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

SOLSTICE WIRELESS LLC, Plaintiff, v. T-MOBILE USA, INC. and T-MOBILE US, INC., Defendants.	Case No. 4:22-cv-00723 Jury Trial Demanded

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Solstice Wireless LLC ("Solstice") files this Complaint against T-Mobile USA, Inc. and T-Mobile US, Inc. (collectively and individually referred to herein as "T-Mobile" or "Defendant") for patent infringement of United States Patent Nos. 8,493,999; 9,071,994; and 9,161,365 (the "patents-in-suit") and alleges as follows:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 1 *et seq.*

THE PARTIES

2. Solstice is a limited liability company organized under laws of the State of Texas with its principal place of business located at 10412 China Spring Rd., Ste F PMB 1034, Waco, Texas 76708.

3. Defendant T-Mobile USA, Inc. ("T-Mobile USA") is a Delaware corporation with a principal place of business at 12920 S.E. 38th Street, Bellevue, Washington 98006. T-Mobile USA may be served through its registered agents, The Corporation Service Company, located at 251 Little Falls Drive, Wilmington, Delaware, 19808.

4. On information and belief, since on or about November 22, 1999, T-Mobile USA has been registered to do business in the state of Texas under Texas SOS file number 0012958406. On information and belief, T-Mobile USA has directly or indirectly conducted business and continues to conduct business directly or indirectly in the State of Texas and within the Eastern District of Texas.

5. Defendant T-Mobile US, Inc. ("T-Mobile US") is a Delaware corporation with a principal place of business at 12920 S.E. 38th Street, Bellevue, Washington 98006. T-Mobile US may be served through its registered agents, The Corporation Service Company, located at 251 Little Falls Drive, Wilmington, Delaware, 19808.

6. On information and belief, T-Mobile US has directly or indirectly conducted business and continues to conduct business directly or indirectly in the State of Texas and within the Eastern District of Texas.

7. T-Mobile USA, Inc. and T-Mobile US, Inc. (individually and collectively, "T-Mobile" or "Defendant") operates and/or employs, either directly or indirectly, communications networks in the United States and in the Eastern District of Texas.

8. On information and belief, T-Mobile operates and/or employs, or has operated or employed, either directly or indirectly, communications networks that

utilize 4G/LTE and/or 5G technology in said networks. (Hereinafter "The T-Mobile Cellular Networks".)

9. On information and belief, The T-Mobile Cellular Networks utilize 4G/LTE and/or 5G technology in a manner designed to facilitate the transmission and reception of network traffic during the normal operation of such networks. More specifically, T-Mobile Cellular Networks utilize 4G/LTE and/or 5G compliant hardware and software components, including but not limited to mobile stations, user equipment, Evolved UMTS Terrestrial Radio Access Network hardware, Evolved UMTS Terrestrial Radio Access Network software, evolved packet core hardware, evolved packet core software, base stations, relay stations, multi-link relay stations, evolved Node Bs, mobile interfaces, backhaul interfaces, parent nodes, IAB nodes, child nodes, X2 Application Protocol compliant hardware, and X2 Application Protocol compliant software that infringe one or more claims of the each of the patents-in-suit.

10. T-Mobile's operation of The T-Mobile Cellular Networks constitutes a use of such infringing hardware and/or software and a practice of methods covered by the patents-in-suit, and therefore constitutes an infringement of one or more claims of the each of the patents-in-suit.

11. On information and belief, T-Mobile operates and/or employs, or has operated or employed, either directly or indirectly, The T-Mobile Cellular Networks in relation to T-Mobile's making, use, sales, and offers for sale, and T-Mobile's customer's use of, T-Mobile's product and service offerings, including but not limited to (1.) T-Mobile 4G LTE Network Service Plans; (2.) T-Mobile 4G LTE-A Network Service Plans;

(3.) T-Mobile 4G LTE-A Pro Network Service Plans; (4.) T-Mobile 5G Network Service Plans; (5.) Metro by T-Mobile service plans; (6.) Sprint mobile service plans; (7.) 4G LTE compliant mobile communication devices; (8.) 5G compliant mobile communication devices; (9.) roaming partnership arraignment services; (10.) current or legacy T-Mobile products or services, which use, or have used, one or more of the foregoing products and services as a component product or component service; (11.) combinations of products and/or services comprising two or more of the foregoing products and services; and (12.) all other current or legacy products and services imported, made, used, sold, or offered for sale by T-Mobile that operate, or have operated in a substantially similar manner as the above-listed products and services, (collectively and individually referred to herein as the "T-Mobile Cellular Products and Services").

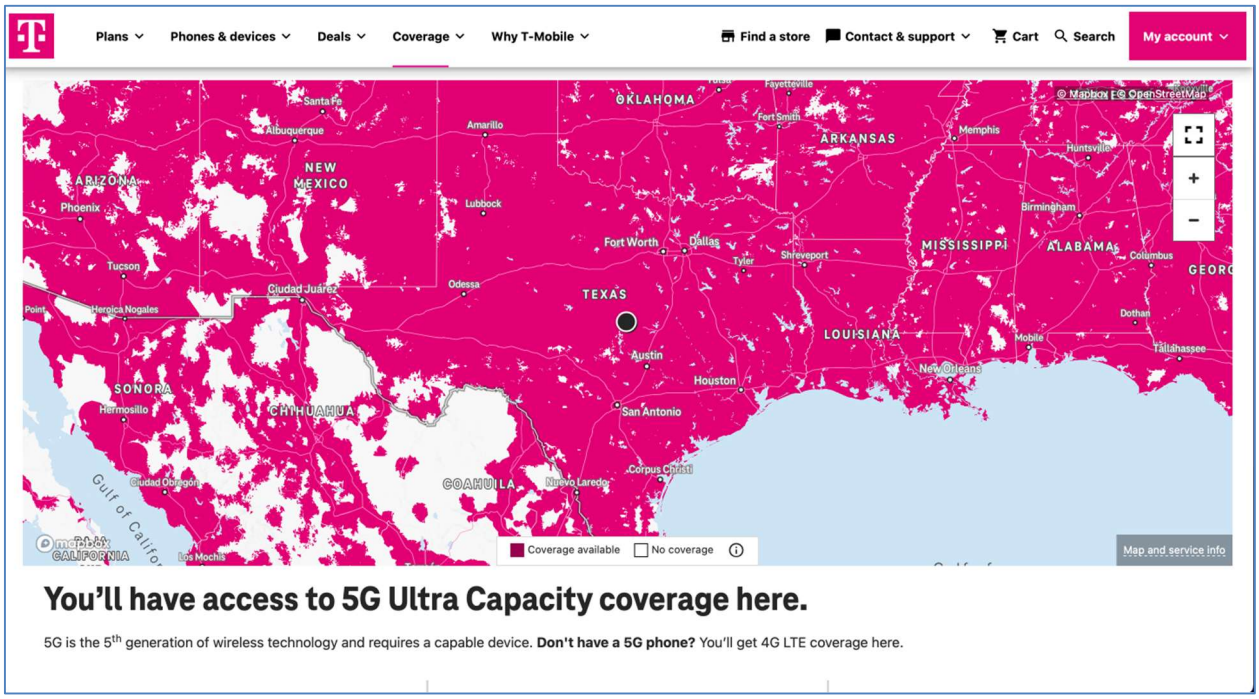
JURISDICTION AND VENUE

12. This Court has subject matter jurisdiction over this action 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. §§ 1 *et seq.*

13. T-Mobile is subject to this Court's personal jurisdiction, in accordance with due process and/or the Texas Long Arm Statute because, in part, T-Mobile "[r]ecruits Texas residents, directly or through an intermediary located in this State, for employment inside or outside this State." See Tex. Civ. Prac. & Rem. Code § 17.042.

14. On information and belief, T-Mobile operates and/or employs, or has operated and/or employed, either directly or indirectly, T-Mobile Cellular Networks within the Eastern District of Texas.

15. On information and belief, T-Mobile operates and/or employs, or has operated and/or employed, either directly or indirectly, the T-Mobile Cellular Networks in all markets where it operates and/or employs, or has operated or employed, either directly or indirectly 4G LTE and/or 5G mobile services, including markets contained in whole or in part within the Eastern District of Texas.[1]



See https://www.t-mobile.com/coverage/coverage-map.

16. On information and belief, T-Mobile has made, used, sold, and offered to sell the T-Mobile Cellular Products and Services within the United States, including within the Eastern District of Texas.

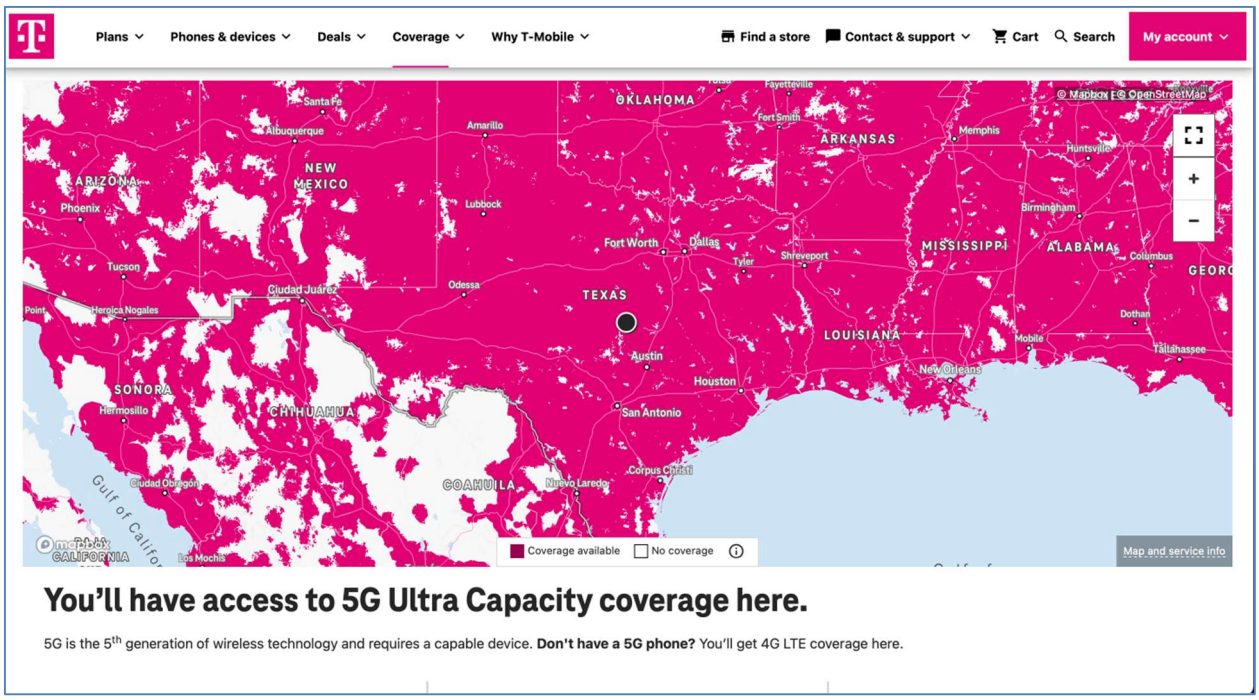
[1] *See* https://www.fiercewireless.com/devices/t-mobile-entices-free-5g-phone-trade-offer.

17. On information and belief, T-Mobile has made, used, sold access to, and offered to sell access to the T-Mobile Cellular Networks within the United States, including within the Eastern District of Texas.

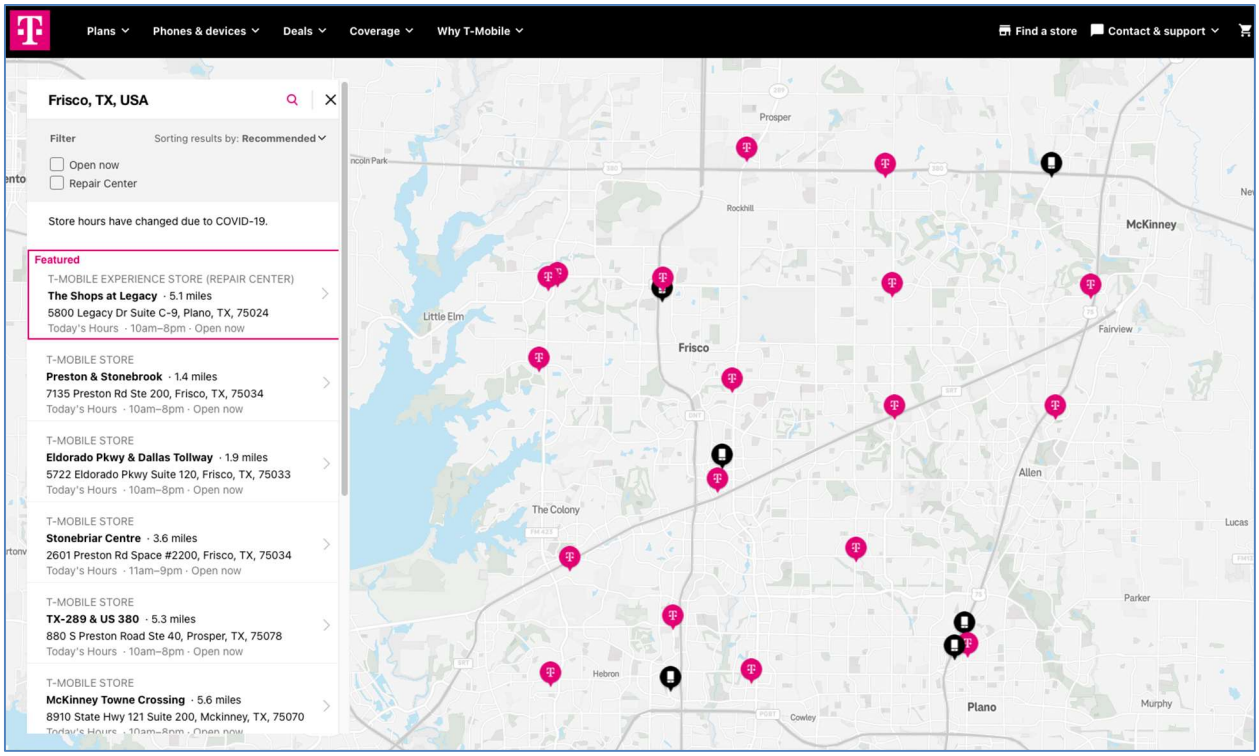
18. On information and belief, T-Mobile's customers located in the Eastern District of Texas have transmitted and/or received network communications to, from, or across T-Mobile Cellular Networks.

