}, l_{CSI-IM}), $(k_{CSI-IM}, l_{CSI-IM}+1)$, $(k_{CSI-IM}+1, l_{CSI-IM})$ and $(k_{CSI-IM}+1, l_{CSI-IM}+1)$, if *csi-IM-ResourceElementPattern* is set to 'pattern0',
> - resource elements (k_{CSI-IM}, l_{CSI-IM}), $(k_{CSI-IM}+1, l_{CSI-IM})$, $(k_{CSI-IM}+2, l_{CSI-IM})$ and $(k_{CSI-IM}+3, l_{CSI-IM})$ if *csi-IM-ResourceElementPattern* is set to 'pattern1',
>
> where k_{CSI-IM} and l_{CSI-IM} are the configured frequency-domain location and time-domain location, respectively, given by the higher layer parameters in the above list.

TS 38.214, Section 5.2.2.4.

59. Based on the above and because of its conformance with the applicable 5G standards, TMO directly infringes at least claim 1 of the '803 patent.

60. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the '803 patent claims. TMO has knowledge of the '803 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '803 patent are not performed by TMO, such acts constituting direct infringement of the '803 patent are performed by TMO's customers or end-users who act at the direction and/or control of TMO, with TMO's knowledge.

61. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 12 of the '803 patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '803 patent.

62. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when a TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

63. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '803 Patent under 35

U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '803 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

64. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '803 Patent by TMO has damaged and will continue to damage Plaintiff.

COUNT II: INFRINGEMENT OF U.S. PATENT NO. 10,484,976

65. Daingean hereby incorporates and re-alleges paragraphs 1 through 64 as if fully set forth herein.

66. On November 19, 2019, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 10,484,976 ("the '976 Patent"), titled "Signaling, Procedures, User Equipment and Base Stations for Uplink Ultra Reliable Low Latency Communications."

67. The '976 Patent is generally directed toward uplink transmission management to address latency and reliability requirements and potential coexistence issues. The '976 Patent generally discloses transmitting and receiving "a radio resource control message including first information used for configuring a periodicity for an uplink data transmission" and transmitting and receiving on a physical downlink control channel "second information used for indicating an

activation for the uplink data transmission." *See* '976 Patent at Abstract. The '976 Patent further discloses transmitting and receiving "confirmation information Medium Access Control (MAC) Control Element (CE) for the second information" and transmitting and receiving "uplink data on the physical uplink shared channel based on the first information and second information." *Id.* As disclosed in the '976 Patent, the system receives on the physical downlink control channel "third information used for indicating a deactivation for the uplink data transmission." *Id.*

68. Daingean holds all rights, title, and interest in and to the '976 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '976 Patent. TMO is not licensed to the '976 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '976 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

69. On information and belief, TMO has infringed directly and continues to infringe directly the '976 Patent in its implementation of its 5G network. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO that are capable of transmitting or receiving DCI format that may be used for activating and/or deactivating an uplink data transmission on the TMO 5G network (collectively, "Accused Instrumentalities").

70. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 2 of the '976 Patent, which is directed to a base station device, such as those provided by TMO in establishing and operating its 5G networks. The following paragraphs provide details regarding one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

71. Claim 2 of the ’976 Patent states:

2. A base station apparatus that communicates with a user equipment (UE), comprising:

transmitting circuitry configured to transmit a radio resource control (RRC) message comprising first information used for configuring a periodicity,

the transmitting circuitry configured to transmit a RRC message comprising second information used for configuring a numerology,

the transmitting circuitry configured to transmit in a common search space of a physical downlink control channel, a downlink control information (DCI) format with cyclic redundancy check (CRC) scrambled by a first radio network identifier (RNTI), the first RNTI being different from a Cell-RNTI (C-RNTI) and a semi-persistent scheduling C-RNTI, the first RNTI being used for indicating an activation and a deactivation for an uplink data transmission on a physical uplink shared channel (PUSCH) based on the periodicity and the numerology; and

receiving circuitry configured to receive confirmation information Medium Access Control (MAC) Control Element (CE) in a case that third information used for indicating the activation for the uplink data transmission on the PUSCH is comprised in the DCI format with the CRC scrambled by the first RNTI,

the receiving circuitry configured to receive, based on a transmission of the DCI format comprising the third information, the uplink data transmission on the PUSCH based on the periodicity and the numerology, wherein

the receiving circuitry is configured to receive confirmation information MAC CE in a case that fourth information used for indicating the deactivation for the uplink data transmission on the PUSCH is comprised in the DCI format with the CRC scrambled by the first RNTI, and

the confirmation information MAC CE for the DCI format comprising the third information is identified by a MAC protocol data unit (MAC PDU) subheader with a logical channel identifier (LCID),

the confirmation information MAC CE for the DCI format comprising the fourth information is identified by the MAC PDU subheader with the LCID, and

the same index of the LCID is used for the confirmation information MAC CE for the DCI format comprising the third information and the confirmation information MAC CE for the DCI format comprising the fourth information.

'976 Patent at 39:13-60.

72. The Accused Instrumentalities implement at least Claim 2 of the '976 Patent.

73. TMO provides multiple data plans for its 5G networks, as the marketing materials from TMO make clear. These data plans include providing access to TMO's 5G Networks.[28]

74. On information and belief, the products implemented by TMO and used in its 5G networks include hardware and/or software that is configured to be capable of transmitting or receiving DCI format that may be used for activating and/or deactivating an uplink data transmission on a TMO 5G network. On information and belief, the products implemented by TMO and used in its 5G networks conform to and implement the technical specifications of the 3GPP 5G Standard, including the portions of the specifications referenced below.

75. The Accused Instrumentalities include "[a] base station apparatus that communicates with a user equipment (UE)." For example, TMO base station devices, such as gNodeBs or gNBs, operate as base stations within a 5G or New Radio (NR) network architecture. The RAN (radio access network) architecture of a 5G network is shown below:[29]

[28] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited July 12, 2023).
[29] *See, e.g.,* TS 38.300 at 14, 16.

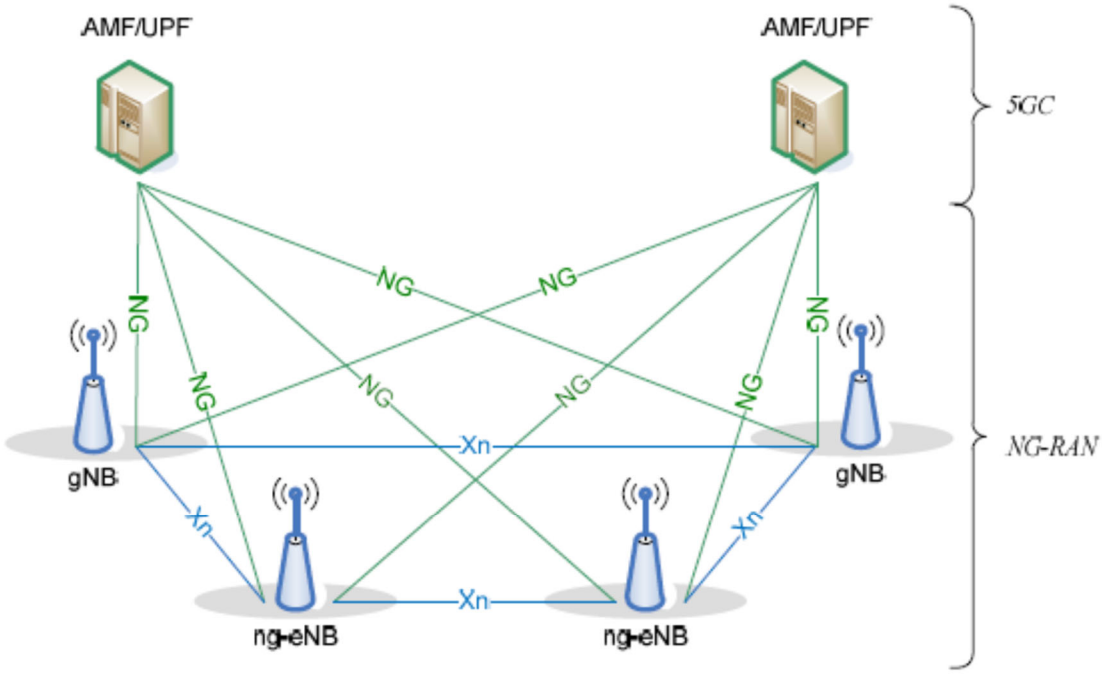


Figure 4.1-1: Overall Architecture

76. The Accused Instrumentalities further comprise "transmitting circuitry configured to transmit a radio resource control (RRC) message comprising first information used for configuring a periodicity," as claimed. TS 38.321 provides for "Radio resource control" (RRC). Specifically, there are two types of uplink transmission without dynamic grant: "Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant" and "Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signaling indicating configured uplink grant activation or deactivation."[30] As provided in TS 38.321, when the Type 2 grant is configured, RRC configures the parameter: "periodicity: periodicity of the configured grant Type 2."

[30] TS 38.321, Section 5.8.2.

5.8.2 Uplink

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;
- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

Type 1 and Type 2 are configured by RRC for a Serving Cell per BWP. Multiple configurations can be active simultaneously only on different Serving Cells. For Type 2, activation and deactivation are independent among the Serving Cells. For the same Serving Cell, the MAC entity is configured with either Type 1 or Type 2.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;
- *periodicity*: periodicity of the configured grant Type 2;
- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

77. Similarly, TS 38.331 provides the RRC protocol specification and specifies the protocol data units, formats and parameters, including for the Radio Resource Control information elements. As provided in TS 38.331, the information element "*ConfiguredGrantConfig* is used to configure uplink transmission without dynamic grant according to two possible schemes" (*i.e.*, Type 1 or Type 2) and includes the "periodicity" parameter:

– *ConfiguredGrantConfig*

The IE *ConfiguredGrantConfig* is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (*type1*) or provided via the PDCCH (addressed to CS-RNTI) (*type2*).

***ConfiguredGrantConfig* information element**

```
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIG-START

ConfiguredGrantConfig ::=           SEQUENCE {
```



```
    frequencyHopping                    ENUMERATED {intraSlot, interSlot}                                   OPTIONAL,   -- Need S
    cg-DMRS-Configuration               DMRS-UplinkConfig,
    mcs-Table                           ENUMERATED {qam256, qam64LowSE}                                     OPTIONAL,   -- Need S
    mcs-TableTransformPrecoder          ENUMERATED {qam256, qam64LowSE}                                     OPTIONAL,   -- Need S
    uci-OnPUSCH                         SetupRelease { CG-UCI-OnPUSCH }                                     OPTIONAL,   -- Need M
    resourceAllocation                  ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch },
    rbg-Size                            ENUMERATED {config2}                                                OPTIONAL,   -- Need S
    powerControlLoopToUse               ENUMERATED {n0, n1},
    p0-PUSCH-Alpha                      P0-PUSCH-AlphaSetId,
    transformPrecoder                   ENUMERATED {enabled, disabled}                                      OPTIONAL,   -- Need S
    nrofHARQ-Processes                  INTEGER(1..16),
    repK                                ENUMERATED {n1, n2, n4, n8},
    repK-RV                             ENUMERATED {s1-0231, s2-0303, s3-0000}                              OPTIONAL,   -- Need R
    periodicity                         ENUMERATED {
                                            sym2, sym7, sym1x14, sym2x14, sym4x14, sym5x14, sym8x14, sym10x14, sym16x14, sym20x14,
                                            sym32x14, sym40x14, sym64x14, sym80x14, sym128x14, sym160x14, sym256x14, sym320x14, sym512x14,
                                            sym640x14, sym1024x14, sym1280x14, sym2560x14, sym5120x14,
                                            sym6, sym1x12, sym2x12, sym4x12, sym5x12, sym8x12, sym10x12, sym16x12, sym20x12, sym32x12,
                                            sym40x12, sym64x12, sym80x12, sym128x12, sym160x12, sym256x12, sym320x12, sym512x12, sym640x12,
                                            sym1280x12, sym2560x12
    }
```

78. The Accused Instrumentalities further comprise "the transmitting circuitry configured to transmit a RRC message comprising second information used for configuring a numerology," as claimed. As provided in TS 38.331, the Radio Resource Control information elements include the *BWP* information element, which "is used to configure generic parameters of a bandwidth part." The *BWP* information element includes the parameter "subcarrierSpacing" which, as described, "[c]orresponds to subcarrier spacing according to TS 38.211."

– *BWP*

The IE *BWP* is used to configure generic parameters of a bandwidth part as defined in TS 38.211 [16], clause 4.5, and TS 38.213 [13], clause 12.