19. On information and belief, T-Mobile's customers have purchased and/or used one or more of the T-Mobile Cellular Products and Services within the Eastern District of Texas.

20. The Court has personal jurisdiction over T-Mobile at least because it has continuous business contacts in the State of Texas and in this District. T-Mobile has engaged in business activities including transacting business in the Eastern District of Texas and purposefully directing its business activities, including the provision of infringing communications networks and services, and the use, marketing, sale or offer for sale of mobile devices and network services, comprising The T-Mobile Cellular Networks and T-Mobile Cellular Products and Services in this District, and the sale or offer for sale of services and goods to this District to aid, abet, or contribute to the infringement of third parties in this District. For example, on information and belief, T-Mobile — either directly or through those acting on its behalf — offers access to The T-Mobile Cellular Networks and the T-Mobile Cellular Products and Services in this District, as shown below:

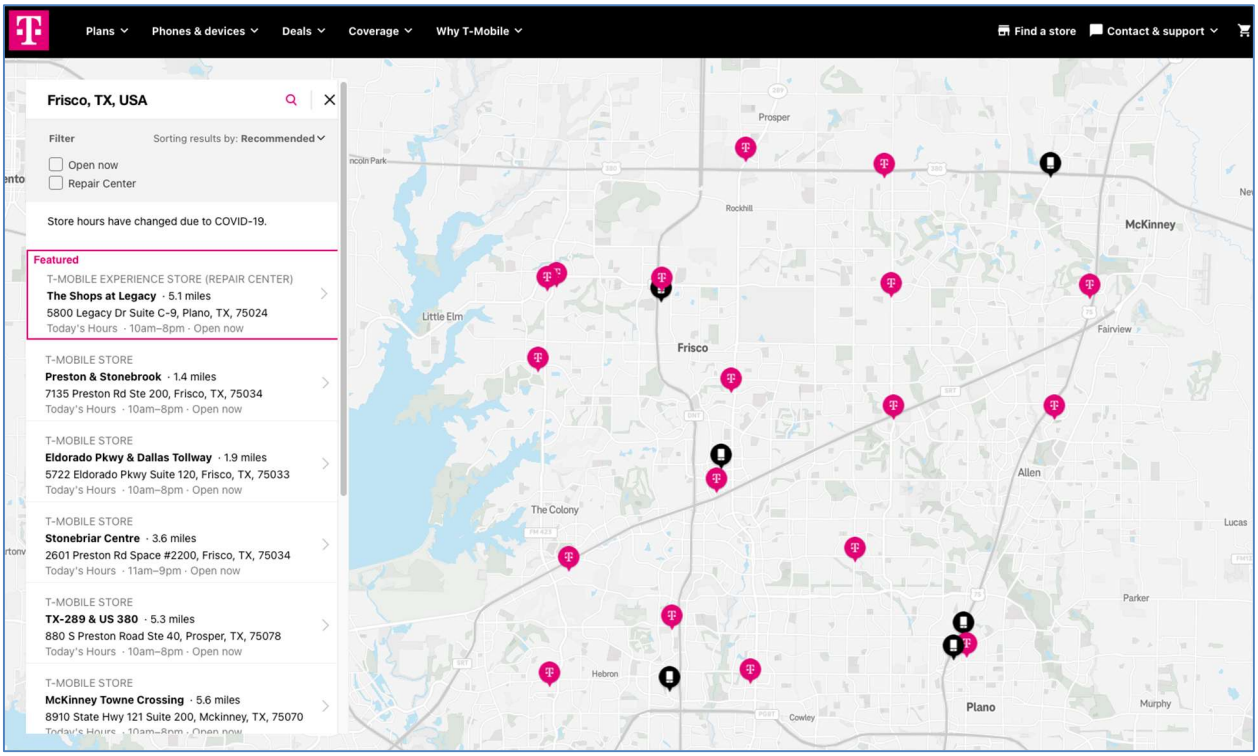


See https://www.t-mobile.com/coverage/coverage-map.



See e.g. https://www.t-mobile.com/store-locator?sortBy=type1&page=1&search=Frisco,%20TX,%20USA.

21. T-Mobile - either directly or through those acting on its behalf - has stores and/or authorized retailers in this District in which infringing communications networks, products, and services are offered for sale.



See e.g. https://www.t-mobile.com/store-locator?sortBy=type1&page=1&search=Frisco,%20TX,%20USA.

22. This Court has personal jurisdiction over T-Mobile because it committed and continues to commit acts of infringement in this judicial district in violation of 35 U.S.C. §§ 271(a). In particular, on information and belief, T-Mobile has made, used,

offered to sell and/or sold T-Mobile Cellular Products and Services, and made, used, offered to sell access to and/or sold access to The T-Mobile Cellular Networks in the Eastern District of Texas.

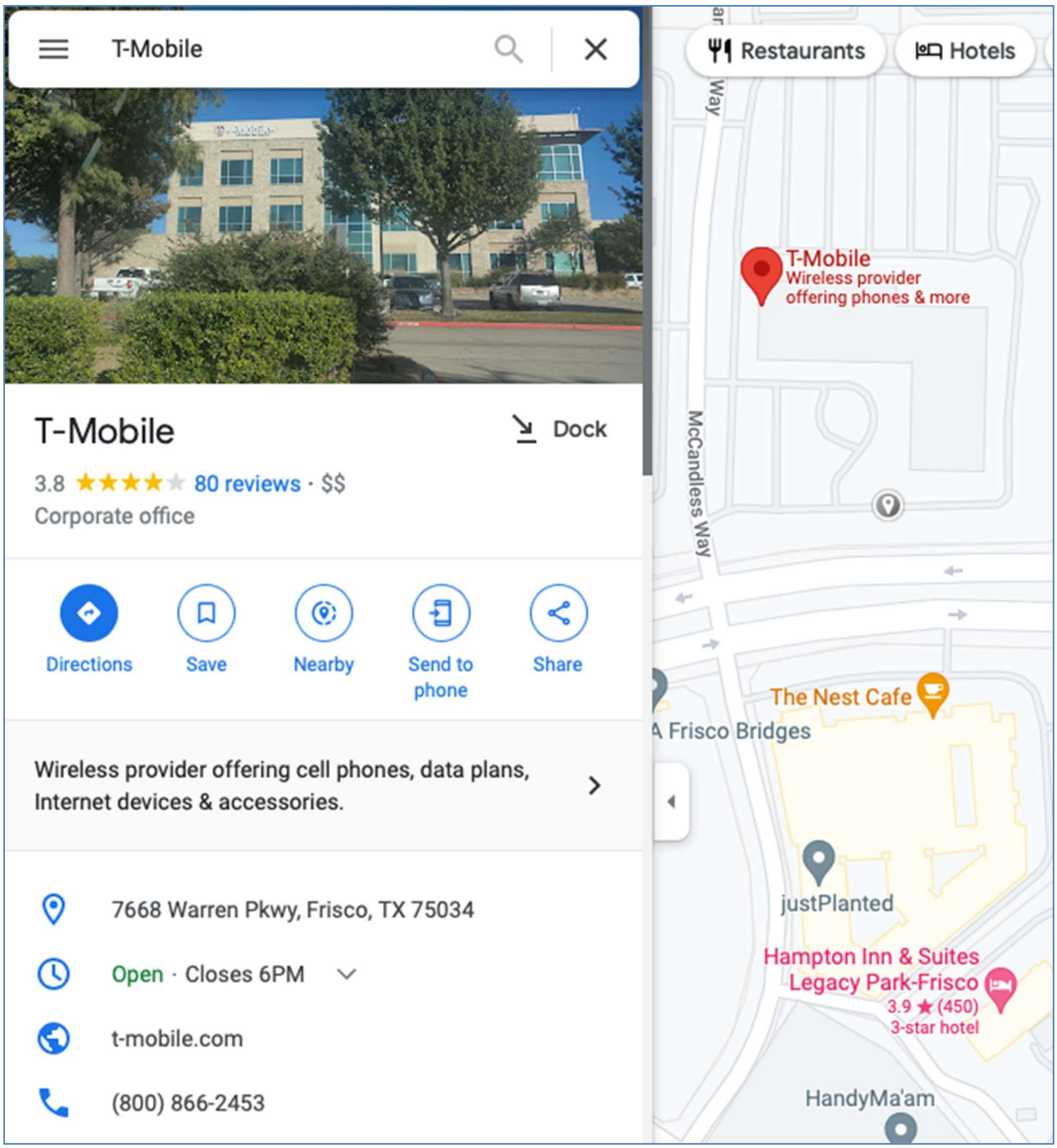
23. On information and belief, T-Mobile is subject to the Court's jurisdiction because it regularly conducts and solicits business, or otherwise engages in other persistent courses of conduct in this judicial district, and/or derives substantial revenue from the sale and distribution of goods and services, including but not limited to The T-Mobile Cellular Networks and T-Mobile Cellular Products and Services provided to individuals and businesses in the Eastern District of Texas.

24. This Court has personal jurisdiction over T-Mobile because, *inter alia*, T-Mobile, on information and belief: (1) has committed acts of patent infringement in this Eastern District of Texas; (2) maintains a regular and established place of business in the Eastern District of Texas; (3) has substantial, continuous, and systematic contacts with this State and the Eastern District of Texas; (4) owns, manages, and operates facilities in this State and the Eastern District of Texas; (5) enjoys substantial income from its operations and sales in this State and the Eastern District of Texas; (6) employs Texas residents in this State and the Eastern District of Texas, and (7) solicits business and markets communications networks, communications products, communication systems and/or communication services in this State and the Eastern District of Texas including, without limitation, The T-Mobile Cellular Networks and T-Mobile Cellular Products and Services.

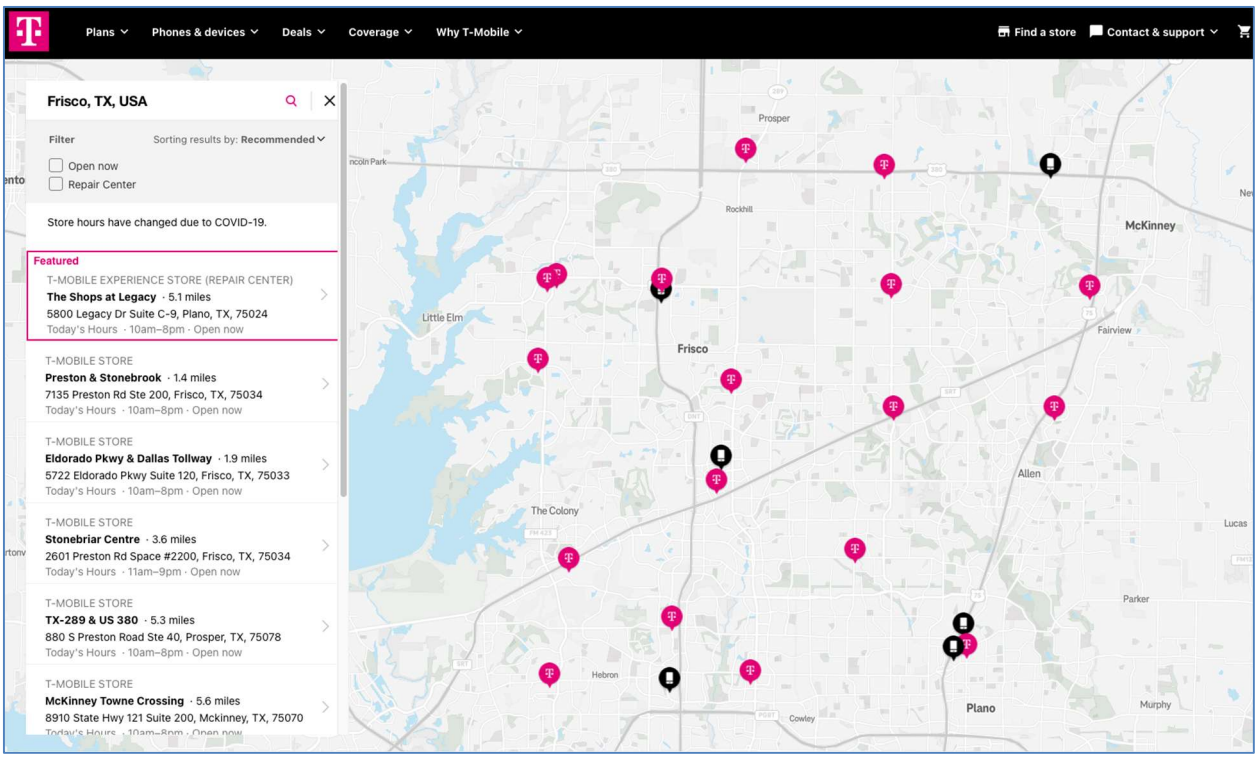
25. Venue is proper pursuant to 28 U.S.C. §§ 1391(b), (c), (d) and/or 1400(b), at least because T-Mobile, has committed acts of infringement in this judicial district, and has a regular and established place of business in this judicial district.