For each serving cell the network configures at least an initial downlink bandwidth part and one (if the serving cell is configured with an uplink) or two (if using supplementary uplink (SUL)) initial uplink bandwidth parts. Furthermore, the network may configure additional uplink and downlink bandwidth parts for a serving cell.

The uplink and downlink bandwidth part configurations are divided into common and dedicated parameters.

***BWP* information element**

```
-- ASN1START
-- TAG-BWP-START

BWP ::=                             SEQUENCE {
    locationAndBandwidth                INTEGER (0..37949),
    subcarrierSpacing                   SubcarrierSpacing,
    cyclicPrefix                        ENUMERATED { extended }                                             OPTIONAL    -- Need R
}


-- TAG-BWP-STOP
-- ASN1STOP
```

subcarrierSpacing
Subcarrier spacing to be used in this BWP for all channels and reference signals unless explicitly configured elsewhere. Corresponds to subcarrier spacing according to TS 38.211 [16], table 4.2-1. The value *kHz15* corresponds to μ=0, value *kHz30* corresponds to μ=1, and so on. Only the values 15 kHz, 30 kHz, or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. For the initial DL BWP this field has the same value as the field *subCarrierSpacingCommon* in *MIB* of the same serving cell. Except for SUL, the network ensures the same subcarrier spacing is used in active DL BWP and active UL BWP within a serving cell.

79. The Accused Instrumentalities further comprise the claimed "transmitting circuitry configured to transmit in a common search space of a physical downlink control channel, a downlink control information (DCI) format with cyclic redundancy check (CRC) scrambled by a first radio network identifier (RNTI), the first RNTI being different from a Cell-RNTI (C-RNTI) and a semi-persistent scheduling C-RNTI, the first RNTI being used for indicating an activation and a deactivation for an uplink data transmission on a physical uplink shared channel (PUSCH) based on the periodicity and the numerology." TS 38.213 provides physical layer procedures, including the procedure for determining physical downlink control channel assignment. As provided in TS 38.213, "[a] set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets." These search space sets include "a Type3-PDCCH CSS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by . . . CS-RNTI(s)."

10.1 UE procedure for determining physical downlink control channel assignment

A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets

- a Type3-PDCCH CSS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, or TPC-SRS-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, or CS-RNTI(s), and

80. When the configured grant Type 2 transmission is configured, the radio resource control configures the parameter "cs-RNTI," which is a configured scheduling radio network temporary identifier. As provided in TS 38.321, the parameter "cs-RNTI" is used for indicating "activation, deactivation and retransmission" for an uplink data transmission.

5.8.2 Uplink

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;
- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;
- *periodicity*: periodicity of the configured grant Type 2;
- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

81. As provided in TS 38.214, for "Type 2 PUSCH transmissions with a configured grant, the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI."

6.1.2.3 Resource allocation for uplink transmission with configured grant

When PUSCH resource allocation is semi-statically configured by higher layer parameter *configuredGrantConfig* in *BWP-UplinkDedicated* information element, and the PUSCH transmission corresponding to a configured grant, the following higher layer parameters are applied in the transmission:

- For Type 2 PUSCH transmissions with a configured grant: the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI.

The UE shall not transmit anything on the resources configured by *configuredGrantConfig* if the higher layers did not deliver a transport block to transmit on the resources allocated for uplink transmission without grant.

A set of allowed periodicities *P* are defined in [12, TS 38.331].

82. The Accused Instrumentalities further comprise the claimed "receiving circuitry configured to receive confirmation information Medium Access Control (MAC) Control Element (CE) in a case that third information used for indicating the activation for the uplink data transmission on the PUSCH is comprised in the DCI format with the CRC scrambled by the first RNTI." TS 38.321 provides the Medium Access Control (MAC) protocol procedures for the uplink data transfer. As provided in TS 38.321, if the MAC entity has a CS-RNTI, it triggers configured

uplink grant confirmation "MAC CE" when the PDCCH contents indicate configured grant Type 2 activation.

> 5.4.1 UL Grant reception
>
> Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC. 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.
>
> 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> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:
>
> 2> else if the NDI in the received HARQ information is 0:
>
> 3> if PDCCH contents indicate configured grant Type 2 deactivation:
>
> 4> trigger configured uplink grant confirmation.
>
> 3> else if PDCCH contents indicate configured grant Type 2 activation:
>
> 4> trigger configured uplink grant confirmation;
>
> 4> store the uplink grant for this Serving Cell and the associated HARQ information as configured uplink grant;
>
> 4> initialise or re-initialise the configured uplink grant for this Serving Cell to start in the associated PUSCH duration and to recur according to rules in clause 5.8.2;
>
> 4> stop the *configuredGrantTimer* for the corresponding HARQ process, if running;

83. The Accused Instrumentalities further comprise the claimed "receiving circuitry configured to receive, based on a transmission of the DCI format comprising the third information, the uplink data transmission on the PUSCH based on the periodicity and the numerology." As provided in TS 38.214, "[f]or Type 2 PUSCH transmissions with a configured grant: the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI."

> 6.1.2.3 Resource allocation for uplink transmission with configured grant
>
> When PUSCH resource allocation is semi-statically configured by higher layer parameter *configuredGrantConfig* in *BWP-UplinkDedicated* information element, and the PUSCH transmission corresponding to a configured grant, the following higher layer parameters are applied in the transmission:
>
> - For Type 2 PUSCH transmissions with a configured grant: the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI.
>
> The UE shall not transmit anything on the resources configured by *configuredGrantConfig* if the higher layers did not deliver a transport block to transmit on the resources allocated for uplink transmission without grant.
>
> A set of allowed periodicities *P* are defined in [12, TS 38.331].

84. TS 38.321 further provides that "if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI," and "if the PDCCH contents indicate configured grant Type 2 activation" then the MAC entity stores the uplink grant for the Serving Cell and the associated HARQ information as configured uplink grant. Under TS 38.321, "[f]or each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall . . . deliver the configured uplink grant and the associated HARQ information to the HARQ entity."

5.4 UL-SCH data transfer

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC. 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.

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:

3> else if PDCCH contents indicate configured grant Type 2 activation:

4> trigger configured uplink grant confirmation;

4> store the uplink grant for this Serving Cell and the associated HARQ information as configured uplink grant;

4> initialise or re-initialise the configured uplink grant for this Serving Cell to start in the associated PUSCH duration and to recur according to rules in clause 5.8.2;

4> stop the *configuredGrantTimer* for the corresponding HARQ process, if running;

For each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall:

1> if the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response for this Serving Cell:

2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;

2> if the *configuredGrantTimer* for the corresponding HARQ process is not running:

3> consider the NDI bit for the corresponding HARQ process to have been toggled;

3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

85. The Accused Instrumentalities further comprise "the receiving circuitry is configured to receive confirmation information MAC CE in a case that fourth information used for indicating the deactivation for the uplink data transmission on the PUSCH is comprised in the DCI format with the CRC scrambled by the first RNTI," as claimed. As provided in TS 38.321, "if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI" and "if PDCCH contents indicate configured grant Type 2 deactivation," the MAC entity triggers configured uplink grant confirmation "MAC CE."

> 5.4.1 UL Grant reception
>
> Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC. 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.
>
> 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> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:
>
> 2> else if the NDI in the received HARQ information is 0:
>
> 3> if PDCCH contents indicate configured grant Type 2 deactivation:
>
> 4> trigger configured uplink grant confirmation.

86. The Accused Instrumentalities further comprise "the confirmation information MAC CE for the DCI format comprising the third information is identified by a MAC protocol data unit (MAC PDU) subheader with a logical channel identifier (LCID), the confirmation information MAC CE for the DCI format comprising the fourth information is identified by the MAC PDU subheader with the LCID, and the same index of the LCID is used for the confirmation information MAC CE for the DCI format comprising the third information and the confirmation information MAC CE for the DCI format comprising the fourth information," as claimed. TS 38.321 provides the MAC Control Elements, including the Configured Grant Confirmation MAC CE. As provided in TS 38.321, "[t]he Configured Grant Confirmation MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-2."

> 6.1.3.7 Configured Grant Confirmation MAC CE
>
> The Configured Grant Confirmation MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-2.

6.2.1 MAC subheader for DL-SCH and UL-SCH

The MAC subheader consists of the following fields:

- LCID: The Logical Channel ID field identifies the logical channel instance of the corresponding MAC SDU or the type of the corresponding MAC CE or padding as described in Tables 6.2.1-1 and 6.2.1-2 for the DL-SCH and UL-SCH respectively. There is one LCID field per MAC subheader. The size of the LCID field is 6 bits;

Table 6.2.1-2 Values of LCID for UL-SCH

Index	LCID values
0	CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5])
1–32	Identity of the logical channel
33–51	Reserved
52	CCCH of size 48 bits (referred to as "CCCH" in TS 38.331 [5])
53	Recommended bit rate query
54	Multiple Entry PHR (four octets C_i)
55	Configured Grant Confirmation
56	Multiple Entry PHR (one octet C_i)
57	Single Entry PHR
58	C-RNTI
59	Short Truncated BSR
60	Long Truncated BSR
61	Short BSR
62	Long BSR
63	Padding

87. Because of its conformance with the applicable 5G standards, on information and belief TMO directly infringes at least claim 2 of the ’976 patent.

88. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the ’976 patent claims. TMO has knowledge of the ’976 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the ’976 patent are not performed by TMO, such acts constituting direct infringement of the ’976 patent are performed by TMO’s customers or end-users who act at the direction and/or control of TMO, with TMO’s knowledge.

89. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 2 of the ’976 patent by active inducement in violation of 35 U.S.C. § 271(b),

by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '976 patent.

90. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when an TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused 5G functionality based upon the hardware and software provided in the Accused Instrumentalities.

91. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '976 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '976 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

92. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '976 Patent by TMO has damaged and will continue to damage Plaintiff.

COUNT III: INFRINGEMENT OF U.S. PATENT NO. 10,841,958

93. Daingean hereby incorporates and re-alleges paragraphs 1 through 89 as if fully set forth herein.

94. On November 17, 2020, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 10,841,958 ("the '958 Patent"), titled "Access Node, a Method for an Access Node, a Wireless Terminal, and a Method for a Wireless Terminal."

95. The inventions disclosed in the '958 Patent provide methods and apparatuses that "use a value tag in conjunction with transmission and/or processing of system information in a wireless communication network, especially in conjunction with second type system information or non-essentially type system information. In certain example embodiment and modes, an access node (22) may initiate broadcasting second type system information when its content gets updated, in order to avoid many on-demand delivery requests from wireless terminals." '958 Patent, Abstract. These inventions provide technological solutions to the network-centric problem of signaling essential and non-essential system information, managing the allocation of network resources for use by a plurality of user devices in a broadcast or on-demand fashion, and providing updates to user devices when such information changes. *See id.* Prior to the claimed invention, "the eNB periodically broadcasts all SIBs relevant for offered services, not just SIBs that are required for access to the system. … this approach may result in wasting valuable radio resources…." '958 at 1:34-58. The '958 teaches embodiments in which the base station may broadcast just a first type of essential SIB that indicates which other second-type non-essential SIBs are available, whether those other SIBs have changed, and whether they are available via broadcast or on-demand, and enable the UE to request on-demand delivery of second-type SIBs on an as-needed basis. These examples, along with the other claimed improvements of the '958 Patent, solve the particular

network-oriented problems associated with system information signaling, bandwidth scarcity, and efficient network functioning. The claimed inventions of the '958 Patent thereby improve the functioning of wireless network devices participating in a network.

96. Daingean holds all rights, title, and interest in and to the '958 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '958 Patent. TMO is not licensed to the '958 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '958 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

97. On information and belief, TMO has infringed directly and continues to infringe directly the '958 Patent. The infringing acts include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO that practice or implement the asserted claims, including for example, wireless network devices that generate, transmit, and/or receive the claimed SIB blocks and associated information (collectively, "Accused Instrumentalities").

98. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the '958 Patent. The following paragraphs provide details regarding only one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under this Court's scheduling order.

99. Claim 1 of the '958 Patent states:

> 1. An access node of a radio access network that communicates over a radio interface with a wireless terminal, the access node comprising:
>
> processor circuitry configured:

to generate a first type system information block (SIB) comprising information and a value tag, the information indicating whether one or more associated second type system information blocks are provided by broadcast or on-demand, the value tag being updated upon a change of a corresponding second type SIB, the first type SIB being required for the wireless terminal to perform an initial access to the radio access network;

upon a change of a second type SIB whose associated information indicated before the change that the second type SIB was provided on-demand, to include in the first type SIB the information associated with the second type SIB indicating that the second type SIB is provided by broadcast;

transmitter circuitry configured to:

transmit the first type SIB;

transmit a message that triggers the wireless terminal to receive the first type SIB, wherein;

whether or not the second type SIB has changed is determined based on a value tag, associated with the second type SIB, stored in the wireless terminal, and the value tag included in the first type SIB corresponding to the second type SIB.