26. In fact, this judicial district was deemed to be a proper venue for patent cases against T-Mobile in actions bearing, at least, C.A. Nos. 2:08-cv-00441, 6:13-cv-00403, 6:13-cv-00507, 2:17-cv-00577, and 2:21-cv-00368.

27. On information and belief, T-Mobile has previously maintained and continues to maintain a regular and established place of business in this judicial district located at 7668 Warren Pkwy, Frisco, TX 75034.


T-Mobile
T-Mobile
Dock
3.8 80 reviews · $$
Corporate office
Directions
Save
Nearby
Send to phone
Share
Wireless provider offering cell phones, data plans, Internet devices & accessories.
7668 Warren Pkwy, Frisco, TX 75034
Open · Closes 6PM
t-mobile.com
(800) 866-2453
Restaurants
Hotels
T-Mobile
Wireless provider offering phones & more
McCandless Way
The Nest Cafe
Frisco Bridges
justPlanted
Hampton Inn & Suites Legacy Park-Frisco
3.9 ★ (450)
3-star hotel
HandyMa'am

28. On information and belief, T-Mobile has previously maintained and continues to maintain over multiple retail locations as regular and established places of business throughout this judicial district.



See e.g. https://www.t-mobile.com/store-locator?sortBy=type1&page=1&search=Frisco,%20TX,%20USA.

29. On information and belief, T-Mobile has previously maintained and continues to maintain a regular and established places of business in this judicial district beyond those specifically named herein.

United States Patent No. 8,493,999

30. On July 23, 2013 the USPTO duly and legally issued United States Patent No. 8,493,999 ("the '999 patent") entitled "System and Method for Using Resources in a Communication System" to inventors Seong-Keun Oh and Min Lee.

31. The '999 patent is presumed valid under 35 U.S.C. § 282.

32. Solstice owns all rights, title, and interest in the '999 patent.

33. Solstice has not granted T-Mobile an approval, an authorization or a license to the rights under the '999 patent.

34. The '999 patent relates to, among other things, minimizing inter-sector interference and improving use efficiency of the resources in a cellular communication system.

35. The claimed invention(s) of the '999 patent sought to solve problems with, and improve upon, cellular communication systems. For example, the '999 patent states:

> In a multi-sector communication system including a plurality of sectors, limited resources including frequency resources, code resources, and time slot resources are divided and used among the sectors. Since the same resources are reused by other sectors, interference can result between the sectors, particularly neighboring sectors. However, although the interference attributable to the reuse may cause performance degradation, it may also increase the entire capacity of the multi-sector communication system. The interference is severe when a frequency reuse factor is 1.
>
> Meanwhile, a next-generation communication system is being actively studied for providing users with services with high quality of service ("QoS"), such as high transmission speed. In particular, a base station ("BS") in the next-generation communication system divides and manages one cell into a plurality of sectors. When providing communication service to mobile stations ("MSs") located in the plurality of sectors, the BS transmits data to the MSs via respective sector antennae. Here, the BS transmits the data to the MSs using beams from the sector antennae, which overlap at a boundary between the sectors. This causes interference between the sectors.
>
> More specifically, the use of the sector antennae in the multi-sector communication system causes inter-sector interference in a signal overlap region between sectors, i.e., a inter-sector boundary region. In other words, since patterns of beams from the sector antennae cannot be designed to be orthogonal to one another, signals from neighboring sectors overlap in the inter-sector boundary region, which causes severe interference between the sector signals, that is, between the neighboring sectors.
>
> A current communication system fails to avoid and minimize such inter-sector interference, and exhibits low reuse efficiency of frequency resources when

attempting to avoid and minimize the inter-sector interference. Accordingly, there is a need for a system and method for using resources that are capable of avoiding inter-sector interference in a signal overlap region between sectors by allocating a central band orthogonal between the sectors to a inter-sector boundary region where signal overlap may occur, and greatly improving the reuse efficiency of frequency resource by allowing remaining frequency resources to be reused without inter-sector interference in sector central regions where there is no inter-sector interference.

Also, there is a need for a system and method capable of preventing signal quality from being degraded by rapid reduction of antenna gain in a inter-sector boundary region that may be caused by signal transmission or reception in the inter-sector boundary region to or from one sector for avoidance and minimization of inter-sector interference in the inter-sector boundary region. Also, there is a need for a system and method capable of providing sufficient time to perform stable dynamic channel allocation ("DCA") and guaranteeing stable QoS so that several DCAs are performed at a high speed upon inter-sector handover of MSs in a plurality of sectors of a communication system. In particular, there is a need for a system and method capable of preventing a system load from increasing due to a ping-pong phenomenon upon frequency movement in a inter-sector boundary region, on a sector central boundary line, from a inter-sector boundary region to a sector central region, or from the sector central region to the inter-sector boundary region.

In other words, in the inter-sector boundary region, signal gain greatly decreases due to rapid reduction of the antenna gain, resulting in degraded signal quality. Also, when a user moves via a sector boundary line, signal quality degradation becomes severe. This requires rapid handover to a neighboring sector, and accordingly, rapid DCA from a current sector band to another band and to a neighboring sector band. This leads to signal quality degradation and QoS degradation, and causes a ping-pong phenomenon, resulting in an increase in a system load. Thus, there is a need for a system and method for solving the problems. That is, there is a need for a system and method capable of avoiding and minimizing inter-sector interference in a inter-sector boundary region of a multi-sector communication system, simplifying a handover procedure while maintaining signal quality, and increasing reuse efficiency of the frequency resource.

Accordingly, the present invention allocates used bands and bands reused in all sectors to be orthogonal among the sectors in order to avoid and minimize inter-sector interference in a inter-sector boundary region and efficiently use frequency resources. Also, there is a need for a method and system for using resources that are capable of entirely avoiding and minimizing inter-sector interference by allocating a specific band of each sector to users located in a boundary region of

> the sector and by reusing a band allocated to be reused in all sectors where inter-sector interference is not considered or there is no inter-sector interference.
>
> When an MS moves between sectors, band allocation is made based on a signal power ratio between neighboring sectors. When a user, *i.e.*, an MS allocated a band in a current sector moves to a inter-sector boundary region, a BS serving the MS performs DCA to a band for the current sector, thus avoiding and minimizing the inter-sector interference. In this case, the present invention prevents signal quality degradation caused by rapid antenna gain reduction in the inter-sector boundary region in handover between sectors. In particular, the present invention prevents signal quality degradation caused by performing rapid handover to a neighboring sector with the intention of preventing rapid signal intensity degradation when an MS moves between sectors, i.e., performing rapid DCA to a band for a neighboring handover sector, and avoids and minimizes the inter-sector interference.
>
> Also, movement of an MS to a neighboring sector requires DCA to a band for the sector, which degrades signal quality in a inter-sector boundary region and in turn necessitates several rapid DCAs. Accordingly, the present invention provides sufficient time to perform stable DCAs and guarantees QoS. Moreover, the present invention prevents a ping-pong phenomenon from being caused by frequent inter-sector handover, *e.g.*, frequent movement between regions in a sector, and particularly, simplifies a DCA procedure and a handover procedure in more frequent and rapid movement between sectors in a cell central region, thus reducing a system load.

See '999 Specification at col. 1, l. 29 – col. 3, l. 9.

36. The '999 patent specification then goes on to state:

> With the system and method for using resources in a communication system according to the present invention, it is possible to avoid and minimize interference in each sector and to prevent degradation of frequency reuse efficiency and signal quality. It is also possible to prevent an increase in a system load by supporting stable DCA and handover. It is also possible to increase system efficiency by efficiently managing the resources and to improve system performance by simplifying a resource allocation procedure.

See '999 Specification at col. 4, ll. 8-17.

37. The invention(s) claimed in the '999 patent solves various technological problems inherent in prior-art cellular communications systems and enables such

systems to, among other things: (1) function more efficiently; (2) accommodate more users; (3) reduce or eliminate costs and technical challenges associated with cellular signal interference; (4) increase bandwith capacity; (5) more fully utilize frequency resources; (6) reduce or eliminate performance degradation; (7) increase the benefits of cell sectorization; (8) reduce and/or prevent degradation of frequency reuse efficiency; (9) reduce and/or prevent degradation of signal quality; (10) reduce and/or prevent an increase in system load associated with the support of stable dynamic channel allocation and handover; (11) efficiently manage resources, including limited resources such as frequency resources, code resources, and time slot resources; (12) improve system performance; (13) simplify resource allocation procedures; (14) increase the entire capacity of the multi-sector communication system; (15) better provide users with services with high quality of service ("QoS"), such as high transmission speed; (16) increase reuse efficiency of frequency resources; (17) preventing signal quality from being degraded by rapid reduction of antenna gain; (18) providing sufficient time to perform stable dynamic channel allocation; and (19) preventing or reducing system load increases due to a ping-pong phenomenon upon frequency movement.

United States Patent No. 9,071,994

38. On July 23, 2013 the USPTO duly and legally issued United States Patent No. 9,071,994 ("the '994 patent") entitled "Apparatus and Method for Relaying Multiple Links in a Communication System" to inventors Seong-Keun Oh and Min Lee.

39. The '994 patent is presumed valid under 35 U.S.C. § 282.

40. Solstice owns all rights, title, and interest in the '994 patent.

41. Solstice has not granted T-Mobile an approval, an authorization or a license to the rights under the '994 patent.

42. The '994 patent relates to, among other things, efficiently transmitting and/or receiving control data and user data between on or more base stations or relay stations using multiple backhaul links.

43. The claimed invention(s) of the '994 patent sought to solve problems with, and improve upon, cellular communication systems. For example, the '994 patent states:

> Next-generation communication systems have developed to offer a variety of high-speed, high-capacity services to Mobile Stations (MSs). In particularly, the next-generation communication systems consider using a multi-hop relay scheme for a variety of reasons such as the expansion of Base Station (BS) coverage and the increase in BS capacity. In other words, the next-generation communication systems consider using the multi-hop relay scheme because this scheme may be efficiently applied to the change in wireless network environments and may actively cope with the change in network environments such as addition of BSs.
>
> The next-generation communication systems now consider only the scheme of relaying signals using a single backhaul link. In other words, the next-generation communication systems now consider only the Relay Stations (RSs) that relay signals using a single backhaul link. However, transmitting/receiving control data and user data between multiple BSs or multiple RSs using a single backhaul link decreases in its efficiency due to many restrictions.
>
> Hence, there is a need for a scheme of efficiently transmitting/receiving control data and user data between multiple BSs or multiple RSs using multiple backhaul links.

See '994 Specification at col. 1, ll. 17-38.

44. The '994 patent specification then goes on to state:

> An aspect of the present invention is to address at least the above-mentioned problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention provides an apparatus and method for transmitting/receiving control data and user data between multiple

communication stations by forming multiple communication paths using multiple backhaul links and/or multiple wireless direct links in a communication system.

Another aspect of the present invention provides an apparatus and method for forming multiple backhaul links and/or multiple wireless direct links for data exchange with multiple communication stations by a Multi-Link Relay Station (MLRS) in a multi-path relay system.

A further another aspect of the present invention provides an apparatus and method for forming multiple backhaul links with at least one of wired links, wireless links and wired/wireless combined links, for data exchange with multiple communication stations by an MLRS in a multi-path relay system.

Yet another aspect of the present invention provides an apparatus and method in which an MLRS includes at least one backhaul interface (I/F) unit and/or at least one Mobile Station (MS) I/F unit to form multiple communication paths in a multi-path relay system.

Still another aspect of the present invention provides an apparatus and method for managing resources independently of multiple communication stations connected through multiple backhaul links by an MLRS in a multi-path relay system.
Still another aspect of the present invention provides an apparatus and method for sharing resources for multiple backhaul links and/or multiple wireless direct links by an MLRS in a multi-path relay system.

Still another aspect of the present invention provides an apparatus and method in which an MLRS includes a control unit and a multi-link relay unit, the control unit controls an operation of the MLRS by performing a control process of a preset level, including a multi-path control, and the multi-link relay unit performs an operation of relaying signals between communication stations in a multi-path relay system.

Still another aspect of the present invention provides an apparatus and method in which a control unit in an MLRS further includes a resource management as well as a multi-path control in a multi-path relay system.

Still another aspect of the present invention provides an apparatus and method for controlling path connection for data transmission/reception between multiple communication stations using multiple backhaul links and/or multiple wireless direct links by an MLRS in a multi-path relay system.

> Still another aspect of the present invention provides an apparatus and method for supporting multi-homing for at least one MS over multiple paths by means of simultaneous use of at least two backhaul links and/or simultaneous use of at least two MS I/F units by an MLRS in a multi-path relay system.
>
> Still another aspect of the present invention provides an apparatus and method for supporting cooperative transmission/reception through multiple paths using at least two backhaul links and/or at least two MS I/F units by an MLRS in a multi-path relay system.
>
> Still another aspect of the present invention provides an apparatus and method for supporting a handover for an MS using multiple backhaul links by an MLRS in a multi-path relay system.

See '994 Specification at col. 2, l. 44 – col. 3, l. 38.

45. The '994 patent specification then goes on to state:

In accordance with one aspect of the present invention, there is provided a Multi-Link Relay Station (MLRS) in a communication system, adapted to perform a multi-path control to provide a communication service through multiple communication paths including at least one of at least two backhaul links and at least two wireless direct links.

In accordance with another aspect of the present invention, there is provided a method of performing a multi-path control in a communication system by providing a communication service through multiple communication paths including at least one of at least two backhaul links and at least two wireless direct links.

See '994 Specification at col. 2, ll. 42-53.

46. The invention(s) claimed in the '994 patent solves various technological problems inherent in prior-art cellular communications systems and enables such systems to, among other things: (1) to more efficiently transmit and/or receive control and/or user data; (2) effectively respond to changes in network environments; (3) increase data transmission capacity; (4) provide for improved resource management; (5) provide improved data path control; (6) provide improved multi-homing support; (7)

provide improved cooperative transmission and/or reception; and (8) provide improved handover procedures.

United States Patent No. 9,161,365

47. On October 13, 2015 the USPTO duly and legally issued United States Patent No. 9,161,365 ("the '365 patent") entitled "System and Method for Using Resources in a Communication System" to inventors Seong-Keun Oh and Min Lee.

48. The '365 patent is presumed valid under 35 U.S.C. § 282.

49. Solstice owns all rights, title, and interest in the '365 patent.

50. Solstice has not granted T-Mobile an approval, an authorization or a license to the rights under the '365 patent.

51. The '365 patent relates to, among other things, minimizing inter-sector interference and improving use efficiency of the resources in a cellular communication system.

52. The '365 patent shares a specification with the '999 patent and is directed addressed the same problems with prior art identified above with respect to the '999 patent.

BACKGROUND OF THE INVENTIONS

53. The patents-in-suit were developed through the research of Dr. Seong Keun Oh, a professor at School of Electrical and Computer Engineering at Ajou University. Ajou University is a private research university focusing on, among other

fields, electrical engineering and computer science. Ajou has recently been recognized as a leading Korean University.[2]

54. Through Ajou University's Industry-Academic Cooperation Foundation, Ajou University has obtained approximately 7,500 patent assets, including over 400 US patents.

55. Ajou University has ranked 7th among Korean universities in technology transfer revenue for 5 consecutive years; generating over $8.6 Million in technology transfer revenues from 2016-2020. [3]

CLAIMS FOR RELIEF

Count I – Infringement of United States Patent No. 8.493,999

56. Solstice repeats, realleges, and incorporates by reference, as if fully set forth here, the allegations of the preceding paragraphs above.

57. On information and belief, T-Mobile (or those acting on its behalf) makes, uses, sells access to, and/or offers to sell access to the T-Mobile Cellular Networks and makes, uses, sells, and/or offers for sale the T-Mobile Cellular Products and Services in the United States. T-Mobile, as well as the T-Mobile Cellular Networks and T-Mobile

[2] *See e.g.*, https://www.ajou.ac.kr/en/ajou/news.do?mode=view&articleNo=196254&article.offset=0&articleLimit=12.

[3] *See e.g.*, https://www.ajou.ac.kr/en/ajou/news.do?mode=view&articleNo=112105&article.offset=0&articleLimit=12.

Cellular Products and Services, infringe (literally and/or under the doctrine of equivalents) at least claim 21 of the '999 patent.

58. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology standards available at https://portal.3gpp.org/Specifications.aspx?q=1&series=30&releases=all&draft=False&underCC=False&withACC=False&withBCC=False&numberNYA=False.

59. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP E-UTRAN radio interface protocol architecture standard available at http://www.3gpp.org/DynaReport/36300.htm

60. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP TS 36.300 (Rel-12), available at http://www.3gpp.org/DynaReport/36300.htm.

61. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system.

16.1.5 Inter-cell Interference Coordination (ICIC)

Inter-cell interference coordination has the task to manage radio resources such that inter-cell interference is kept under control. ICIC mechanism includes a frequency domain component and time domain component. ICIC is inherently a multi-cell RRM function that needs to take into account information (e.g. the resource usage status and traffic load situation) from multiple cells. The preferred ICIC method may be different in the uplink and downlink.

The frequency domain ICIC manages radio resource, notably the radio resource blocks, such that multiple cells coordinate use of frequency domain resources.

For the time domain ICIC, subframe utilization across different cells are coordinated in time through backhaul signalling or OAM configuration of so called Almost Blank Subframe patterns. The Almost Blank Subframes (ABSs) in an aggressor cell are used to protect resources in subframes in the victim cell receiving strong inter-cell interference. Almost blank subframes are subframes with reduced transmit power (including no transmission) on some physical channels and/or reduced activity. The eNB ensures backwards compatibility towards UEs by transmitting necessary control channels and physical signals as well as System Information. Patterns based on ABSs are signalled to the UE to restrict the UE measurement to specific subframes, called measurement resource restrictions. There are different patterns depending on the type of measured cell (serving or neighbour cell) and measurement type (e.g. RRM, RLM). MBSFN subframes can be used for time domain ICIC when they are also included in ABS patterns. The eNB cannot configure MBSFN subframes TS 36.211 [4] as ABSs when these MBSFN subframes are used for other usages (e.g., MBMS, LCS).

Extending the coverage of a cell by means of connecting a UE to cell that is weaker than the strongest detected cell is referred to as cell range extension (CRE). With time domain ICIC, a CRE UE may continue to be served by a victim cell (i.e., the weaker cell) even while under strong interference from aggressor cells (i.e., the stronger cell).

A UE under strong interference from aggressor cells may need to mitigate interference from the aggressor cells on some physical channels and signals in order to receive data from serving cell or to detect the weak cells or to perform measurements on the weak cells.

The network may provide SIB1 to the UE in the CRE region by a dedicated RRC signalling to assist UE system information acquisition.

ICIC is located in the eNB.

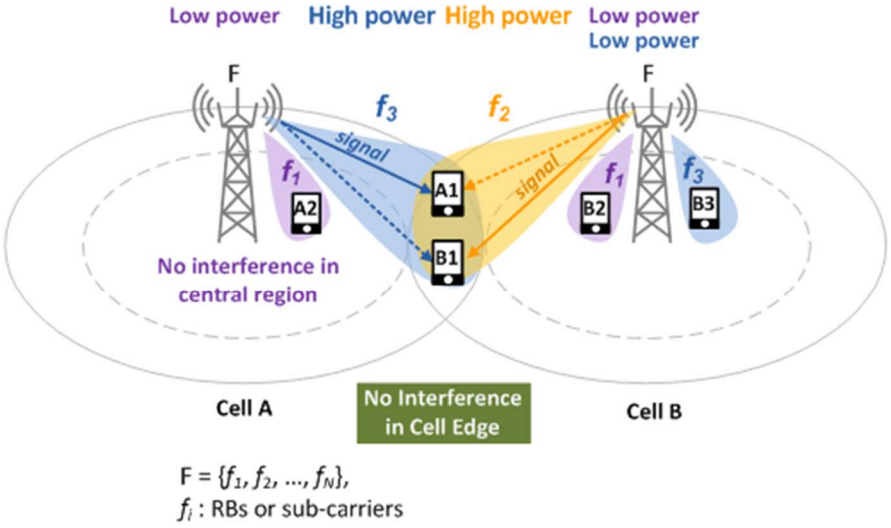
See e.g., 3GPP TS 36.300 (Rel-12), p. 123-24, available at

http://www.3gpp.org/DynaReport/36300.htm.

ICIC Concept

ICIC is defined in 3GPP release 8 as an interference coordination technology used in LTE systems. It reduces inter-cell interference by having UEs, at the same cell edge but belonging to different cells, use different frequency resources. Base stations that support this feature can generate interference information for each frequency resource (RB), and exchange the information with neighbor base stations through X2 messages. Then, from the messages, the neighbor stations can learn the interference status of their neighbors, and allocate radio resources (frequency, Tx power, etc.) to their UEs in a way that would avoid inter-cell interference.

For instance, let's say a UE belonging to Cell A is using high Tx power on frequency resouce (f_3) at the cell edge. With ICIC, Cell B then allocates a different frequency resource (f_2) to its UE at the cell edge, and f_3 to its other UE at the cell center, having the one at the center use low Tx power in communicating.



Cell A and Cell B coordinate to ensure:

- *different frequency resources (f3 and f2) are allocated to A1 and B1 at the cell edge, allowing for enhanced communication quality with no interference.*
- *Cell B allocates f3 to a UE that uses low Tx power if Cell A is already using f3 for a UE at the cell edge that uses high Tx power.*

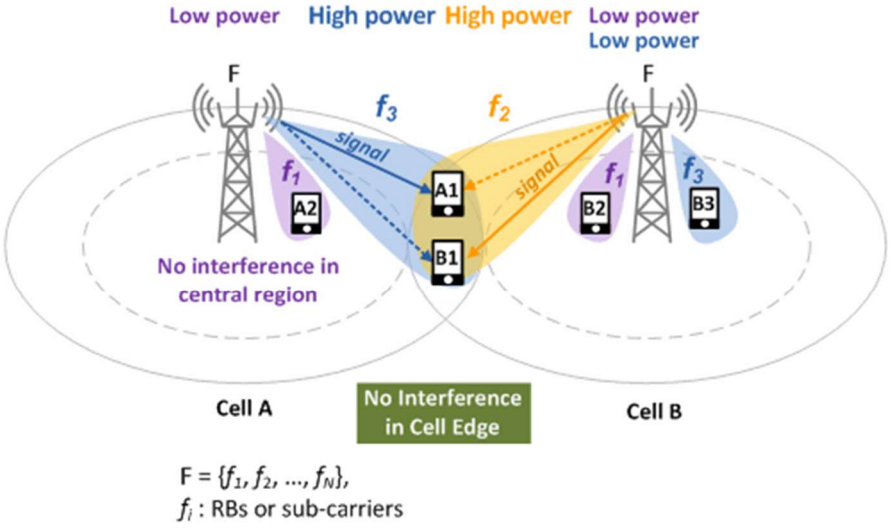
See e.g., https://www.netmanias.com/en/post/blog/6391/lte-lte-a/interference-coordination-in-lte-lte-a-1-inter-cell-interference-coordination-icic.

62. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system, comprising the step of determining a communication node set for serving one user terminal simultaneously; and allocating in common at least one resource to the user terminal by at least two communication nodes included in the communication node set.

ICIC Concept

ICIC is defined in 3GPP release 8 as an interference coordination technology used in LTE systems. It reduces inter-cell interference by having UEs, at the same cell edge but belonging to different cells, use different frequency resources. Base stations that support this feature can generate interference information for each frequency resource (RB), and exchange the information with neighbor base stations through X2 messages. Then, from the messages, the neighbor stations can learn the interference status of their neighbors, and allocate radio resources (frequency, Tx power, etc.) to their UEs in a way that would avoid inter-cell interference.

For instance, let's say a UE belonging to Cell A is using high Tx power on frequency resouce (f_3) at the cell edge. With ICIC, Cell B then allocates a different frequency resource (f_2) to its UE at the cell edge, and f_3 to its other UE at the cell center, having the one at the center use low Tx power in communicating.



Cell A and Cell B coordinate to ensure:

- *different frequency resources (f3 and f2) are allocated to A1 and B1 at the cell edge, allowing for enhanced communication quality with no interference.*
- *Cell B allocates f3 to a UE that uses low Tx power if Cell A is already using f3 for a UE at the cell edge that uses high Tx power.*

See e.g., https://www.netmanias.com/en/post/blog/6391/lte-lte-a/interference-coordination-in-lte-lte-a-1-inter-cell-interference-coordination-icic.

63. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system, wherein when a new communication node set is created due to deletion of at least one communication node from the communication node set and/or insertion of at least one new communication node into the communication node set, the common allocation comprises allocating in common at

least one of resources in use for the user terminal to the user terminal, by at least two of the communication nodes included in the new communication node set.

16.1.5 Inter-cell Interference Coordination (ICIC)

Inter-cell interference coordination has the task to manage radio resources such that inter-cell interference is kept under control. ICIC mechanism includes a frequency domain component and time domain component. ICIC is inherently a multi-cell RRM function that needs to take into account information (e.g. the resource usage status and traffic load situation) from multiple cells. The preferred ICIC method may be different in the uplink and downlink.

The frequency domain ICIC manages radio resource, notably the radio resource blocks, such that multiple cells coordinate use of frequency domain resources.

For the time domain ICIC, subframe utilization across different cells are coordinated in time through backhaul signalling or OAM configuration of so called Almost Blank Subframe patterns. The Almost Blank Subframes (ABSs) in an aggressor cell are used to protect resources in subframes in the victim cell receiving strong inter-cell interference. Almost blank subframes are subframes with reduced transmit power (including no transmission) on some physical channels and/or reduced activity. The eNB ensures backwards compatibility towards UEs by transmitting necessary control channels and physical signals as well as System Information. Patterns based on ABSs are signalled to the UE to restrict the UE measurement to specific subframes, called measurement resource restrictions. There are different patterns depending on the type of measured cell (serving or neighbour cell) and measurement type (e.g. RRM, RLM). MBSFN subframes can be used for time domain ICIC when they are also included in ABS patterns. The eNB cannot configure MBSFN subframes TS 36.211 [4] as ABSs when these MBSFN subframes are used for other usages (e.g., MBMS, LCS).

Extending the coverage of a cell by means of connecting a UE to cell that is weaker than the strongest detected cell is referred to as cell range extension (CRE). With time domain ICIC, a CRE UE may continue to be served by a victim cell (i.e., the weaker cell) even while under strong interference from aggressor cells (i.e., the stronger cell).

A UE under strong interference from aggressor cells may need to mitigate interference from the aggressor cells on some physical channels and signals in order to receive data from serving cell or to detect the weak cells or to perform measurements on the weak cells.

The network may provide SIB1 to the UE in the CRE region by a dedicated RRC signalling to assist UE system information acquisition.