'958 Patent at 27:28-55.

100. As alleged and shown above, TMO's Accused Instrumentalities comply with the 5G standard, including at least 3GPP release version 15 and/or later releases and/or versions of the 3GPP standards.

101. The Accused Instrumentalities possess the recited capabilities of claim 1. The Accused Instrumentalities comprise "an access node of a radio access network that communicates over a radio interface with a wireless terminal," as claimed. The accused instrumentalities include, for example, base stations, cell towers, eNodeB, and/or gNodeB devices. These devices are access

nodes of TMO's radio access network, and communicate with wireless terminals (such as User Equipment) over a radio interface.

102. The Accused Instrumentalities include processor circuitry configured with the recited capabilities of '958 claim 1.

103. The Accused Instrumentalities "generate a first type system information block (SIB) comprising information and a value tag, the information indicating whether one or more associated second type system information blocks are provided by broadcast or on-demand, the value tag being updated upon a change of a corresponding second type SIB, the first type SIB being required for the wireless terminal to perform an initial access to the radio access network," as claimed. This is shown, for example in the following portions of the 3GPP specifications, TS 38.331 and TS 38.300:

5.2.1 Introduction

System Information (SI) is divided into the *MIB* and a number of SIBs where:

- the *MIB* is always transmitted on the BCH with a periodicity of 80 ms and repetitions made within 80 ms (TS 38.212 [17], clause 7.1) and it includes parameters that are needed to acquire *SIB1* from the cell. The first transmission of the *MIB* is scheduled in subframes as defined in TS 38.213 [13], clause 4.1 and repetitions are scheduled according to the period of SSB;

- the *SIB1* is transmitted on the DL-SCH with a periodicity of 160 ms and variable transmission repetition periodicity within 160 ms as specified in TS 38.213 [13], clause 13. The default transmission repetition periodicity of *SIB1* is 20 ms but the actual transmission repetition periodicity is up to network implementation. For SSB and CORESET multiplexing pattern 1, *SIB1* repetition transmission period is 20 ms. For SSB and CORESET multiplexing pattern 2/3, *SIB1* transmission repetition period is the same as the SSB period (TS 38.213 [13], clause 13). *SIB1* includes information regarding the availability and scheduling (e.g. mapping of SIBs to SI message, periodicity, SI-window size) of other SIBs with an indication whether one or more SIBs are only provided on-demand and, in that case, the configuration needed by the UE to perform the SI request. *SIB1* is cell-specific SIB;

- SIBs other than *SIB1* are carried in *SystemInformation* (SI) messages, which are transmitted on the DL-SCH. Only SIBs having the same periodicity can be mapped to the same SI message. Each SI message is transmitted within periodically occurring time domain windows (referred to as SI-windows with same length for all SI messages). Each SI message is associated with an SI-window and the SI-windows of different SI messages do not overlap. That is, within one SI-window only the corresponding SI message is transmitted. An SI message may be transmitted a number of times within the SI-window. Any SIB except *SIB1* can be configured to be cell specific or area specific, using an indication in *SIB1*. The cell specific SIB is applicable only within a cell that provides the SIB while the area specific SIB is applicable within an area referred to as SI area, which consists of one or several cells and is identified by *systemInformationAreaID*;

TS 38.331, Section 5.2.1 (highlighting added).

6.2.2 Message definitions

– *SIB1*

SIB1 contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information. It also contains radio resource configuration information that is common for all UEs and barring information applied to the unified access control.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH

Direction: Network to UE

***SIB1* message**

```
-- ASN1START
-- TAG-SIB1-START

SIB1 ::=        SEQUENCE {
    cellSelectionInfo                   SEQUENCE {
        q-RxLevMin                          Q-RxLevMin,
        q-RxLevMinOffset                    INTEGER (1..8)                                          OPTIONAL,   -- Need S
        q-RxLevMinSUL                       Q-RxLevMin                                              OPTIONAL,   -- Need R
        q-QualMin                           Q-QualMin                                               OPTIONAL,   -- Need S
        q-QualMinOffset                     INTEGER (1..8)                                          OPTIONAL    -- Need S
    }                                                                                               OPTIONAL,   -- Cond Standalone
    cellAccessRelatedInfo               CellAccessRelatedInfo,
    connEstFailureControl               ConnEstFailureControl                                       OPTIONAL,   -- Need R
    si-SchedulingInfo                   SI-SchedulingInfo                                           OPTIONAL,   -- Need R
    servingCellConfigCommon             ServingCellConfigCommonSIB                                  OPTIONAL,   -- Need R
    ims-EmergencySupport                ENUMERATED {true}                                           OPTIONAL,   -- Need R
    eCallOverIMS-Support                ENUMERATED {true}                                           OPTIONAL,   -- Cond Absent
    ue-TimersAndConstants               UE-TimersAndConstants                                       OPTIONAL,   -- Need R

    uac-BarringInfo                     SEQUENCE {
        uac-BarringForCommon                UAC-BarringPerCatList                                   OPTIONAL,   -- Need S
        uac-BarringPerPLMN-List             UAC-BarringPerPLMN-List                                 OPTIONAL,   -- Need S
        uac-BarringInfoSetList              UAC-BarringInfoSetList,
        uac-AccessCategory1-SelectionAssistanceInfo CHOICE {
            plmnCommon                          UAC-AccessCategory1-SelectionAssistanceInfo,
            individualPLMNList                  SEQUENCE (SIZE (2..maxPLMN)) OF UAC-AccessCategory1-SelectionAssistanceInfo
        }                                                                                           OPTIONAL    -- Need S
    }                                                                                               OPTIONAL,   -- Need R

    useFullResumeID                     ENUMERATED {true}                                           OPTIONAL,   -- Need R

    lateNonCriticalExtension            OCTET STRING                                                OPTIONAL,
    nonCriticalExtension                SEQUENCE{}                                                  OPTIONAL
}
```

TS 38.331, Section 6.2.2 (highlighting added).

6.3.2 Radio resource control information elements

– *SI-SchedulingInfo*

The IE *SI-SchedulingInfo* contains information needed for acquisition of SI messages.

***SI-SchedulingInfo* information element**

```
-- ASN1START
-- TAG-SI-SCHEDULINGINFO-START

SI-SchedulingInfo ::=               SEQUENCE {
    schedulingInfoList                  SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo,
    si-WindowLength                     ENUMERATED {s5, s10, s20, s40, s80, s160, s320, s640, s1280},
    si-RequestConfig                    SI-RequestConfig                                        OPTIONAL,  -- Cond MSG-1
    si-RequestConfigSUL                 SI-RequestConfig                                        OPTIONAL,  -- Cond SUL-MSG-1
    systemInformationAreaID             BIT STRING (SIZE (24))                                  OPTIONAL,   -- Need R
    ...
}

SchedulingInfo ::=                  SEQUENCE {
    si-BroadcastStatus                  ENUMERATED {broadcasting, notBroadcasting},
    si-Periodicity                      ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},
    sib-MappingInfo                     SIB-Mapping
}

SIB-Mapping ::=                     SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo

SIB-TypeInfo ::=                    SEQUENCE {
    type                                ENUMERATED {sibType2, sibType3, sibType4, sibType5, sibType6, sibType7, sibType8, sibType9,
                                                    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1,... },
    valueTag                            INTEGER (0..31)                                         OPTIONAL, -- Cond SIB-TYPE
    areaScope                           ENUMERATED {true}                                       OPTIONAL -- Need S
}

-- Configuration for Msg1 based SI Request
SI-RequestConfig ::=                SEQUENCE {
    rach-OccasionsSI                    SEQUENCE {
        rach-ConfigSI                       RACH-ConfigGeneric,
        ssb-perRACH-Occasion                ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}
    }                                                                                           OPTIONAL,   -- Need R
    si-RequestPeriod                    ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen}   OPTIONAL,   -- Need R
    si-RequestResources                 SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResources
}

SI-RequestResources ::=             SEQUENCE {
    ra-PreambleStartIndex               INTEGER (0..63),
    ra-AssociationPeriodIndex           INTEGER (0..15)                                         OPTIONAL,   -- Need R
    ra-ssb-OccasionMaskIndex            INTEGER (0..15)                                         OPTIONAL    -- Need R
}

-- TAG-SI-SCHEDULINGINFO-STOP
-- ASN1STOP
```

TS 38.331, Section 6.3.2 (highlighting added).

5.2.2.2 SIB validity and need to (re)-acquire SIB

5.2.2.2.1 SIB validity

The UE shall apply the SI acquisition procedure as defined in clause 5.2.2.3 upon cell selection (e.g. upon power on), cell-reselection, return from out of coverage, after reconfiguration with sync completion, after entering the network from another RAT, upon receiving an indication that the system information has changed, upon receiving a PWS notification; and whenever the UE does not have a valid version of a stored SIB.

When the UE acquires a *MIB* or a *SIB1* or an SI message in a serving cell as described in clause 5.2.2.3, and if the UE stores the acquired SIB, then the UE shall store the associated *areaScope*, if present, the first *PLMN-Identity* in the *PLMN-IdentityInfoList*, the *cellIdentity*, the *systemInformationAreaID*, if present, and the *valueTag*, if present, as indicated in the *si-SchedulingInfo* for the SIB. The UE may use a valid stored version of the SI except *MIB*, *SIB1*, *SIB6*, *SIB7* or *SIB8* e.g. after cell re-selection, upon return from out of coverage or after the reception of SI change indication.

NOTE: The storage and management of the stored SIBs in addition to the SIBs valid for the current serving cell is left to UE implementation.

The UE shall:

1> delete any stored version of a SIB after 3 hours from the moment it was successfully confirmed as valid;

1> for each stored version of a SIB:

2> if the *areaScope* is associated and its value for the stored version of the SIB is the same as the value received in the *si-SchedulingInfo* for that SIB from the serving cell:

3> if the first *PLMN-Identity* included in the *PLMN-IdentityInfoList*, the *systemInformationAreaID* and the *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

2> if the *areaScope* is not present for the stored version of the SIB and the *areaScope* value is not included in the *si-SchedulingInfo* for that SIB from the serving cell:

3> if the first *PLMN-Identity* in the *PLMN-IdentityInfoList,* the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity,* the *cellIdentity* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

TS 38.331, Section 5.2.2.2 (highlighting added).

***SchedulingInfo* field descriptions**
areaScope Indicates that a SIB is area specific. If the field is absent, the SIB is cell specific.
si-BroadcastStatus Indicates if the SI message is being broadcasted or not. Change of *si-BroadcastStatus* should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*.
si-Periodicity Periodicity of the SI-message in radio frames. Value *rf8* corresponds to 8 radio frames, value *rf16* corresponds to 16 radio frames, and so on.

TS 38.331, Section 6.3.2 (highlighting added).

7.3.3 SI Modification

Change of system information (other than for ETWS/CMAS, see clause 16.4) only occurs at specific radio frames, i.e. the concept of a modification period is used. System information may be transmitted a number of times with the same content within a modification period, as defined by its scheduling. The modification period is configured by system information.

When the network changes (some of the) system information, it first notifies the UEs about this change, i.e. this may be done throughout a modification period. In the next modification period, the network transmits the updated system information. Upon receiving a change notification, the UE acquires the new system information from the start of the next modification period. The UE applies the previously acquired system information until the UE acquires the new system information.

TS 38.300, Section 7.3.3 (highlighting added).

7.3 System Information Handling

7.3.1 Overview

System Information (SI) consists of a MIB and a number of SIBs, which are divided into Minimum SI and Other SI:

- **Minimum SI** comprises basic information required for initial access and information for acquiring any other SI. Minimum SI consists of:
  - *MIB* contains cell barred status information and essential physical layer information of the cell required to receive further system information, e.g. CORESET#0 configuration. *MIB* is periodically broadcast on BCH.
  - *SIB1* defines the scheduling of other system information blocks and contains information required for initial access. SIB1 is also referred to as Remaining Minimum SI (RMSI) and is periodically broadcast on DL-SCH or sent in a dedicated manner on DL-SCH to UEs in RRC_CONNECTED.
- **Other SI** encompasses all SIBs not broadcast in the Minimum SI. Those SIBs can either be periodically broadcast on DL-SCH, broadcast on-demand on DL-SCH (i.e. upon request from UEs in RRC_IDLE or RRC_INACTIVE), or sent in a dedicated manner on DL-SCH to UEs in RRC_CONNECTED. Other SI consists of:

TS 38.300, Section 7.3.1 (highlighting added).

5.2.2.2 SIB validity and need to (re)-acquire SIB

5.2.2.2.1 SIB validity

The UE shall apply the SI acquisition procedure as defined in clause 5.2.2.3 upon cell selection (e.g. upon power on), cell-reselection, return from out of coverage, after reconfiguration with sync completion, after entering the network from another RAT, upon receiving an indication that the system information has changed, upon receiving a PWS notification; and whenever the UE does not have a valid version of a stored SIB.

TS 38.331, Section 5.2.2.2.1 (highlighting added).

5.2.2.4.2 Actions upon reception of the *SIB1*

Upon receiving the *SIB1* the UE shall:

4> if the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1:

5> for the SI message(s) that, according to the *si-SchedulingInfo*, contain at least one required SIB and for which *si-BroadcastStatus* is set to broadcasting:

6> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;

5> for the SI message(s) that, according to the *si-SchedulingInfo*, contain at least one required SIB and for which *si-BroadcastStatus* is set to *notBroadcasting*:

6> trigger a request to acquire the SI message(s) as defined in sub-clause 5.2.2.3.3;

TS 38.331, Section 5.2.2.4.2 (highlighting added).

104. As shown in the example above, a first type system information block comprising "SIB1" is generated by the Accused Instrumentality. This SIB1 block includes "information indicating whether one or more associated second type system information blocks are provided by broadcast or on-demand," as claimed. Second type system information blocks are identified in the fields SIB-TypeInfo and/or SIB-Mapping of the SI-SchedulingInfo field. The field si-BroadcastStatus indicates whether one or more associated second type system information blocks are provided by broadcast or on-demand.

105. As shown in the example above, the SIB1 block includes "a value tag … the value tag being updated upon a change of a corresponding second type SIB," as claimed. The value tag for each second-type system information block is stored in the vector valueTag of the SI-SchedulingInfo field. When a second type SIB changes, its corresponding value tag is updated.

106. As shown in the example above, "the first type SIB [is] required for the wireless terminal to perform an initial access to the radio access network," as claimed. SIB1 is part of the "Minimum SI" which is "basic information required for initial access" to the radio access network.

107. As shown in the example above, the Accused Instrumentalities are capable of "upon a change of a second type SIB whose associated information indicated before the change that the second type SIB was provided on-demand, to include in the first type SIB the information associated with the second type SIB indicating that the second type SIB is provided by broadcast," as claimed. As shown above, "When the network changes (some of the) system information, it first notifies the UEs about this change… In the next modification period, the network transmits the updated system information." The Accused Instrumentalities modify the si-BroadcastStatus field in SIB1 to indicate that the corresponding second-type SIB is provided by broadcast.

108. As shown in the example above, the Accused Instrumentalities comprise the claimed "transmitter circuitry configured to transmit the first type SIB." For example, the 3GPP specification states "the SIB1 is transmitted on the DL-SCH with a periodicity of 160 ms….".

109. The Accused Instrumentalities "transmit a message that triggers the wireless terminal to receive the first type SIB," as claimed. For example, TS 38.331 describes the Short Message that triggers acquisition of SIB1:

5.2.2.2.2 SI change indication and PWS notification

A modification period is used, i.e. updated SI (other than for ETWS and CMAS) is broadcasted in the modification period following the one where SI change indication is transmitted. The modification period boundaries are defined by SFN values for which SFN mod m = 0, where m is the number of radio frames comprising the modification period. The modification period is configured by system information. The UE receives indications about SI modifications and/or PWS notifications using Short Message transmitted with P-RNTI over DCI (see clause 6.5). Repetitions of SI change indication may occur within preceding modification period.

UEs in RRC_IDLE or in RRC_INACTIVE shall monitor for SI change indication in its own paging occasion every DRX cycle. UEs in RRC_CONNECTED shall monitor for SI change indication in any paging occasion at least once per modification period if the UE is provided with common search space on the active BWP to monitor paging, as specified in TS 38.213 [13], clause 13.

ETWS or CMAS capable UEs in RRC_IDLE or in RRC_INACTIVE shall monitor for indications about PWS notification in its own paging occasion every DRX cycle. ETWS or CMAS capable UEs in RRC_CONNECTED shall monitor for indication about PWS notification in any paging occasion at least once every *defaultPagingCycle* if the UE is provided with common search space on the active BWP to monitor paging.

For Short Message reception in a paging occasion, the UE monitors the PDCCH monitoring occasion(s) for paging as specified in TS 38.304 [20] and TS 38.213 [13].

If the UE receives a Short Message, the UE shall:

1> if the UE is ETWS capable or CMAS capable, the *etwsAndCmasIndication* bit of Short Message is set, and the UE is provided with *searchSpaceOtherSystemInformation* on the active BWP or the initial BWP:

2> immediately re-acquire the *SIB1*;

2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB6*:

3> acquire *SIB6*, as specified in sub-clause 5.2.2.3.2, immediately;

2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB7*:

3> acquire *SIB7*, as specified in sub-clause 5.2.2.3.2, immediately;

2> if the UE is CMAS capable and *si-SchedulingInfo* includes scheduling information for *SIB8*:

3> acquire *SIB8*, as specified in sub-clause 5.2.2.3.2, immediately;

NOTE: In case *SIB6*, *SIB7*, or *SIB8* overlap with a measurement gap it is left to UE implementation how to immediately acquire *SIB6*, *SIB7*, or *SIB8*.

1> if the *systemInfoModification* bit of Short Message is set:

2> apply the SI acquisition procedure as defined in sub-clause 5.2.2.3 from the start of the next modification period.

TS 38.331, Section 5.2.2.2.2 (highlighting added).

> 5.2.2.3 Acquisition of System Information
>
> 5.2.2.3.1 Acquisition of *MIB* and *SIB1*
>
> The UE shall:
>
> 1> if the UE is in RRC_CONNECTED while T311 is running:
>
> 2> if *ssb-SubcarrierOffset* indicates *SIB1* is transmitted in the cell (TS 38.213 [13]) and if *SIB1* acquisition is required for the UE:
>
> 3> acquire the *SIB1*, which is scheduled as specified in TS 38.213 [13];

TS 38.331, Section 5.2.2.3.1 (highlighting added).

110. In the Accused Instrumentalities, "whether or not the second type SIB has changed is determined based on a value tag, associated with the second type SIB, stored in the wireless terminal, and the value tag included in the first type SIB corresponding to the second type SIB," as claimed. As shown in the examples above, under "5.2.2.2.1 SIB validity," the UE shall, for each stored version of a SIB, "if the … valueTag … included in the si-SchedulingInfo for the SIB received from the serving cell [is] identical to the … valueTag associated with the stored version of that SIB … consider the stored SIB as valid for the cell." As such, whether the second type SIB has changed is determined based on the state of the value tag stored at the wireless terminal and the state of the value tag in the SIB1 message.

111. Because of its conformance with the applicable 5G standards, on information and belief TMO directly infringes at least claim 1 of the '958 patent.

112. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the '958 patent claims. TMO has knowledge of the '958 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '958 patent are not performed by TMO, such acts constituting

direct infringement of the '958 patent are performed by TMO's customers or end-users who act at the direction and/or control of TMO, with TMO's knowledge.

113. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 1 of the '958 patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '958 patent.

114. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when an TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused 5G functionality based upon the hardware and software provided in the Accused Instrumentalities.

115. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '958 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '958 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

116. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '958 Patent by TMO has damaged and will continue to damage Plaintiff.

COUNT IV: INFRINGEMENT OF U.S. PATENT NO. 10,932,207

117. Daingean hereby incorporates and re-alleges paragraphs 1 through 116 as if fully set forth herein.

118. On February 23, 2021, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 10,932,207 ("the '207 Patent"), titled "Terminal Apparatus, Base Station Apparatus, Communication Method, and Integrated Circuit."

119. The inventions disclosed in the '207 Patent describe "a radio access method and a radio network for cellular mobile communications" enabling communications between a base station and a user's device. '207 Patent at 1:16-17. More specifically, the '207 Patent describes a random access procedure that minimizes the number of exchanges required between the base station and the user terminal in order for the user terminal to access the cellular network. This procedure provides faster access to the network under appropriate circumstances. *See generally* '207 Patent at 13:17-14:7. This more efficient random access procedure is referred to in the '207 Patent as the 2-step random access procedure. In addition, the '207 Patent describes an alternative random access procedure (the 4-step procedure) that is implemented in the event that the more efficient technique is not available or if an error occurs during the 2-step procedure. *See, e.g.*, '207 Patent at 14:8-58.

120. Daingean holds all rights, title, and interest in and to the '207 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '207 Patent. TMO is not licensed to the '207 Patent, either expressly or implicitly, nor does it enjoy or

benefit from any other rights in or to the '207 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

121. On information and belief, TMO has infringed directly and continues to infringe directly the '207 Patent in its implementation of its 5G network. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO that are capable of performing and do perform both a 2-step contention based random access procedure and a 4-step contention based random access procedure for accessing the TMO 5G network (collectively, "Accused Instrumentalities").

122. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 4 of the '207 Patent, which is directed to a base station device, such as those provided by TMO in establishing and operating its 5G networks. The following paragraphs provide details regarding one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

123. Claim 4 of the '207 Patent states:

> 4. A base station device comprising:
>
> control circuitry configured to control a 2-step contention based random-access procedure and a 4-step contention based random-access procedure; and
>
> reception circuitry configured to receive a physical random access channel with a random access preamble in a first step of the 2-step contention based random access procedure or in a first step of the 4-step contention based random-access procedure;
>
> wherein transmission power for the physical random access channel is given based at least on a PREAMBLE_RECEIVED TARGET POWER;
>
> for the 4-step contention based random access procedure, the PREAMBLE_RECEIVED_TARGET_POWER is given based at least

on a preambleinitialReceivedTargetPower(0) and a powerRampingStep(0); and

for the 2-step contention based random access procedure, the PREAMBLE_RECEIVED_TARGET_POWER is given based at least on a preambleinitialReceivedTargetPower(l) and a powerRampingStep(l).

'207 Patent at 36:43-62.

124. TMO provides multiple unlimited data plans for its 5G networks, as the marketing materials from TMO make clear. These data plans include providing access to TMO's 5G Networks. [31]

125. The Accused Instrumentalities include TMO base station devices, such as gNodeBs or gNBs, which operate as base stations within a 5G or New Radio (NR) network architecture. The RAN (radio access network) architecture of a 5G network is shown below:[32]

[31] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited July 12, 2023).
[32] *See, e.g.,* TS 38.300 at 16 (Release 16.2).

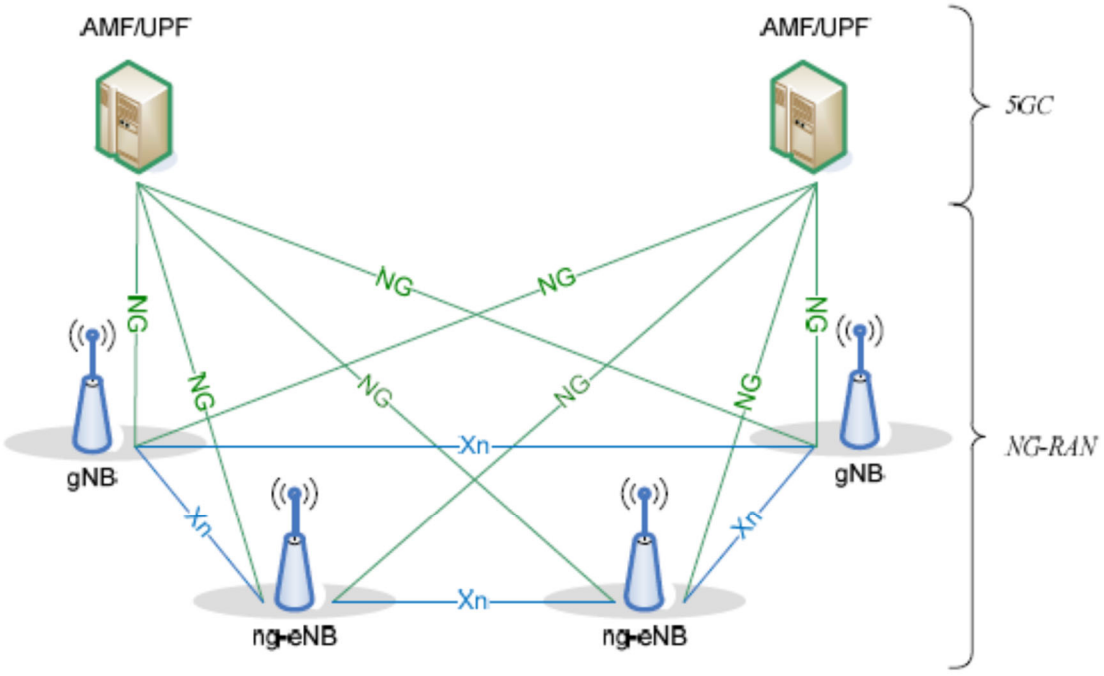


Figure 4.1-1: Overall Architecture

126. On information and belief, the Accused Products implemented by TMO in its 5G networks include hardware and/or software that is configured to control both a 2-step contention based random access procedure and a 4-step contention based random access procedure.