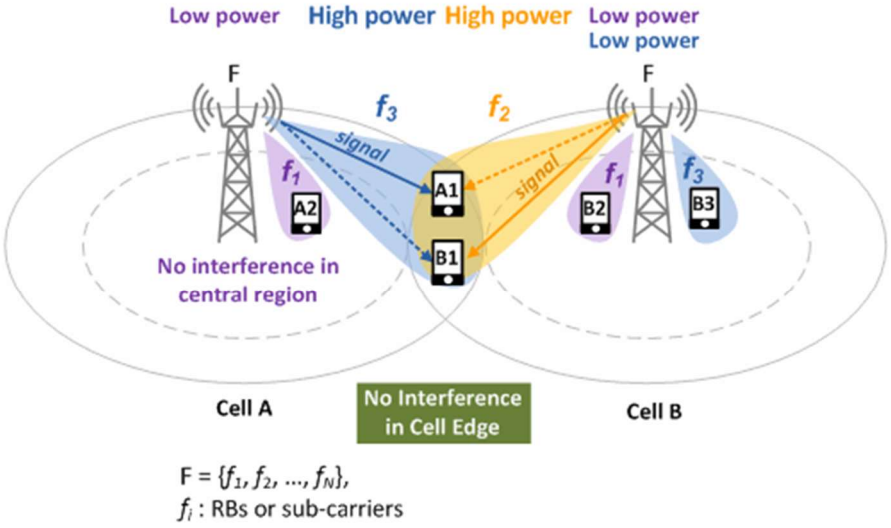
ICIC is located in the eNB.

See e.g., 3GPP TS 36.300 (Rel-12), p. 123-24, available at http://www.3gpp.org/DynaReport/36300.htm.

ICIC Concept

ICIC is defined in 3GPP release 8 as an interference coordination technology used in LTE systems. It reduces inter-cell interference by having UEs, at the same cell edge but belonging to different cells, use different frequency resources. Base stations that support this feature can generate interference information for each frequency resource (RB), and exchange the information with neighbor base stations through X2 messages. Then, from the messages, the neighbor stations can learn the interference status of their neighbors, and allocate radio resources (frequency, Tx power, etc.) to their UEs in a way that would avoid inter-cell interference.

For instance, let's say a UE belonging to Cell A is using high Tx power on frequency resouce (f_3) at the cell edge. With ICIC, Cell B then allocates a different frequency resource (f_2) to its UE at the cell edge, and f_3 to its other UE at the cell center, having the one at the center use low Tx power in communicating.



Cell A and Cell B coordinate to ensure:

- *different frequency resources (f3 and f2) are allocated to A1 and B1 at the cell edge, allowing for enhanced communication quality with no interference.*
- *Cell B allocates f3 to a UE that uses low Tx power if Cell A is already using f3 for a UE at the cell edge that uses high Tx power.*

See e.g., https://www.netmanias.com/en/post/blog/6391/lte-lte-a/interference-coordination-in-lte-lte-a-1-inter-cell-interference-coordination-icic.

64. On information and belief, T-Mobile directly infringes at least claim 21 of the '999 patent, and is in violation of 35 U.S.C. § 271(a) by making, using, selling, and offering to sell the T-Mobile Cellular Products and Services and making, using, selling access to, and offering to sell access to the T-Mobile Cellular Networks.

65. T-Mobile's direct infringement has damaged Solstice and caused it to suffer and continue to suffer irreparable harm and damages.

Count II – Infringement of United States Patent No. 9,071,994

66. Solstice repeats, realleges, and incorporates by reference, as if fully set forth here, the allegations of the preceding paragraphs above.

67. On information and belief, T-Mobile (or those acting on its behalf) makes, uses, sells access to, and/or offers to sell access to the T-Mobile Cellular Networks and makes, uses, sells, and/or offers for sale the T-Mobile Cellular Products and Services in the United States. T-Mobile, as well as the T-Mobile Cellular Networks and T-Mobile Cellular Products and Services, infringe (literally and/or under the doctrine of equivalents) at least claim 12 of the '994 patent.

68. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP 5G-NR standards.

69. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP TS 38.340 standard.

70. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the ESTI TS 138 300 v16.2.0, available at https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.02.00_60/ts_138300v160200p.pdf.

71. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the ESTI TS 138 401 v16.2.0, available at https://www.etsi.org/deliver/etsi_ts/138400_138499/138401/16.02.00_60/ts_138401v160200p.pdf.

72. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method of performing a multi-path control in a communication system by providing a communication service through at least two independent backhaul links connecting simultaneously at least two communication stations.

4.7 Integrated Access and Backhaul

4.7.1 Architecture

Integrated access and backhaul (IAB) enables wireless relaying in NG-RAN. The relaying node, referred to as *IAB-node*, supports access and backhauling via NR. The terminating node of NR backhauling on network side is referred to as the *IAB-donor*, which represents a gNB with additional functionality to support IAB. Backhauling can occur via a single or via multiple hops. The IAB architecture is shown in Figure 4.7.1-1.

The IAB-node supports gNB-DU functionality, as defined in TS 38.401 [4], to terminate the NR access interface to UEs and next-hop IAB-nodes, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor. The gNB-DU functionality on the IAB-node is also referred to as *IAB-DU*.

In addition to the gNB-DU functionality, the IAB-node also supports a subset of the UE functionality referred to as *IAB-MT*, which includes, e.g., physical layer, layer-2, RRC and NAS functionality to connect to the gNB-DU of another IAB-node or the IAB-donor, to connect to the gNB-CU on the IAB-donor, and to the core network.

The IAB-node can access the network using either SA-mode or EN-DC. In EN-DC, the IAB-node also connects via E-UTRA to a MeNB, and the IAB-donor terminates X2-C as SgNB (TS 37.340 [21]).

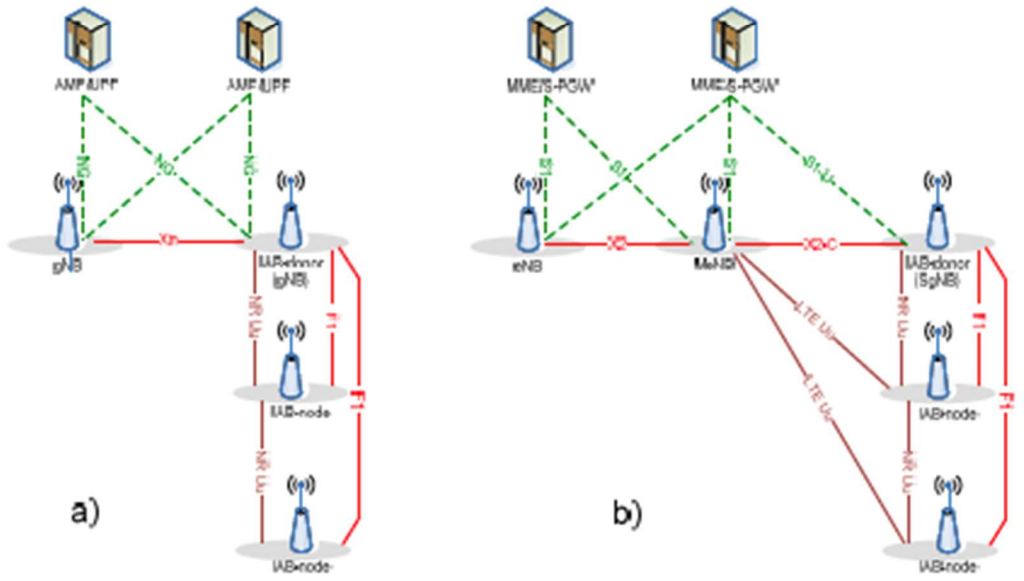


Figure 4.7.1-1: IAB architecture; a) IAB-node using SA mode with NGC; b) IAB-node using EN-DC

All IAB-nodes that are connected to an IAB-donor via one or multiple hops form a directed acyclic graph (DAG) topology with the IAB-donor at its root (Fig. 4.7.1-2). In this DAG topology, the neighbour node on the IAB-DU's interface is referred to as *child* node and the neighbour node on the IAB-MT's interface is referred to as *parent* node. The direction toward the child node is further referred to as *downstream* while the direction toward the parent node is

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.02.00_60/ts_138300v160200p.pdf.

2.2 IAB Architecture

The architecture of IAB networks will also represent a fundamental evolution in 5G networks. This section describes those changes.

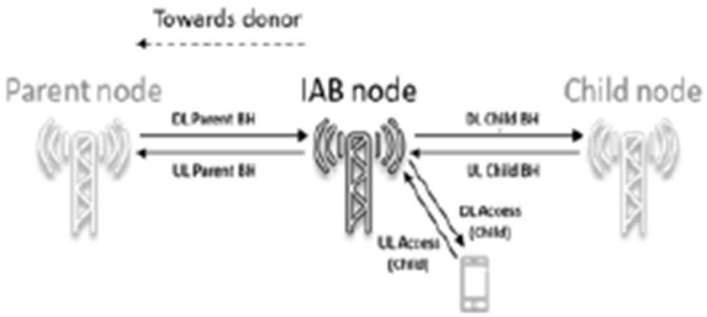


Figure 10 - IAB Parent and Child relation

Two types of links are supported in IAB networks: access links and backhaul links. An access link is a link between an access UE and an IAB node or IAB donor, while a backhaul link is a link between an IAB parent node and IAB child node (Figure 10).

IAB parent node is responsible for scheduling the DL/UL traffic for both access and backhaul links, and the IAB child node at the end of the transmission chain is responsible for scheduling the DL/UL traffic between itself and the UEs.

See e.g., https://www.5gamericas.org/wp-content/uploads/2020/06/Innovations-in-5G-Backhaul-Technologies-WP-PDF.pdf.

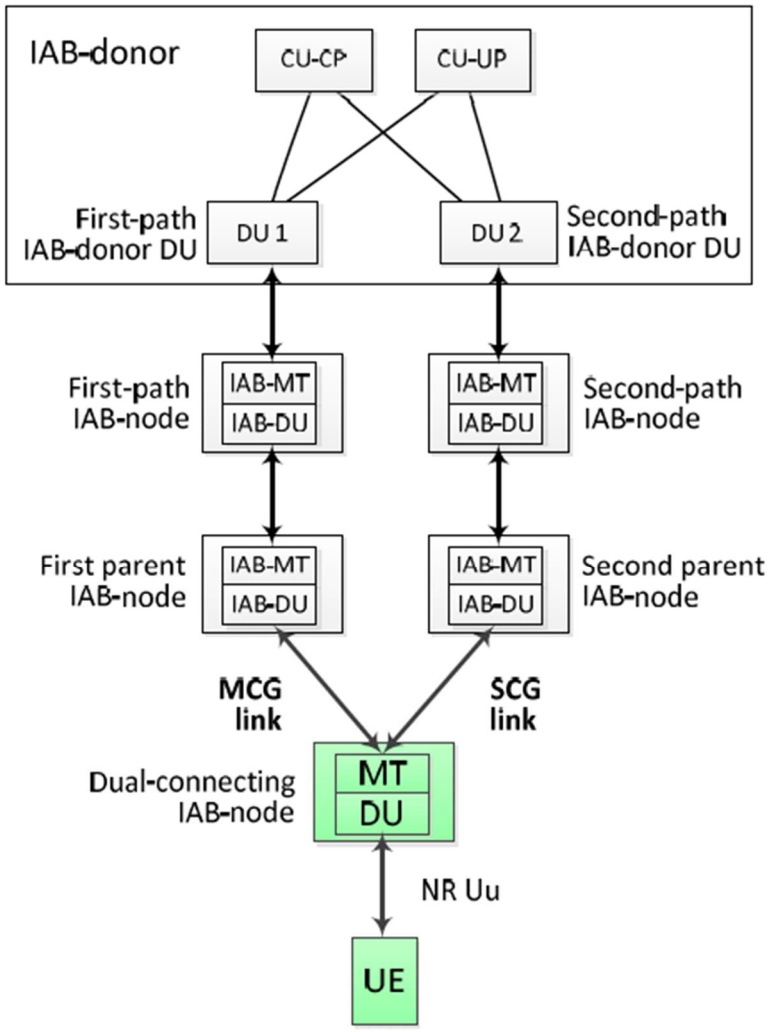


Figure 8.2.4-1: Example for IAB topology with two redundant paths

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138400_138499/138401/16.02.00_60/ts_138401v160200p.pdf.

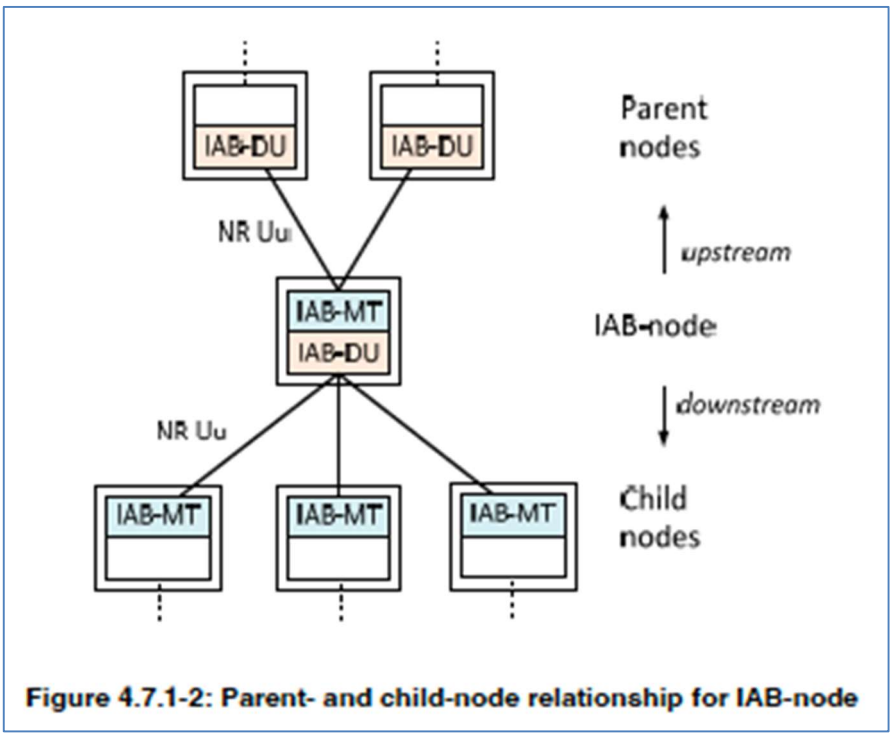


Figure 4.7.1-2: Parent- and child-node relationship for IAB-node

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.02.00_60/ts_138300v160200p.pdf.