127. On information and belief, the TMO 5G networks conform to and implement TS 38.321 of the 3GPP 5G Standard. TS 38.321 provides the Medium Access Control protocol specification, which governs the operation of MACs within user equipment (UEs) devices that exchange communications with a base station on a 5G (or NR) network. The Accused Base Station Products are capable of responding to UE devices that implement these NR protocols. UE devices initiate a random access (RA) procedure with the Accused Base Station Products to support communication within the 5G network. The operation of these RA procedures is described in TS 38.321 at section 5.1:

5 MAC procedures

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.

TS 38.321 at 16 (Release 16.2) (highlighting added).

128. On information and belief, as part of performing the RA procedure the UE devices operating on the TMO 5G networks use multiple variables for Random Access procedures, as defined below in TS 38.321:

The following UE variables are used for the Random Access procedure:

- *PREAMBLE_INDEX*;
- *PREAMBLE_TRANSMISSION_COUNTER*;
- *PREAMBLE_POWER_RAMPING_COUNTER*;
- *PREAMBLE_POWER_RAMPING_STEP*;
- *PREAMBLE_RECEIVED_TARGET_POWER*;
- *PREAMBLE_BACKOFF*;
- *PCMAX*;
- *SCALING_FACTOR_BI*;
- *TEMPORARY_C-RNTI*;
- *RA_TYPE*;
- *POWER_OFFSET_2STEP_RA*;
- *MSGA_PREAMBLE_POWER_RAMPING_STEP*.

TS 38.321 at 18-19 (Release 16.2).

129. Consistent with the '207 Patent, the RA_TYPE variable can be set to either a 2-stepRA or a 4-stepRA in the UE devices, which corresponds to the 2-step contention based random-access procedure and a 4-step contention based random-access procedure. For example, TS 38.321

defines the following random access procedures which are some examples in which the RA_TYPE field is set to either a 2-stepRA or a 4-stepRA:

> 1> else if the BWP selected for Random Access procedure is configured with both 2-step and 4-step RA type Random Access Resources and the RSRP of the downlink pathloss reference is above *msgA-RSRP-Threshold*; or
>
> 1> if the BWP selected for Random Access procedure is only configured with 2-step RA type Random Access resources (i.e. no 4-step RACH RA type resources configured); or
>
> 1> if the Random Access procedure was initiated for reconfiguration with sync and if the contention-free Random Access Resources for 2-step RA type have been explicitly provided in *rach-ConfigDedicated* for the BWP selected for Random Access procedure:
>
> 2> set the *RA_TYPE* to *2-stepRA*.
>
> 1> else:
>
> 2> set the *RA_TYPE* to *4-stepRA*.
>
> 1> perform initialization of variables specific to Random Access type as specified in clause 5.1.1a;
>
> 1> if *RA_TYPE* is set to *2-stepRA*:
>
> 2> perform the Random Access Resource selection procedure for 2-step RA type (see clause 5.1.2a).
>
> 1> else:
>
> 2> perform the Random Access Resource selection procedure (see clause 5.1.2).

TS 38.321 at 20 (Release 16.2).

130. On information and belief, the Accused Products include control circuitry configured to control a 2-step contention based random-access procedure and a 4-step contention based random-access procedure based on the RA_TYPE specified in RA procedure messages received from a UE.

131. On information and belief, the Accused Products also include reception circuitry that has been configured to receive a physical random access channel transmission with a random access preamble as a first step of the 2-step contention based random-access procedure or as a first step of the 4-step contention based random-access procedure. The transmission power for the physical random access channel is provided based at least on a PREAMBLE_RECEIVED_TARGET_POWER.

132. The 5G (NR) Standard defines PRACH as a Physical Random Access Channel. *See* TS 38.300 at 13 (Release 16.2). On information and belief, TMO conforms and implements the NR and NG-RAN Standard defined in TS 38.300. For the first step of the 2-step contention based random-access procedure, a UE device sends a MSGA transmission to the gNB *(i.e.*, the Accused Base Station Products):

> **5.1.2a Random Access Resource selection for 2-step RA type**
>
> If the selected *RA_TYPE* is set to *2-stepRA*, the MAC entity shall:
>
> ....
>
> 1> perform the MSGA transmission procedure (see clause 5.1.3a).

TS 38.321 at 24-26 (Release 16.2) (highlighting added).

133. That transmission is performed using the Physical Random Access Channel (PRACH) and a corresponding PREAMBLE_RECEIVED_TARGET_POWER (e.g., PREAMBLE_RECEIVED_TARGET_POWER, msgA-PreambleReceivedTargetPower) as indicated in TS 38.321:

> **5.1.3a MSGA transmission**
>
> The MAC entity shall, for each MSGA:
>
> ....
>
> 1> instruct the physical layer to transmit the MSGA using the selected PRACH occasion and the associated PUSCH resource of MSGA (if the selected preamble and PRACH occasion is mapped to a valid PUSCH occasion), using the corresponding RA-RNTI, MSGB-RNTI, *PREAMBLE_INDEX*, *PREAMBLE_RECEIVED_TARGET_POWER*, *msgA-PreambleReceivedTargetPower*, and the amount of power ramping applied to the latest MSGA preamble transmission (i.e. (*PREAMBLE_POWER_RAMPING_COUNTER* – 1) × *PREAMBLE_POWER_RAMPING_STEP*);

TS 38.321 at 28 (Release 16.2) (highlighting added).

134. The MSGA transmission includes the random access preamble for the first step of a 2-step contention based random-access procedure, as set forth in claim 4 of the ’207 Patent.

135. For the first step of the 4-step contention based random-access procedure, a UE device sends a Msg1 to the gNB (*i.e.*, the Accused Base Station Products). *See* TS 38.321 at 16 ("*prach-ConfigurationIndex:* the available set of PRACH occasions for the transmission of the Random Access Preamble for Msg1. These are also applicable to the to the MSGA PRACH if the PRACH occasions are shared between 2-step and 4-step RA types"). Section 5.1.2 of TS 38.321 describes the Random Access Resource selection:

> **5.1.2 Random Access Resource selection**
>
> If the selected *RA_TYPE* is set to *4-stepRA*, the MAC entity shall:
>
> ....
>
> 1> perform the Random Access Preamble transmission procedure (see clause 5.1.3).

TS 38.321 at 22-24 (Release 16.2) (highlighting added).

136. The Random Access Preamble transmission is performed using the physical random access channel and a corresponding PREAMBLE_RECEIVED_TARGET_POWER as indicated in Section 5.1.3:

> **5.1.3 Random Access Preamble transmission**
>
> The MAC entity shall, for each Random Access Preamble:
>
> ....
>
> 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*.

TS 38.321 at 26 (Release 16.2) (highlighting added).

137. The Random Access Preamble (Msg1) comprises the random access preamble for the first step of a 4-step contention based random-access procedure.

138. For the 4-step contention based random access procedure, the PREAMBLE_RECEIVED_TARGET_POWER is provided based at least on a preambleInitialReceivedTargetPower (0) and a powerRampingStep (0). The parameters used for

the 4-step RA procedure are provided in the Information Element (IE) RACH-ConfigGeneric, as indicated below:

> – *RACH-ConfigGeneric*
>
> The IE *RACH-ConfigGeneric* is used to specify the random-access parameters both for regular random access as well as for beam failure recovery.

TS 38.331 at 554 (Release 16.2) (highlighting added).

139. On information and belief, the TMO 5G networks conform to and implement TS 38.331.

140. The RACH-ConfigGeneric IE includes a preambleReceivedTargetPower entry as well as a powerRampingStep entry, corresponding to the preambleInitialReceivedTargetPower (0) and powerRampingStep (0), respectively.

***RACH-ConfigGeneric* information element**

```
-- ASN1START
-- TAG-RACH-CONFIGGENERIC-START

RACH-ConfigGeneric ::=              SEQUENCE {
    prach-ConfigurationIndex            INTEGER (0..255),
    msg1-FDM                            ENUMERATED {one, two, four, eight},
    msg1-FrequencyStart                 INTEGER (0..maxNrofPhysicalResourceBlocks-1),
    zeroCorrelationZoneConfig           INTEGER(0..15),
    preambleReceivedTargetPower         INTEGER (-202..-60),
    preambleTransMax                    ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, r
    powerRampingStep                    ENUMERATED {dB0, dB2, dB4, dB6},
    ra-ResponseWindow                   ENUMERATED {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80},
    ...,
    [[
    prach-ConfigurationPeriodScaling-IAB-r16    ENUMERATED {scf1,scf2,scf4,scf8,scf16,scf32,scf64}
    prach-ConfigurationFrameOffset-IAB-r16      INTEGER (0..63)
    prach-ConfigurationSOffset-IAB-r16          INTEGER (0..39)
    ra-ResponseWindow-v1610                     ENUMERATED { sl60, sl160}
    prach-ConfigurationIndex-v1610              INTEGER (256..262)
    ]]
}
```

TS 38.331 at 554 (Release 16.2) (highlighting added).

141. The TS 38.331 standard explains that the preambleReceveidTargetPower is the "target power level at the network receiver side," and the powerRampingStep is the "[p]ower ramping steps for PRACH." TS 38.331 at 555 (Release 16.2).

142. At initialization, the PREAMBLE_POWER_RAMPING_STEP UE variable is set to RACH-ConfigGeneric.powerRampingStep for the 4-step random access procedure as indicated in Section 5.1.1a of TS 38.321:

> **5.1.1a Initialization of variables specific to Random Access type**
>
> The MAC entity shall:
>
> ....
>
> 1> else (i.e. *RA_TYPE* is set to *4-stepRA*):
>
> 2> set *PREAMBLE_POWER_RAMPING_STEP* to *powerRampingStep*;

TS 38.321 at 20-21 (Release 16.2) (highlighting added).

143. When sending the Random Access Preamble, the UE device will set the PREAMBLE_RECEIVED_TARGET_POWER based on the preambleInitial RecievedTargetPower(0) and powerRampingStep (0):

> **5.1.3 Random Access Preamble transmission**
>
> The MAC entity shall, for each Random Access Preamble:
>
> ....
>
> 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to *preambleReceivedTargetPower* + *DELTA_PREAMBLE* + (*PREAMBLE_POWER_RAMPING_COUNTER* – 1) × *PREAMBLE_POWER_RAMPING_STEP* + *POWER_OFFSET_2STEP_RA*;

TS 38.321 at 26 (Release 16.2) (highlighting added).

144. Within the Accused Products and for the 2-step contention based random access procedure, the PREAMBLE_RECEIVED_TARGET_POWER is given based at least on a preambleInitialReceivedTargetPower (1) and a powerRampingStep (1). The parameters used for the 2-step RA procedure are provided in the IE called RACH-ConfigGenericTwoStepRA.

> – *RACH-ConfigGenericTwoStepRA*
>
> The IE *RACH-ConfigGenericTwoStepRA* is used to specify the 2-step random access type parameters.

TS 38.331 at 555-556 (Release 16.2) (highlighting added).

145. The RACH-ConfigGenericTwoStepRA IE includes a msgA-PreambleReceivedTargetPower-r16 entry and a msgA-PreamblePowerRampingStep-r16, corresponding to the preambleReceivedTargetPower(1) and powerRampingStep (1), respectively, as shown below:

***RACH-ConfigGenericTwoStepRA* information element**

```
-- ASN1START
-- TAG-RACH-CONFIGGENERICTWOSTEPRA-START

RACH-ConfigGenericTwoStepRA-r16 ::=     SEQUENCE {
    msgA-PRACH-ConfigurationIndex-r16       INTEGER (0..262)
    msgA-RO-FDM-r16                         ENUMERATED {one, two, four, eight}
    msgA-RO-FrequencyStart-r16                INTEGER (0..maxNrofPhysicalResourceBlocks-1)
    msgA-ZeroCorrelationZoneConfig-r16        INTEGER (0..15)
    msgA-PreamblePowerRampingStep-r16         ENUMERATED {dB0, dB2, dB4, dB6}
    msgA-PreambleReceivedTargetPower-r16      INTEGER (-202..-60)
    msgB-ResponseWindow-r16                   ENUMERATED {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80

    preambleTransMax-r16                      ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n10
    ...
}
```

TS 38.331 at 555-556 (Release 16.2) (highlighting added).

146. The 5G Standard explains that the msgA-PreambleReceivedTargetPower-r16 is the "target power level at the network receiver side," and msgA-PreamblePowerRampingStep-r16 is the "[p]ower ramping steps for msgA PRACH." TS 38.331 at 557. (Release 16.2)

147. At initialization, the PREAMBLE_POWER_RAMPING_STEP UE variable is set to RACH-ConfigGenericTwoStepRA.msgA-PreambleRecievedTargetPower-r16 for the 2-step random access procedure.

5.1.1a Initialization of variables specific to Random Access type

The MAC entity shall:

1> if *RA_TYPE* is set to *2-stepRA*:

2> set *PREAMBLE_POWER_RAMPING_STEP* to *msgA-PreamblePowerRampingStep*;

TS 38.321 at 20 (Release 16.2) (highlighting added).

148. In preparing to send the Random Access Preamble (MsgA), the UE will set the PREAMBLE_RECIEVED_TARGET_POWER based on the preambleInitial RecievedTargetPower(1) and powerRampingStep (1).

> **5.1.3a MSGA transmission**
>
> The MAC entity shall, for each MSGA:
>
> ....
>
> 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to *msgA-PreambleReceivedTargetPower* + *DELTA_PREAMBLE* + (*PREAMBLE_POWER_RAMPING_COUNTER* – 1) × *PREAMBLE_POWER_RAMPING_STEP*;

TS 38.321 at 27 (Release 16.2) (highlighting added).

149. Because of its conformance with the applicable 5G standards for the MAC protocol (TS 38.321), Radio Resource Control (RRC) protocol (TS 38.331) and NR and NG-RAN specification, on information and belief TMO directly infringes at least claim 4 of the ’207 patent.

150. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the ’207 patent claims. TMO has knowledge of the ’207 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the ’207 patent are not performed by TMO, such acts constituting direct infringement of the ’207 patent are performed by TMO’s customers or end-users who act at the direction and/or control of TMO, with TMO’s knowledge.

151. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 4 of the ’207 patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the ’207 patent.

152. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when an TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused 5G functionality based upon the hardware and software provided in the Accused Instrumentalities.

153. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '207 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '207 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

154. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '207 Patent by TMO has damaged and will continue to damage Plaintiff.

COUNT V: INFRINGEMENT OF U.S. PATENT NO. 11,134,400

155. Daingean hereby incorporates and re-alleges paragraphs 1 through 154 as if fully set forth herein.

156. On September 28, 2021, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 11,134,400 ("the '400 Patent"), titled "User Equipment, Base Station, Related Methods."

157. Daingean holds all rights, title, and interest in and to the '400 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '400 Patent. TMO is not licensed to the '400 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '400 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

158. The inventions disclosed in the '400 Patent describe User Equipments (UE), base stations, and methods for use in each of UEs and base stations. In one claimed embodiment, a base station is a Master Cell group (MCG) base station communicating with UE over a MCG duplicated Signaling Radio bearer (SRB), which is associated with an MCG and a Secondary Cell group (SCG) and configured to be used for uplink transmission via the SCG. If an SCG failure is detected, the MCG duplicated SRB is reconfigured to be used for uplink transmission via the MCG. '400 Patent at 2:25-35. Configuring the base station in this manner adds robustness to the cellular system and allows it to more rapidly recover from an uplink failure.

159. On information and belief, TMO has infringed directly and continues to infringe directly the '400 Patent in its implementation of its 5G networks. The infringing acts include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO that are capable of supporting E-UTRAN and NR Dual Connectivity ("EN-DC") or Multi-Radio Dual Connectivity ("MR-DC") operations.

160. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 5 of the '400 Patent. The following paragraphs provide details regarding only

one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under this Court's scheduling order.

161. Claim 5 of the '400 Patent states:

> 5. A method for a base station, wherein the base station includes a Master Cell Group (MCG) base station and communicates with User Equipment (UE) over a first MCG duplicated Signaling Radio Bearer (SRB) and a second MCG duplicated SRB, and the first MCG duplicated SRB is associated with the MCG and a Secondary Cell Group (SCG) and configured to be used for uplink transmission via the SCG, the method comprising:
>
> receiving, from the UE, a report of an SCG failure;
>
> reconfiguring the first MCG duplicated SRB to receive uplink transmission via the MCG; and
>
> reconfiguring the second MCG duplicated SRB to receive uplink transmission via the MCG.

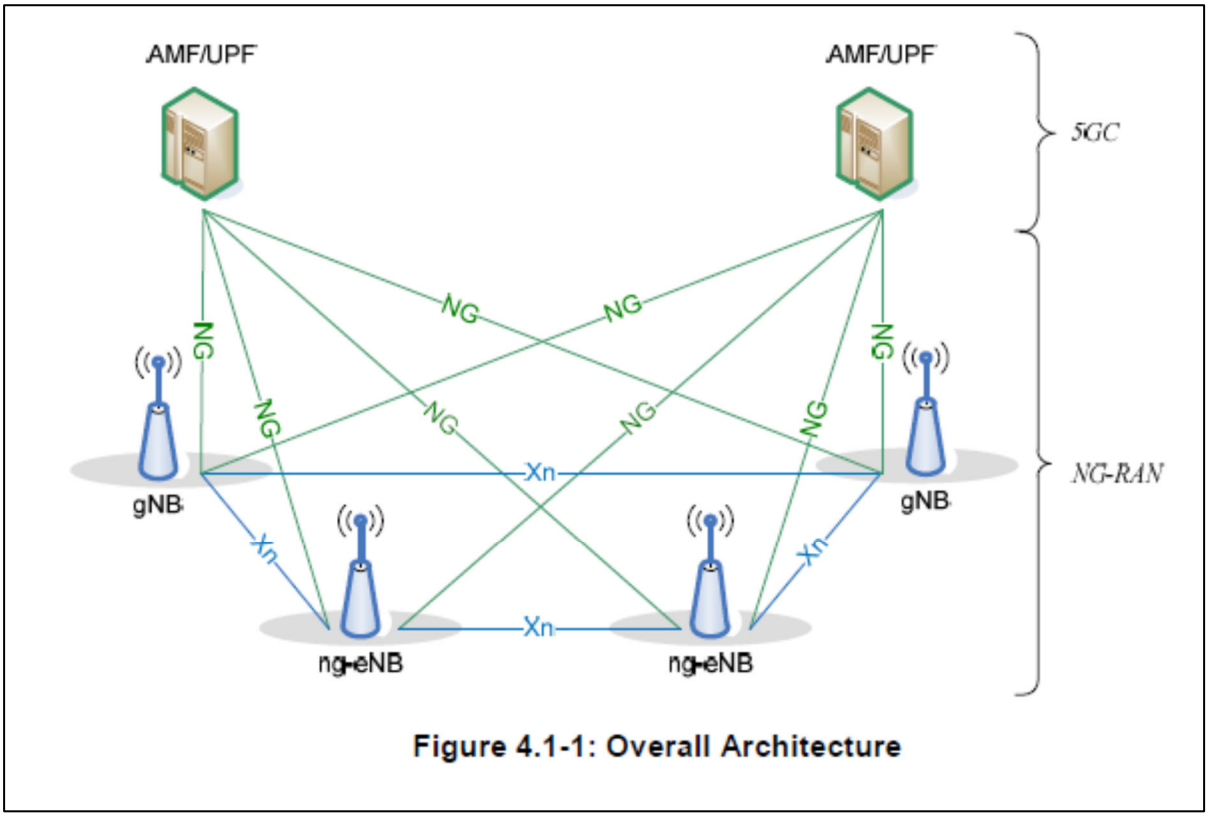
'400 Patent at 17:10-21.

162. TMO provides multiple data plans for its 5G networks, as the marketing materials from TMO make clear. These data plans include providing access to TMO's 5G networks.[33]

163. The Accused Instrumentalities include a base station that "includes a Master Cell Group (MCG) base station and communicates with User Equipment (UE) over a first MCG duplicated Signaling Radio Bearer (SRB) and a second MCG duplicated SRB," as claimed. The Accused Instrumentalities include TMO base station devices, such as gNodeBs (or gNBs), ng-eNBs, eNodeBs (or eNBs), and/or en-gNBs, which operate as base stations within TMO's 5G

[33] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited July 12, 2023).

network architecture. An exemplary RAN (radio access network) architecture of a 5G network is shown below:[34]



164. On information and belief, TMO's 5G networks support Dual Connectivity. Two deployment options are defined for 5G: 5G Non-Standalone ("5G NSA") and 5G Standalone ("5G SA").[35] In the 5G NSA architecture, the 5G Radio Access Network (AN) and its New Radio (NR) interface are used in conjunction with the existing LTE and EPC infrastructure Core Network (i.e., 4G Radio and 4G Core).[36] The NSA offers dual connectivity, via both the 4G AN (E-UTRA) and the 5G AN (NR).[37] NSA is also called "EN-DC" which stands for "E-UTRAN and NR Dual

[34] *See, e.g.,* TS 38.300 at 14, 16.
[35] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited March 9, 2023).
[36] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited March 9, 2023).
[37] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited March 9, 2023).

Connectivity." [38] On information and belief, TMO implements a 5G NSA network and a 5G SA network.

165. Aspects of Dual Connectivity are defined in various industry standards, including 3GPP TS 36.300 V16.7.0 (2021-12), titled "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall Description; Stage 2 (Release 16)" ; 3GPP TS 37.340 V16.7.0 (2021-09), titled "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-Connectivity; Stage 2 (Release 16)"; and 3GPP TS 38.331 V16.7.0 (2021-12), titled "NR; Radio Resource Control (RRC) protocol specification (Release 16)."

166. Specifically, the Radio Protocol Architecture is defined in Section 4.9.2 of TS 36.300. In Dual Connectivity implementations, the radio protocol architecture used by a radio bearer depends upon the manner in which the bearer is set up. There are three bearer types: (i) MCG bearer; (ii) SCG bearer; and (iii) split bearer. Those three types of bearers are shown below in Figure 4.9.2-1:

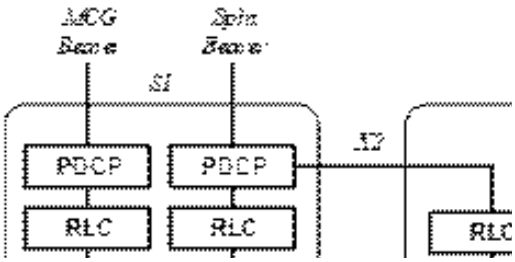


Figure 4.9.2-1: Radio Protocol Architecture for Dual Connectivity.

[38] *See, e.g.,* https://www.3gpp.org/technologies/5g-system-overview (last visited March 9, 2023).

167. As provided in TS 36.300, "MCG Bearer" is defined as "in dual connectivity, a bearer whose radio protocols are only located in the MeNB to use the MeNB resources only." The term "MeNB" refers to the Master eNB. TS 36.300 further defines "SCG Bearer" as "in dual connectivity, a bearer whose radio protocols are only located in the SeNB to use SeNB resources." The term "SeNB" refers to the Secondary eNB, which "is providing additional radio resources for the UE but is not the Master eNB." Lastly, the term "Split Bearer" is defined as "in dual connectivity, a bearer whose radio protocols are located in both the MeNB and the SeNB to use both MeNB and SeNB resources."

Master Cell Group: in dual connectivity, a group of serving cells associated with the MeNB, comprising of the PCell and optionally one or more SCells.

Master eNB: in dual connectivity, the eNB which terminates at least S1-MME.

MBMS-dedicated cell: cell dedicated to MBMS transmission.

MBMS/Unicast-mixed cell: cell supporting both unicast and MBMS transmissions.

MCG bearer: in dual connectivity, a bearer whose radio protocols are only located in the MeNB to use MeNB resources only.

SCG bearer: in dual connectivity, a bearer whose radio protocols are only located in the SeNB to use SeNB resources.

Secondary Cell Group: in dual connectivity, a group of serving cells associated with the SeNB, comprising of PSCell and optionally one or more SCells.

Secondary eNB: in dual connectivity, the eNB that is providing additional radio resources for the UE but is not the Master eNB.

Split bearer: in dual connectivity, a bearer whose radio protocols are located in both the MeNB and the SeNB to use both MeNB and SeNB resources.

TS 36.300, Section 3.1.

168. Split Signaling Radio Bearer (SRB) is supported for all Multi-Radio Dual Connectivity (MR-DC) options. It allows duplication of Radio Resource Control (RRC) Packet Data Units (PDUs) generated by the Master Node (MN), via both a direct path and via the Secondary Node (SN). Split SRB uses New Radio (NR) Packet Data Convergence Protocol

(PDCP). A split SRB is a duplicated SRB between the MCG and the SCG as shown in Figure 4.9.2-1, above. *See also* TS37.340 V16.8 (2021-12) (Release 16) at Sections 3.1 and 4.2.1

169. For the Accused Instrumentalities, "the first MCG duplicated SRB is associated with the MCG and a Secondary Cell Group (SCG) and configured to be used for uplink transmission via the SCG." The User Equipment (UE) device(s) may be configured with a split Signaling Radio Bearer (SRB), which enables transmission of Radio Resource Control (RRC) signaling via the MCG and/or SCG. MCG duplicated SRBs can be used for both SRB1 and SRB2, as detailed below.