2. Integrated Access & Backhaul (IAB)

Integrated Access and Backhaul (IAB) is a promising solution for successful 5G adoption. The key concept of IAB is to reuse the existing framework of 5G access link for the backhaul as well, by efficiently multiplexing access and backhaul in the time, frequency and/or space domain. While as per standard, IAB can be supported in sub-6GHz as well as above 6GHz spectrum, the availability of mmWave spectrum for 5G opens the opportunity to leverage a large amount of new access spectrum that is very well suited for IAB. The beam steering capability in massive MIMO solution may be used to allow for the spatial separation between the backhaul and the access, increasing spectrum efficiency.

This type of solution allows the operator to improve coverage by installing denser networks, without having to lay fiber or, at least, delaying the large and difficult investment of laying fiber for backhaul. In this way, IAB facilitates and reduces the costs of very dense deployments, improving cellular coverage.

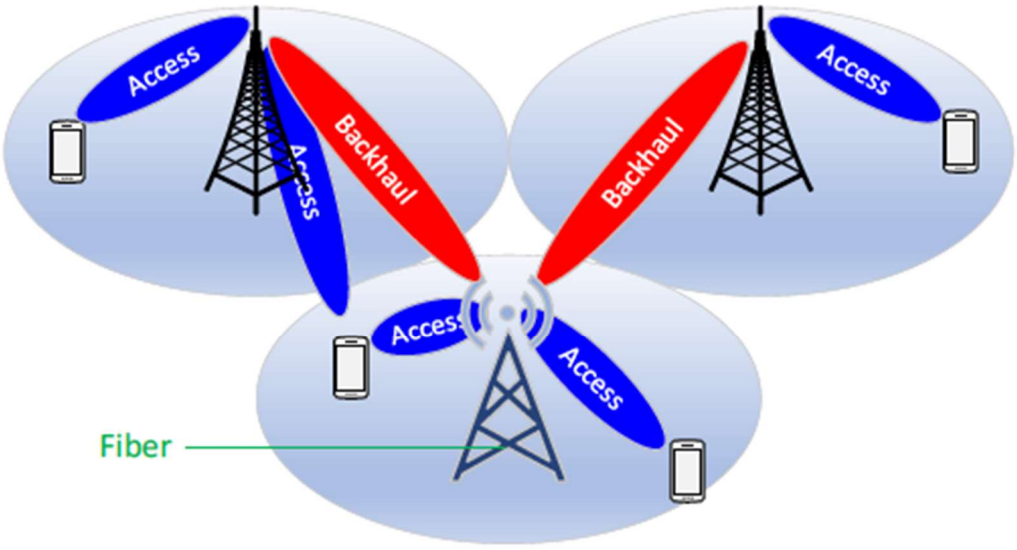


Figure 8 - Integrated access and backhaul

See e.g., https://www.5gamericas.org/wp-content/uploads/2020/06/Innovations-in-5G-Backhaul-Technologies-WP-PDF.pdf.

10.4 Measurements to Support Scheduler Operation

Measurement reports are required to enable the scheduler to operate in both uplink and downlink. These include transport volume and measurements of a UEs radio environment.

Uplink buffer status reports (BSR) are needed to provide support for QoS-aware packet scheduling. In NR, uplink buffer status reports refer to the data that is buffered in for a group of logical channels (LCG) in the UE. Eight LCGs and two formats are used for reporting in uplink:

- A short format to report only one BSR (of one LCG);
- A flexible long format to report several BSRs (up to all eight LCGs).

Uplink buffer status reports are transmitted using MAC signalling. When a BSR is triggered (e.g. when new data arrives in the transmission buffers of the UE), a Scheduling Request (SR) can be transmitted by the UE (e.g. when no resources are available to transmit the BSR).

For IAB, the Pre-emptive BSR can be configured on the backhaul links. The Pre-emptive BSR is sent based on expected data rather than buffered data, as described in Section 4.7.3.3.

Power headroom reports (PHR) are needed to provide support for power-aware packet scheduling. In NR, three types of reporting are supported: a first one for PUSCH transmission, a second one for PUSCH and PUCCH transmission in an LTE Cell Group in EN-DC (see TS 37.340 [21]) and a third one for SRS transmission on SCells configured with SRS only. In case of CA, when no transmission takes place on an activated SCell, a reference power is used to provide a virtual report. Power headroom reports are transmitted using MAC signalling.

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.02.00_60/ts_138300v160200p.pdf.

73. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method of performing a multi-path control in a communication system by providing a communication service through at least two independent backhaul links connecting simultaneously at least two communication stations wherein at least one backhaul interface unit and at least one Mobile Station (MS) interface unit are used for the multi-path control.

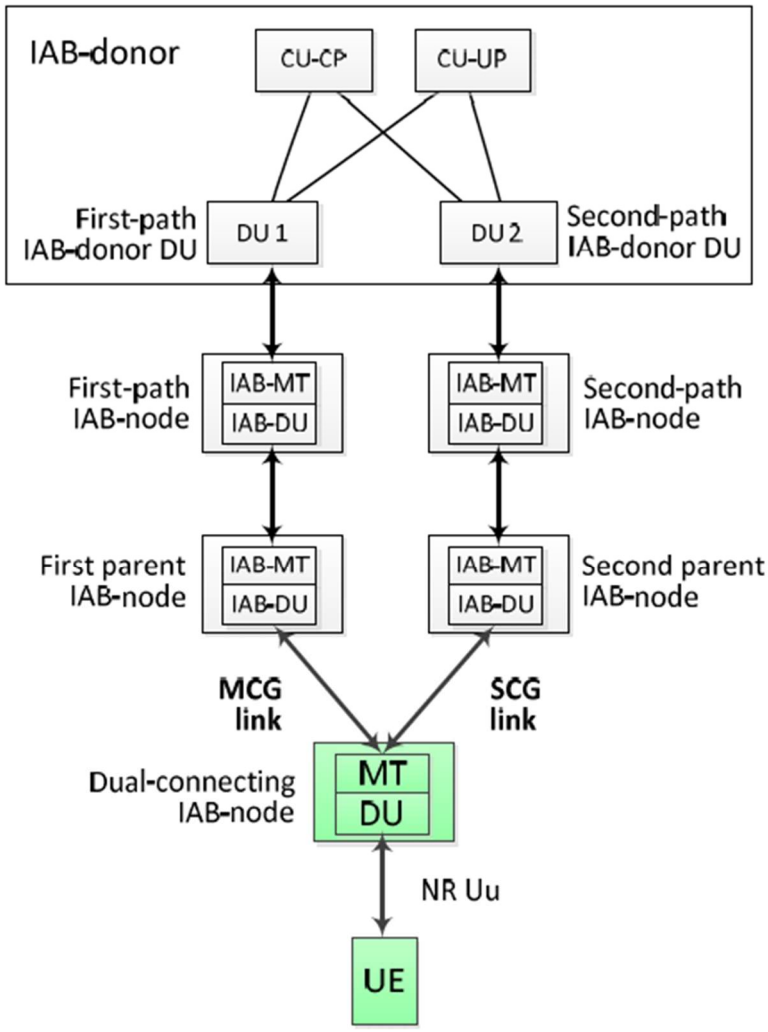


Figure 8.2.4-1: Example for IAB topology with two redundant paths

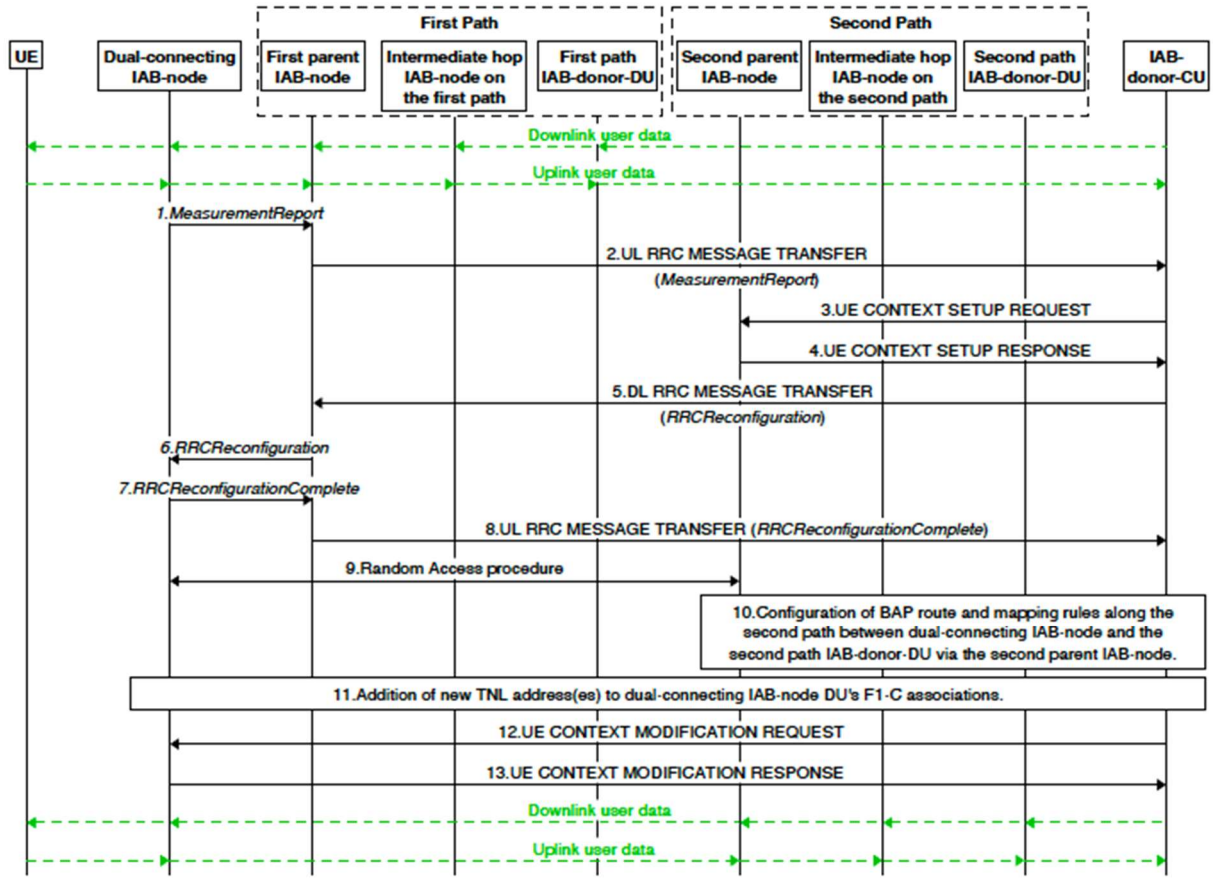


Figure 8.2.4-2: Procedure for establishment of redundant path in IAB topology

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138400_138499/138401/16.02.00_60/ts_138401v160200p.pdf.

74. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method of performing a multi-path control in a communication system by providing a communication service through at least two independent backhaul links connecting simultaneously at least two communication stations wherein the at least two independent backhaul links are formed by allowing the at least two communication stations to share at least one

backhaul interface unit, allowing the at least two communication stations to use independent backhaul interface units, or allowing each of the at least two communication stations to use at least two backhaul interface units.