> ### 4.2.2 Signalling radio bearers
>
> "Signalling Radio Bearers" (SRBs) are defined as Radio Bearers (RBs) that are used only for the transmission of RRC and NAS messages. More specifically, the following SRBs are defined:
>
> - SRB0 is for RRC messages using the CCCH logical channel;
> - SRB1 is for RRC messages (which may include a piggybacked NAS message) as well as for NAS messages prior to the establishment of SRB2, all using DCCH logical channel;
> - SRB2 is for NAS messages and for RRC messages which include logged measurement information, all using DCCH logical channel. SRB2 has a lower priority than SRB1 and may be configured by the network after AS security activation;
> - SRB3 is for specific RRC messages when UE is in (NG)EN-DC or NR-DC, all using DCCH logical channel;
> - SRB4 is for RRC messages which include application layer measurement report information, all using DCCH logical channel. SRB4 can only be configured by the network after AS security activation.
>
> In downlink, piggybacking of NAS messages is used only for one dependant (i.e. with joint success/failure) procedure: bearer establishment/modification/release. In uplink piggybacking of NAS message is used only for transferring the initial NAS message during connection setup and connection resume.
>
> NOTE 1: The NAS messages transferred via SRB2 are also contained in RRC messages, which however do not include any RRC protocol control information.
>
> Once AS security is activated, all RRC messages on SRB1, SRB2, SRB3 and SRB4, including those containing NAS messages, are integrity protected and ciphered by PDCP. NAS independently applies integrity protection and ciphering to the NAS messages, see TS 24.501 [23].
>
> Split SRB is supported for all the MR-DC options in both SRB1 and SRB2 (split SRB is not supported for SRB0 and SRB3).
>
> For operation with shared spectrum channel access, SRB0, SRB1 and SRB3 are assigned with the highest priority Channel Access Priority Class (CAPC), (i.e. CAPC = 1) while CAPC for SRB2 is configurable.

TS 38.331 V15.17.0 (2022-03), Section 4.2.2 (highlighting added). Additionally, the split SRBs can be configured for uplink via the SCG. *See* TS 37.340 V16.7.0 (2021-09), Section 7.6 ("For the split SRB, the selection of transmission path in downlink depends on network implementation. ***For***

uplink, the UE is configured via MN RRC signaling whether to use MCG path or ***duplicate the transmission on both MCG and SCG***." (emphasis added)).

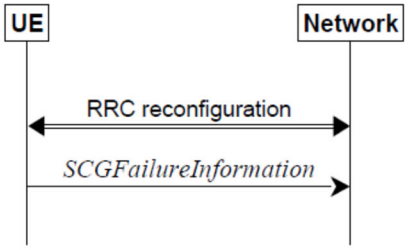
170. Section 7.7 of the TS 37.340 Standard identifies the instances and manner in which Secondary Cell group (SCG) failures are handled. Specifically, this Standard provides that if SCG failure is detected by the UE, it "reports *SCGFailureInformation* to the Main Node (MN) instead of triggering re-establishment."

> ## 7.7 SCG/MCG failure handling
>
> RLF is declared separately for the MCG and for the SCG.
>
> The following SCG failure cases are supported:
>
> - SCG RLF;
> - SN addition/change failure;
> - For EN-DC, NGEN-DC and NR-DC, SCG configuration failure or CPC configuration failure (only for messages on SRB3);
> - For EN-DC, NGEN-DC and NR-DC, SCG RRC integrity check failure (on SRB3);
> - For EN-DC, NGEN-DC and NR-DC, consistent UL LBT failure on PSCell;
> - For IAB-MT, reception of a BH RLF indication from SCG;
> - CPC execution failure.
>
> Upon SCG failure, if MCG transmissions of radio bearers are not suspended, the UE suspends SCG transmissions for all radio bearers and reports the *SCGFailureInformation* to the MN, instead of triggering re-establishment. If SCG failure is detected while MCG transmissions for all radio bearers are suspended, the UE initiates the RRC connection re-establishment procedure.

TS 37.340, Section 7.7 (highlighting added).

171. This same Section 7.7 of the TS 37.340 Standard also indicates that "The UE includes in the *SCGFailureInformation* message the measurement results available according to current measurement configuration of both the MN and the SN. The MN handles the *SCGFailureInformation* message and may decide to keep, change, or release the SN/SCG. In all the cases, the measurement results according to the SN configuration and the SCG failure type may be forwarded to the old SN and/or to the new SN."

172. The *SCGFailureInformation* message is described in the Standard, 3GPP TS 38.331 as a message to provide reconfiguration:

> 5.7.3 SCG failure information
>
> 5.7.3.1 General
>
> 
>
>
> **Figure 5.7.3.1-1: SCG failure information**
>
> The purpose of this procedure is to inform E-UTRAN or NR MN about an SCG failure the UE has experienced i.e. SCG radio link failure, failure of SCG reconfiguration with sync, SCG configuration failure for RRC message on SRB3, SCG integrity check failure, and consistent uplink LBT failures on PSCell for operation with shared spectrum channel access.
>
> 5.7.3.2 Initiation
>
> A UE initiates the procedure to report SCG failures when neither MCG nor SCG transmission is suspended and when one of the following conditions is met:
>
> 1> upon detecting radio link failure for the SCG, in accordance with clause 5.3.10.3;
>
> 1> upon detecting beam failure of the PSCell while the SCG is deactivated, in accordance with TS 38.321[3];
>
> 1> upon reconfiguration with sync failure of the SCG, in accordance with clause 5.3.5.8.3;
>
> 1> upon SCG configuration failure, in accordance with clause 5.3.5.8.2;
>
> 1> upon integrity check failure indication from SCG lower layers concerning SRB3.

TS 38.331, Section 5.7.3.

173. TS 38.331 indicates that if the UE is (NG)EN-DC, the UE will initiate transmission of the *SCGFailureInformation* message according to Section 5.7.3.5 unless it initiates transmission of the *SCGFailureInformationNR* message. Section 5.7.3.5 of TS 38.331 provides:

> 5.7.3.5 Actions related to transmission of *SCGFailureInformation* message
>
> The UE shall set the contents of the *SCGFailureInformation* message as follows:
>
> 1> if the UE initiates transmission of the *SCGFailureInformation* message due to T310 expiry:
>
> 2> set the *failureType* as *t310-Expiry*;
>
> 1> else if the UE initiates transmission of the *SCGFailureInformation* message due to T312 expiry:
>
> 2> set the *failureType* as *other* and set the *failureType-v1610* as *t312-Expiry*;
>
> 1> else if the UE initiates transmission of the *SCGFailureInformation* message to provide reconfiguration with sync failure information for an SCG:
>
> 2> set the *failureType* as *synchReconfigFailureSCG*;

TS 38.331, Section 5.7.3.5 (highlighting added).

174. Similarly, if the failure type determination is for (NG)EN-DC and the failure message is *SCGFailureInformationNR*, then:

> 5.7.3.3 Failure type determination for (NG)EN-DC
>
> The UE shall set the SCG failure type as follows:
>
> 1> if the UE initiates transmission of the *SCGFailureInformationNR* message due to T310 expiry:
>
> 2> set the *failureType* as t310-Expiry;
>
> 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to T312 expiry:
>
> 2> set the *failureType* as any value and set the *failureType-v1610* as t312-Expiry;
>
> 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message to provide reconfiguration with sync failure information for an SCG:
>
> 2> set the *failureType* as *synchReconfigFailureSCG*;

TS 38.331, Section 5.7.3.3 (highlighting added).

175. As TS 38.331 indicates, if the UE initiates transmission of *SCGFailureInformation* or *SCGFailureInformationNR* to provide reconfiguration, then the *failuretype* is set to *synchReconfiguFailureSCG*. Through these *SCGFailureInformation* messages, the UE provides the Master Node (MN) with information about the SCG failure for the purpose of causing a reconfiguration upon SCG sync failure, which would involve reconfiguration of duplicated or split

radio bearers SRB1 and/or SRB2 to receive uplink transmission via the MCG. *See* TS 38.331, Section 5.3.5.

176. Because of its conformance with the applicable 5G standards discussed above, on information and belief TMO directly infringes at least claim 5 of the '400 patent.

177. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the '400 patent claims. TMO has knowledge of the '400 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '400 patent are not performed by TMO, such acts constituting direct infringement of the '400 patent are performed by TMO's customers or end-users who act at the direction and/or control of TMO, with TMO's knowledge.

178. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 5 of the '400 patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '400 patent.

179. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when an TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

180. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '400 patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '400 patent and are not staple articles of commerce suitable for substantial non-infringing use.

181. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '400 Patent by TMO has damaged and will continue to damage Plaintiff.

COUNT VI: INFRINGEMENT OF U.S. PATENT NO. 11,196,509

182. Daingean hereby incorporates and re-alleges paragraphs 1 through 181 as if fully set forth herein.

183. On December 7, 2021, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 11,196,509 ("the '509 Patent"), titled "Terminal, Apparatus, Base Station Apparatus, and Communication Method."

184. Daingean holds all rights, title, and interest in and to the '509 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '509 Patent. TMO is not licensed to the '509 Patent, either expressly or implicitly, nor does it enjoy or

benefit from any other rights in or to the '509 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, Daingean.

185. The inventions disclosed in the '509 Patent describe base stations "capable of efficiently performing uplink and/or downlink communication." '509 at 1:53-61, 5:48-51. More specifically, the '509 Patent teaches subdividing a Transport Block ("TB") into multiple Code Blocks ("CB") and then grouping those CBs into Code Block Groups ("CBGs"). *Id*. at 1:66-2:17. The CBs and CBGs can be of different sizes. *Id*. This subdividing and grouping process allows the Hybrid Automatic Repeat Request ("HARQ") procedure to be performed on a more granular basis. *Id.* Instead of performing HARQ on an entire TB basis (*e.g.*, sending a NACK signal corresponding to the entire TB that requires retransmitting the entire TB when just a single CBG within that TB is not properly received), the '509 granular HARQ approach permits performing HARQ on a CBG basis (*e.g.*, sending a NACK signal with a bit corresponding each CBG so that when just one CBG is not properly received, only that CBG is retransmitted). *Id*.; *see also id.* at 35:40-62.

186. Annotated Figure 11b of the '509 Patent illustrates a preferred embodiment. *See* '509 at 23:7-12, 22-25. The TB is subdivided into 11 CBs (CB#1 to CB#11), and those CBs are grouped into four CBGs (CBG#1 to CBG#4). *Id*. The CBs have two different sizes: a first CB size, colored white ("First CB") and a second CB size, colored black ("Second CB"). *Id*. And the CBGs also have different sizes: CBGs#1-3 have a first size with three CBs each, blue box ("First CBGs"), while CBG#4 has a second size with only two CBs, red box ("Second CBGs"). *Id*. Of the First CBGs, CBG#1 has the most Second CBs.

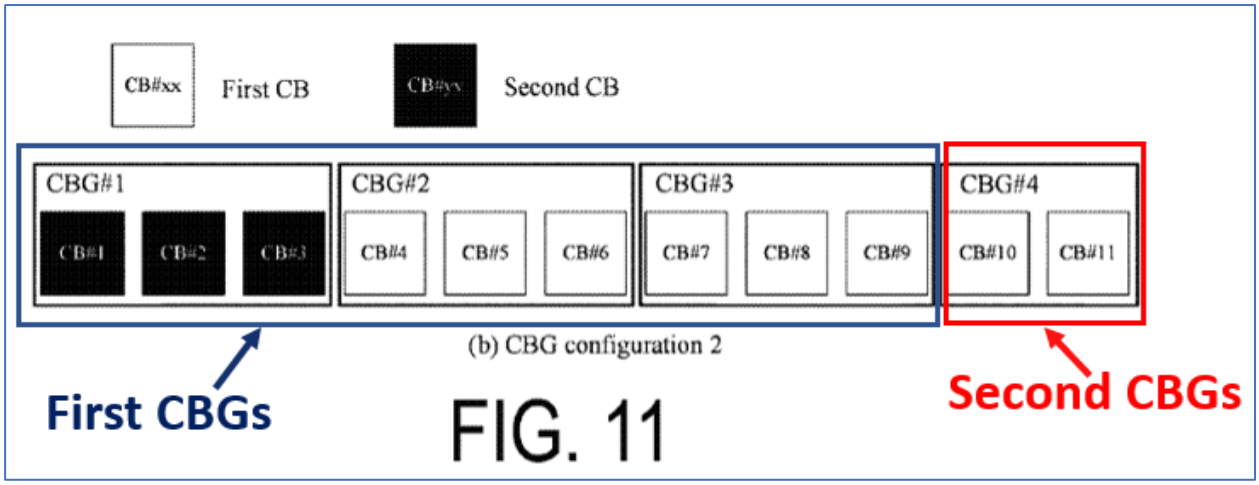


FIG. 11

187. On information and belief, TMO has infringed directly and continues to infringe directly the '509 Patent in its implementation of its 5G network. The infringing acts include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO that implement the 5G Code Block Segmentation and CBG-based HARQ-ACK functionality, as described in 3GPP 5G standards such as TS 38.212 (Multiplexing and channel coding), 3GPP TS 38.213 (Physical layer procedures for control), 3GPP TS 38.214 (Physical layer procedures for data), and 3GPP TS 38.331 (Radio Resource Control Protocol).

188. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 10 of the '509 Patent. The following paragraphs provide details regarding only one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under this Court's scheduling order.

189. Claim 10 of the '509 Patent states:

> 10. A communication method for a base station apparatus, the communication method comprising the steps of:
>
> segmenting a transport block into multiple CBs and coding each of the multiple CBs;

transmitting the transport block, and

receiving HARQ-ACKs corresponding to multiple CBGs, wherein

the multiple CBs include one or more first CBs and one or more second CBs,

a first size of a first CB of the one or more first CBs is greater than a second size of a second CB of the one or more second CBs,

each of the multiple CBs is included in any one of the multiple CBs,

the multiple CBGs include one or more first CBGs and one or more second CBGs,

a first total number of the one or more first CBs and the one or more second CBs included in each of the one or more first CBGs is greater than a second total number of the one or more first CBs and the one or more second CBs included in each of the one or more second CBGs, and

a first CBG of the one or more first CBGs includes a greatest number of the one or more second CBs.

'509 Patent at 50:32-55.

190. 3GPP TS 38.212 generally "specifies the coding, multiplexing and mapping to physical channels for 5G NR." 3GPP TS 38.212 at §1. Clause 7.2.3 of 3GPP TS 38.212 generally explains the code block segmentation for 5G NR. As shown below, the 5G transport block includes *B* bits, and its code blocks are segmented according to the algorithm in clause 5.2.2 of 3GPP TS 38.212:

> **7.2.3 Code block segmentation and code block CRC attachment**
>
> The bits input to the code block segmentation are denoted by $b_0, b_1, b_2, b_3, \ldots, b_{B-1}$ where B is the number of bits in the transport block (including CRC).
>
> Code block segmentation and code block CRC attachment are performed according to Clause 5.2.2.

3GPP TS 38.212 at §7.2.3. Specifically, clause 5.2.2 of 3GPP TS 38.212 details how to determine the total number of code blocks *C* within a transport block:

Total number of code blocks C is determined by:

if $B \leq K_{cb}$

$L = 0$

Number of code blocks: $C = 1$

$B' = B$

else

$L = 24$

Number of code blocks: $C = \lceil B/(K_{cb} - L) \rceil$.

$B' = B + C \cdot L$

end if

3GPP TS 38.212 at §5.2.2.

191. Clause 7.2.4 of 3GPP TS 38.212 explains how those code blocks are coded:

7.2.4 Channel coding

Code blocks are delivered to the channel coding block. The bits in a code block are denoted by $c_{r0}, c_{r1}, c_{r2}, c_{r3}, \ldots, c_{r(K_r-1)}$, where r is the code block number, and K_r is the number of bits in code block number r. The total number of code blocks is denoted by C and each code block is individually LDPC encoded according to Clause 5.3.2.

After encoding the bits are denoted by $d_{r0}, d_{r1}, d_{r2}, d_{r3}, \ldots, d_{r(N_r-1)}$, where the values of N_r is given in Clause 5.3.2.

3GPP TS 38.212 at §7.2.4.

192. Clause 5.1.7 of 3GPP TS 38.214 explains how those code blocks are grouped into code block groups:

5.1.7.1 UE procedure for grouping of code blocks to code block groups

If a UE is configured to receive code block group (CBG) based transmissions by receiving the higher layer parameter *codeBlockGroupTransmission* for PDSCH, the UE shall determine the number of CBGs for a transport block reception as

$$M = \min(N, C),$$

where N is the maximum number of CBGs per transport block as configured by *maxCodeBlockGroupsPerTransportBlock* for PDSCH, and C is the number of code blocks in the transport block according to the procedure defined in Clause 7.2.3 of [5, TS 38.212].

Define $M_1 = \mathrm{mod}(C, M)$, $K_1 = \left\lceil \frac{C}{M} \right\rceil$, and $K_2 = \left\lfloor \frac{C}{M} \right\rfloor$.

If $M_1 > 0$, CBG m, $m = 0,1,\ldots,M_1 - 1$, consists of code blocks with indices $m \cdot K_1 + k, k = 0,1,\ldots,K_1 - 1$. CBG m, $m = M_1, M_1 + 1,\ldots,M - 1$, consists of code blocks with indices $M_1 \cdot K_1 + (m - M_1) \cdot K_2 + k, k = 0,1,\ldots,K_2 - 1$.

3GPP TS 38.214 at §5.1.7.1.

193. Finally, clause 9.1.1 of 3GPP TS 38.213 explains the CBG-based HARQ-ACK procedure:

9.1.1 CBG-based HARQ-ACK codebook determination

If a UE is provided *PDSCH-CodeBlockGroupTransmission* for a serving cell, the UE receives a PDSCH scheduled by DCI format 1_1, that includes code block groups (CBGs) of a transport block. The UE is also provided *maxCodeBlockGroupsPerTransportBlock* indicating a maximum number $N_{\text{HARQ-ACK}}^{\text{CBG/TB, max}}$ of CBGs for generating respective HARQ-ACK information bits for a transport block reception for the serving cell.

For a number of C code blocks (CBs) in a transport block, the UE determines a number of CBGs M according to clause 5.1.7.1 of [6, TS 38.214] and determines a number of HARQ-ACK bits for the transport block as $N_{\text{HARQ-ACK}}^{\text{CBG/TB}} = M$.

The UE generates an ACK for the HARQ-ACK information bit of a CBG if the UE correctly received all code blocks of the CBG and generates a NACK for the HARQ-ACK information bit of a CBG if the UE incorrectly received at least one code block of the CBG. If the UE receives two transport blocks, the UE concatenates the HARQ-ACK information bits for CBGs of the second transport block after the HARQ-ACK information bits for CBGs of the first transport block.

The HARQ-ACK codebook includes the $N_{\text{HARQ-ACK}}^{\text{CBG/TB, max}}$ HARQ-ACK information bits and, if $N_{\text{HARQ-ACK}}^{\text{CBG/TB}} < N_{\text{HARQ-ACK}}^{\text{CBG/TB,max}}$ for a transport block, the UE generates a NACK value for the last $N_{\text{HARQ-ACK}}^{\text{CBG/TB,max}} - N_{\text{HARQ-ACK}}^{\text{CBG/TB}}$ HARQ-ACK information bits for the transport block in the HARQ-ACK codebook.

If the UE generates a HARQ-ACK codebook in response to a retransmission of a transport block, corresponding to a same HARQ process as a previous transmission of the transport block, the UE generates an ACK for each CBG that the UE correctly decoded in a previous transmission of the transport block.

If a UE correctly detects each of the $N_{\text{HARQ-ACK}}^{\text{CBG/TB}}$ CBGs and does not correctly detect the transport block for the $N_{\text{HARQ-ACK}}^{\text{CBG/TB}}$ CBGs, the UE generates a NACK value for each of the $N_{\text{HARQ-ACK}}^{\text{CBG/TB}}$ CBGs.

3GPP TS 38.213 at §9.1.1.

194. As shown above, the Accused Instrumentalities include a base station that segments a transport block into multiple code blocks ("CB") of different sizes and then codes and groups the code blocks into code block groups ("CBG") of different sizes. Thus, the 3GPP segmentation and coding algorithm described above "segment[s] a transport block into multiple CBs and cod[es] each of the multiple CBs," as claimed. *See* 3GPP TS 38.212 at §§7.2.3, 7.2.4, 5.2.

195. Further, the 3GPP segmentation and coding algorithm described above provides that "the multiple CBs include one or more first CBs and one or more second CBs" and "a first size of a first CB of the one or more first CBs is greater than a second size of a second CB of the one or more second CBs," as claimed. *See* 3GPP TS 38.212 at §§7.2.3, 7.2.4, 5.2.

196. Further, the 3GPP segmentation and coding algorithm described above ensures that "each of the multiple CBs is included in any one of the multiple CBGs" and "the multiple CBGs include one or more first CBGs and one or more second CBGs," as claimed. *See* 3GPP TS 38.212 at §§7.2.3, 7.2.4, 5.2; 3GPP TS 38.214 at §5.1.7.1.

197. Further, the 3GPP segmentation and coding algorithm described above confirms that "a first total number of the one or more first CBs and the one or more second CBs included in each of the one or more first CBGs is greater than a second total number of the one or more first CBs and the one or more second CBs included in each of the one or more second CBGs" and "a first CBG of the one or more first CBGs includes a greatest number of the one or more second CBGs," as claimed. *See* 3GPP TS 38.212 at §§7.2.3, 7.2.4, 5.2; 3GPP TS 38.214 at §5.1.7.1.

198. Finally, the 3GPP CBG-based HAR-ACK algorithm described above shows that, after the base station "transmit[s] the transport block," that base station will "receiv[e] HARQ-ACKs corresponding to multiple CBGs," as claimed. *See* 3GPP TS 38.213 at §9.1.1.

199. Because of its conformance with the applicable 5G standards, on information and belief TMO directly infringes at least claim 10 of the '509 patent.

200. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, TMO also indirectly infringes the '509 patent claims. TMO has knowledge of the '509 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '509 patent are not performed by TMO, such acts constituting direct infringement of the '509 patent are performed by TMO's customers or end-users who act at the direction and/or control of TMO, with TMO's knowledge.

201. Daingean is informed and believes, and on that basis alleges, that TMO indirectly infringes at least claim 10 of the '509 patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '509 patent.

202. For example, TMO advertises to its customers that it sells products that comply with the 5G standard and affirmatively promotes the advantages of its 5G network relative to other cellular networks. *See* https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited July 12, 2023). On information and belief, when an TMO customer with a 5G-compliant device communicates with TMO's 5G base stations, the customer's device will automatically implement the accused 5G functionality based upon the hardware and software provided in the Accused Instrumentalities.

203. TMO also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '509 Patent under 35

U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. TMO knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '509 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

204. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '509 Patent by TMO has damaged and will continue to damage Plaintiff.

JURY DEMAND

205. Plaintiff hereby demands a trial by jury on all issues.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff requests entry of judgment in its favor and against TMO as follows:

a) A declaration that TMO has infringed and is infringing one or more claims of the '803 Patent, either literally or under the doctrine of equivalents;

b) A declaration that TMO has infringed and is infringing one or more claims of the '976 Patent, either literally or under the doctrine of equivalents;

c) A declaration that TMO has infringed and is infringing one or more claims of the '958 Patent, either literally or under the doctrine of equivalents;

d) A declaration that TMO has infringed and is infringing one or more claims of the '207 Patent, either literally or under the doctrine of equivalents;

e) A declaration that TMO has infringed and is infringing one or more claims of the '400 Patent, either literally or under the doctrine of equivalents;

f) A declaration that TMO has infringed and is infringing one or more claims of the '509 Patent, either literally or under the doctrine of equivalents;

g) An award of damages pursuant to 35 U.S.C. §§ 284, 285, 286, and 287 adequate to compensate Daingean for TMO's infringement of the Asserted Patents in an amount according to proof at trial (together with prejudgment and post-judgment interest), but no less than a reasonable royalty, including but not limited to a post-judgment running royalty in lieu of a permanent injunction;

h) A declaration that TMO's infringement is willful since at least the filing of this Complaint (Dkt. 1) and enhancing damages pursuant to 35 U.S.C. § 284;

i) An award of costs and expenses pursuant to 35 U.S.C. § 284 or as otherwise permitted by law;

j) An award of attorneys' fees pursuant to 35 U.S.C. § 285 or as otherwise permitted by law; and

k) Such other and further relief, whether legal, equitable, or otherwise, to which Plaintiff may be entitled or which this Court may order.

Dated: July 24, 2023

Respectfully submitted,

/s/ Demetrios Anaipakos

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