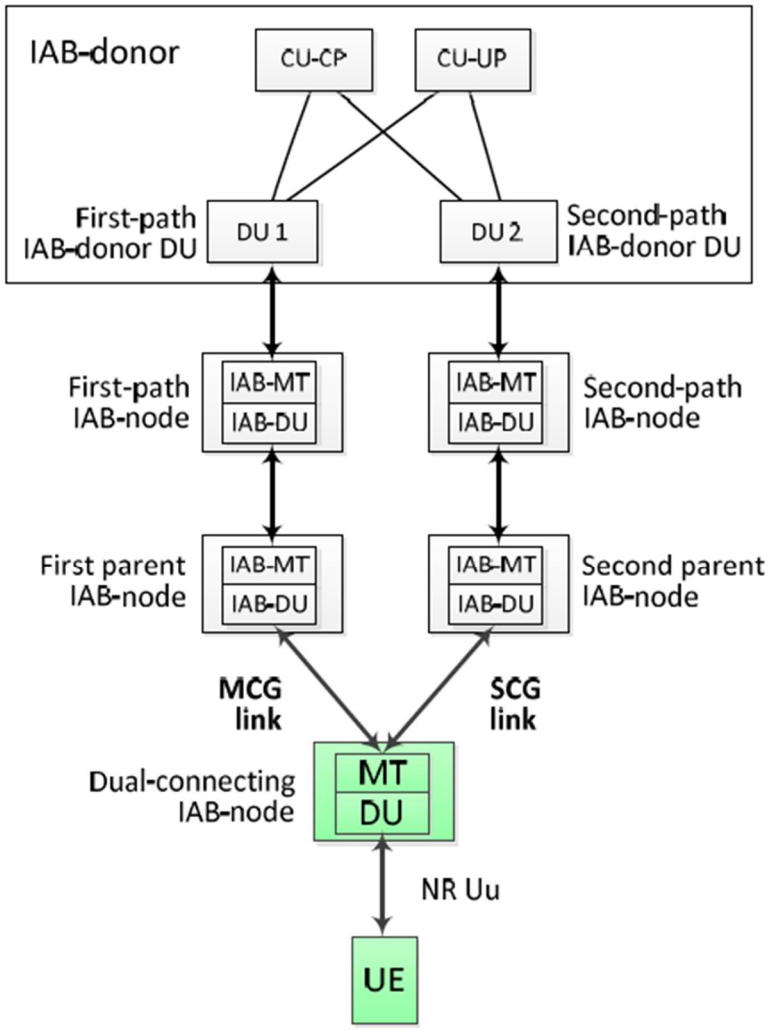


Figure 8.2.4-1: Example for IAB topology with two redundant paths

See e.g.,

https://www.etsi.org/deliver/etsi_ts/138400_138499/138401/16.02.00_60/ts_138401v160200p.pdf.

75. On information and belief, T-Mobile directly infringes at least claim 12 of the '994 patent, and is in violation of 35 U.S.C. § 271(a) by making, using, selling, and offering to sell the T-Mobile Cellular Products and Services and making, using, selling access to, and offering to sell access to the T-Mobile Cellular Networks.

76. T-Mobile's direct infringement has damaged Solstice and caused it to suffer and continue to suffer irreparable harm and damages.

Count III – Infringement of United States Patent No. 9,161,365

77. Solstice repeats, realleges, and incorporates by reference, as if fully set forth here, the allegations of the preceding paragraphs above.

78. On information and belief, T-Mobile (or those acting on its behalf) makes, uses, sells access to, and/or offers to sell access to the T-Mobile Cellular Networks and makes, uses, sells, and/or offers for sale the T-Mobile Cellular Products and Services in the United States. T-Mobile, as well as the T-Mobile Cellular Networks and T-Mobile Cellular Products and Services, infringe (literally and/or under the doctrine of equivalents) at least claim 1 of the '365 patent.

79. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology standards available at

https://portal.3gpp.org/Specifications.aspx?q=1&series=30&releases=all&draft=False&underCC=False&withACC=False&withBCC=False&numberNYA=False.

80. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP LTE-Advanced Coordinated Multipoint standard.

81. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP TR 36.819 (Rel-11), available at http://www.3gpp.org/DynaReport/36819.htm standard.

82. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP X2 Application Protocol standard.

83. On information and belief, the T-Mobile Cellular Networks and the hardware and software that enable the T-Mobile Cellular Networks to function as intended conform to one or more of the requirements of the 3GPP TR 36.423 (Rel-8), available at https://www.etsi.org/deliver/etsi_ts/136400_136499/136423/08.02.00_60/ts_136423v080200p.pdf.

84. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using

resources in a communication system comprising determining a communication node set having communication nodes which cooperatively provide a communication service to a user terminal by using a same network resource.

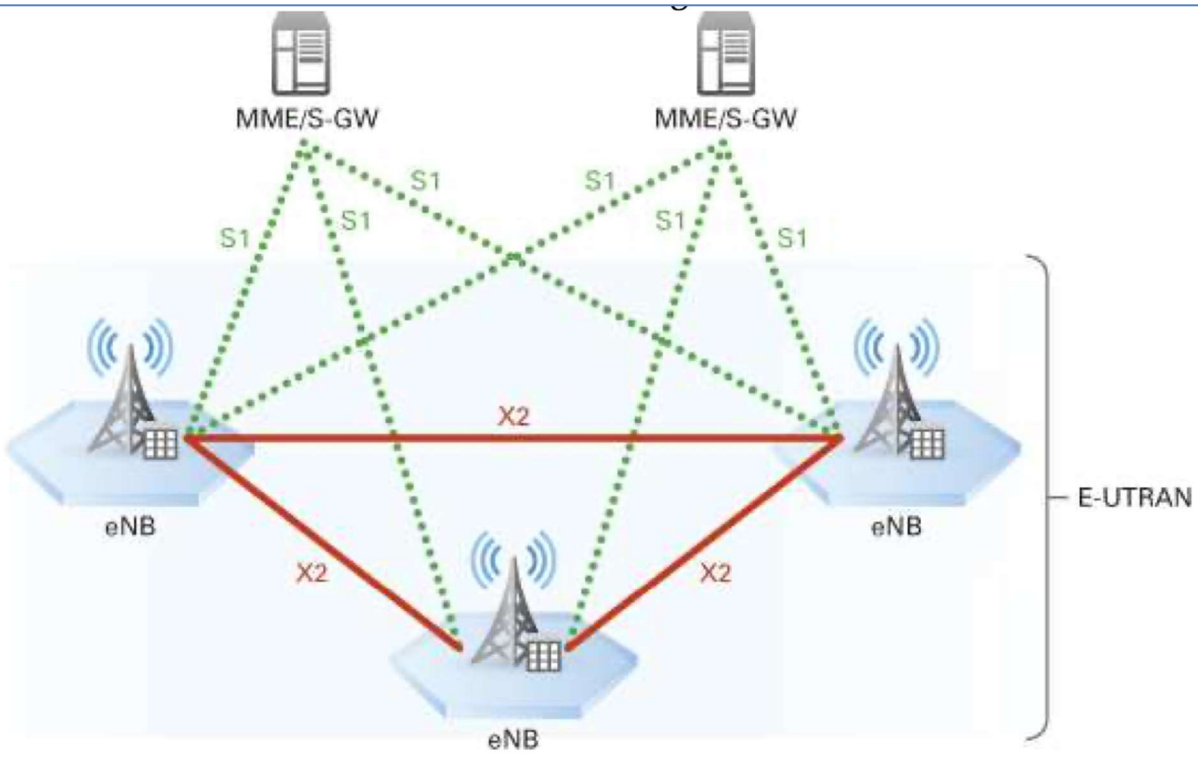


Figure 3: Overall E-UTRAN architecture

See e.g.,

https://www.eddywireless.com/yahoo_site_admin/assets/docs/lte_advanced_white_paper_03.9141941.pdf.

8.3 Global Procedures

8.3.1 Load Indication

8.3.1.1 General

The purpose of the Load Indication procedure is to transfer load and interference co-ordination information between intra-frequency neighboring eNBs.

The procedure uses non UE associated signalling.

8.3.1.2 Successful Operation

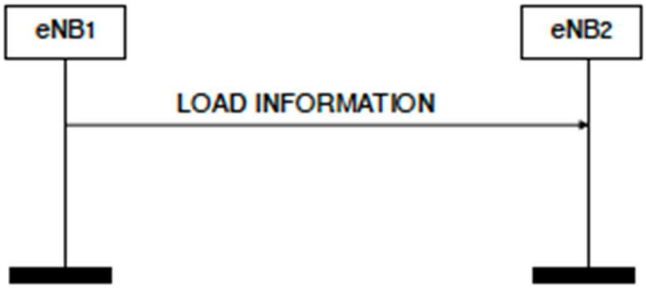


Figure 8.3.1.2-1: Load Indication

An eNB initiates the procedure by sending LOAD INFORMATION message to intra-frequency neighbouring eNBs.

If the *UL Interference Overload Indication* IE is received in the LOAD INFORMATION message, it indicates the interference level experienced by the sending eNB on some resource blocks. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *UL Interference Overload Indication* IE value valid until reception of a new LOAD INFORMATION message carrying an update of the same IE.

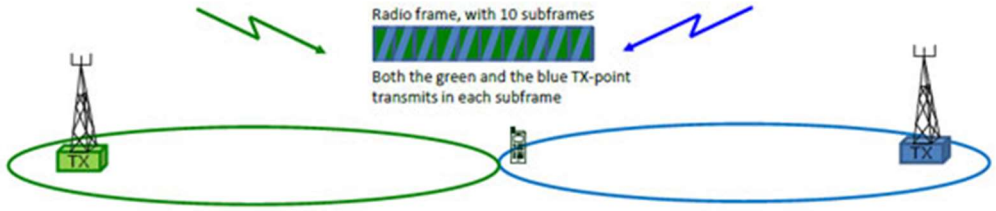
If the *UL High Interference Indication* IE is received in the LOAD INFORMATION message, it indicates, per PRB, the occurrence of high interference sensitivity, as seen from the sending eNB. The receiving eNB should try to avoid scheduling cell edge UEs in its cells for the concerned PRBs. The *Target Cell ID* IE received within the *UL High Interference Information* IE group in the LOAD INFORMATION message indicates the cell for which the corresponding UL High Interference Indication is meant. The receiving eNB shall consider the value of the *UL High Interference Information* IE group valid until reception of a new LOAD INFORMATION message carrying an update.

See e.g.,

https://www.etsi.org/deliver/etsi_ts/136400_136499/136423/08.02.00_60/ts_136423v080200p.pdf.

The main reason to introduce CoMP is to improve network performance at cell edges. In CoMP a number of TX (transmit) points provide coordinated transmission in the DL, and a number of RX (receive) points provide coordinated reception in the UL. A TX/RX-point constitutes of a set of co-located TX/RX antennas providing coverage in the same sector. The set of TX/RX-points used in CoMP can either be at different locations, or co-sited but providing coverage in different sectors, they can also belong to the same or different eNBs. CoMP can be done in a number of ways, and the coordination can be done for both homogenous networks as well as heterogeneous networks. In figure 8 two simplified examples for DL CoMP is shown. In both these cases DL data is available for transmission from two TX-points. When two, or more, TX-points, transmit on the same frequency in the same subframe it is called Joint Transmission. When data is available for transmission at two or more TX-points but only scheduled from one TX-point in each subframe it is called Dynamic Point Selection. For UL CoMP there is for example Joint Reception, a number of RX-points receive the UL data from one UE, and the received data is combined to improve the quality. When the TX/RX-points are controlled by different eNBs extra delay might be added, since the eNBs must communicate, for example in order to make scheduling decisions. When CoMP is used additional radio resources for signaling is required e.g. to provide UE scheduling information for the different DL/UL resources.

a) Joint Transmission
Data is transmitted – in the same frequency and at the same time - from multiple TX-points , here two



See e.g., https://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced.

6.1.3 CoMP categories

Each CoMP scheme may be categorized into one of the following categories.

- Joint Reception (JR): PUSCH transmitted by the UE is received jointly at multiple points (part of or entire CoMP cooperating set) at a time, e.g., to improve the received signal quality
- Coordinated Scheduling and Beamforming (CS/CB): user scheduling and precoding selection decisions are made with coordination among points corresponding to the CoMP cooperating set. Data is intended for one point only.

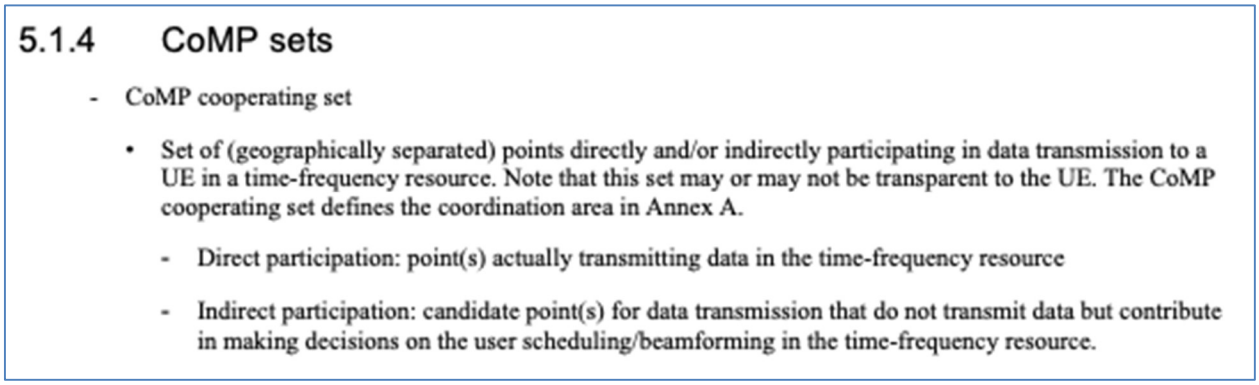
6.1.4 CoMP sets

- CoMP cooperating set

- Set of (geographically separated) points that may be intended for data reception from a UE.
- CoMP reception point(s): point or set of points receiving data from a UE
  - CoMP reception point(s) is (are) a subset of the CoMP cooperating set
  - For JR, CoMP reception points may include multiple points in the CoMP cooperating set at each subframe for a certain frequency resource.
  - For CS/CB, a single point in the CoMP cooperating set is the CoMP reception point at each subframe for a certain frequency resource.

See e.g., https://www.3gpp.org/DynaReport/36819.htm.

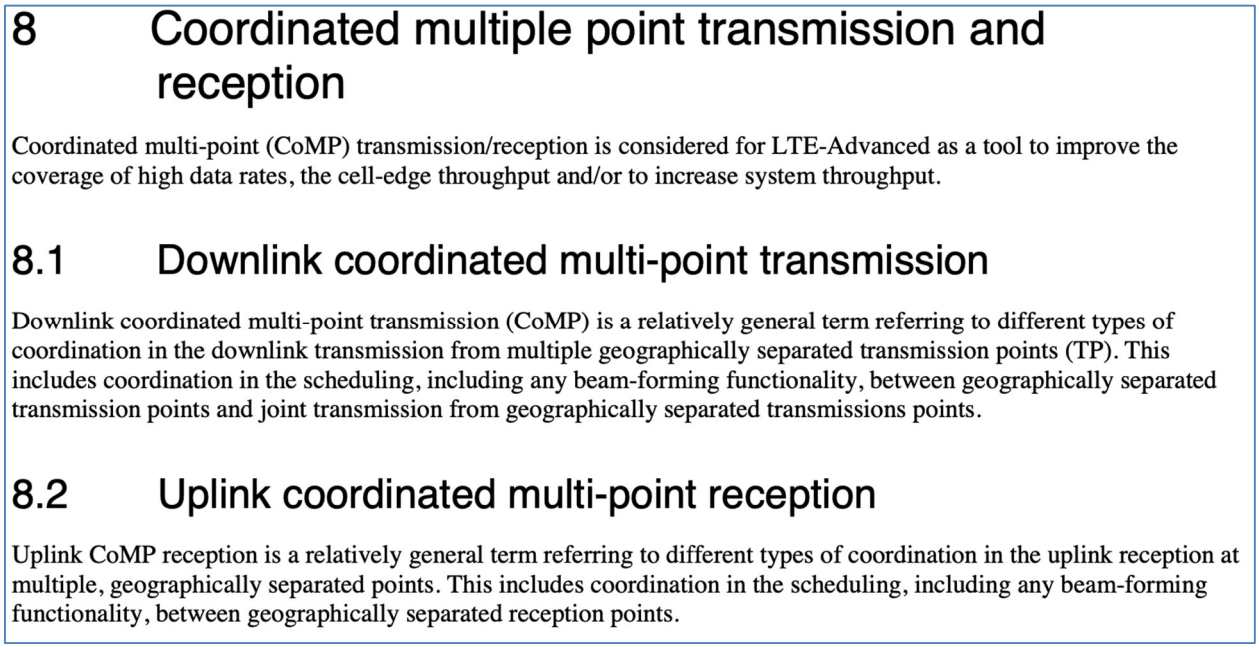
85. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system comprising determining a transceiving node set from among the communication nodes included in the determined communication node set, wherein said transceiving node set comprises at least one communication node which transceives information from/to the user terminal.



5.1.4 CoMP sets

- CoMP cooperating set
  - Set of (geographically separated) points directly and/or indirectly participating in data transmission to a UE in a time-frequency resource. Note that this set may or may not be transparent to the UE. The CoMP cooperating set defines the coordination area in Annex A.
    - Direct participation: point(s) actually transmitting data in the time-frequency resource
    - Indirect participation: candidate point(s) for data transmission that do not transmit data but contribute in making decisions on the user scheduling/beamforming in the time-frequency resource.

See e.g., https://www.3gpp.org/DynaReport/36819.htm.



8 Coordinated multiple point transmission and reception

Coordinated multi-point (CoMP) transmission/reception is considered for LTE-Advanced as a tool to improve the coverage of high data rates, the cell-edge throughput and/or to increase system throughput.

8.1 Downlink coordinated multi-point transmission

Downlink coordinated multi-point transmission (CoMP) is a relatively general term referring to different types of coordination in the downlink transmission from multiple geographically separated transmission points (TP). This includes coordination in the scheduling, including any beam-forming functionality, between geographically separated transmission points and joint transmission from geographically separated transmissions points.

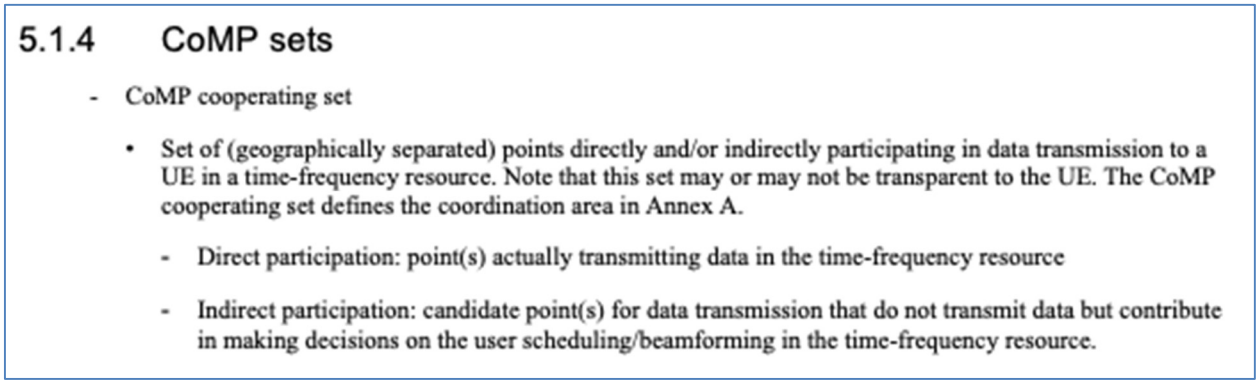
8.2 Uplink coordinated multi-point reception

Uplink CoMP reception is a relatively general term referring to different types of coordination in the uplink reception at multiple, geographically separated points. This includes coordination in the scheduling, including any beam-forming functionality, between geographically separated reception points.

See e.g.,

https://www.etsi.org/deliver/etsi_tr/136900_136999/136912/11.00.00_60/tr_136912v110000p.pdf.

86. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein the communication node set further comprises at least one communication node that does not provide the communication service to the user terminal.

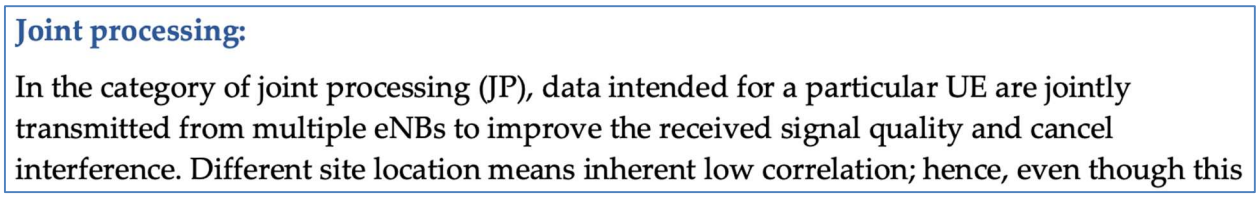


5.1.4 CoMP sets

- CoMP cooperating set
  - Set of (geographically separated) points directly and/or indirectly participating in data transmission to a UE in a time-frequency resource. Note that this set may or may not be transparent to the UE. The CoMP cooperating set defines the coordination area in Annex A.
    - Direct participation: point(s) actually transmitting data in the time-frequency resource
    - Indirect participation: candidate point(s) for data transmission that do not transmit data but contribute in making decisions on the user scheduling/beamforming in the time-frequency resource.

See e.g., https://www.3gpp.org/DynaReport/36819.htm.

87. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein the communication node set further comprises at least one communication node that is unable to provide the communication service to the user terminal.



Joint processing:

In the category of joint processing (JP), data intended for a particular UE are jointly transmitted from multiple eNBs to improve the received signal quality and cancel interference. Different site location means inherent low correlation; hence, even though this

See e.g.,

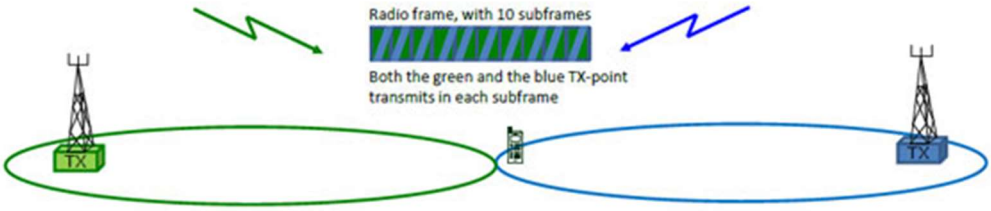
https://www.eddywireless.com/yahoo_site_admin/assets/docs/lte_advanced_white_paper_03.9141941.pdf.

88. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein the communication node set further comprises at least one communication node having a first service coverage which is not adjacent to a second service coverage of at least one of the remaining communication nodes included in the communication node set.

89. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein the communication node set further comprises at least one communication node having a third service coverage which is overlapped with a fourth service coverage of at least one of the remaining communication nodes included in the communication node set.

The main reason to introduce CoMP is to improve network performance at cell edges. In CoMP a number of TX (transmit) points provide coordinated transmission in the DL, and a number of RX (receive) points provide coordinated reception in the UL. A TX/RX-point constitutes of a set of co-located TX/RX antennas providing coverage in the same sector. The set of TX/RX-points used in CoMP can either be at different locations, or co-sited but providing coverage in different sectors, they can also belong to the same or different eNBs. CoMP can be done in a number of ways, and the coordination can be done for both homogenous networks as well as heterogeneous networks. In figure 8 two simplified examples for DL CoMP is shown. In both these cases DL data is available for transmission from two TX-points. When two, or more, TX-points, transmit on the same frequency in the same subframe it is called Joint Transmission. When data is available for transmission at two or more TX-points but only scheduled from one TX-point in each subframe it is called Dynamic Point Selection. For UL CoMP there is for example Joint Reception, a number of RX-points receive the UL data from one UE, and the received data is combined to improve the quality. When the TX/RX-points are controlled by different eNBs extra delay might be added, since the eNBs must communicate, for example in order to make scheduling decisions. When CoMP is used additional radio resources for signaling is required e.g. to provide UE scheduling information for the different DL/UL resources.

a) Joint Transmission
Data is transmitted – in the same frequency and at the same time - from multiple TX-points , here two



See e.g., https://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced.

90. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein if the transceiving node set has more than one communication node, two or more communication nodes included in the transceiving node set transceive the same information from/to the user terminal by using the same network resource for each of the two or more communication nodes.

The main reason to introduce CoMP is to improve network performance at cell edges. In CoMP a number of TX (transmit) points provide coordinated transmission in the DL, and a number of RX (receive) points provide coordinated reception in the UL. A TX/RX-point constitutes of a set of co-located TX/RX antennas providing coverage in the same sector. The set of TX/RX-points used in CoMP can either be at different locations, or co-sited but providing coverage in different sectors, they can also belong to the same or different eNBs. CoMP can be done in a number of ways, and the coordination can be done for both homogenous networks as well as heterogeneous networks. In figure 8 two simplified examples for DL CoMP is shown. In both these cases DL data is available for transmission from two TX-points. When two, or more, TX-points, transmit on the same frequency in the same subframe it is called Joint Transmission. When data is available for transmission at two or more TX-points but only scheduled from one TX-point in each subframe it is called Dynamic Point Selection. For UL CoMP there is for example Joint Reception, a number of RX-points receive the UL data from one UE, and the received data is combined to improve the quality. When the TX/RX-points are controlled by different eNBs extra delay might be added, since the eNBs must communicate, for example in order to make scheduling decisions. When CoMP is used additional radio resources for signaling is required e.g. to provide UE scheduling information for the different DL/UL resources.

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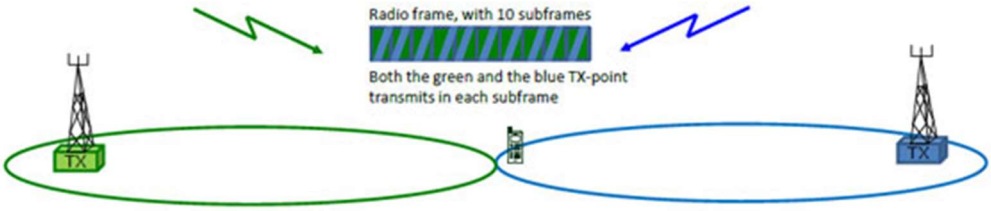
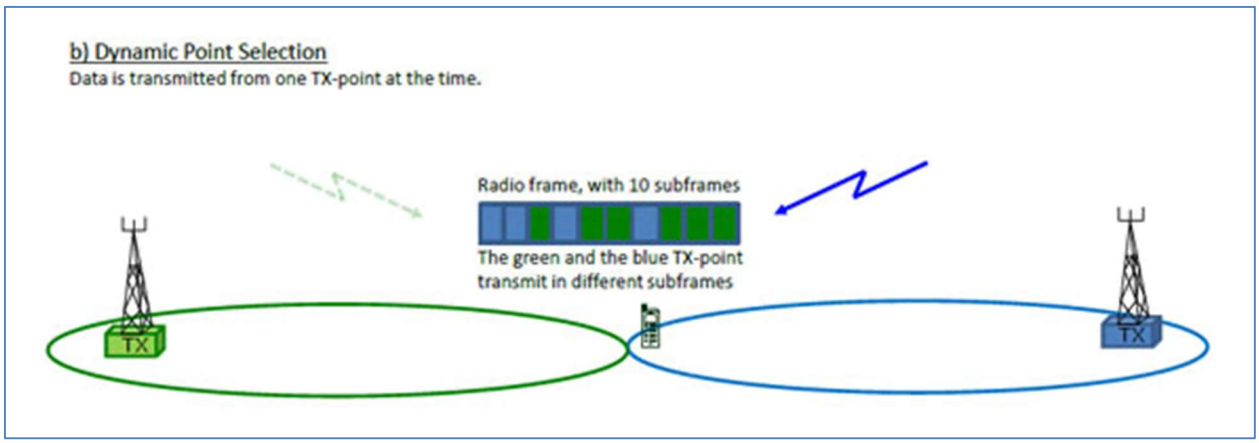


See e.g., https://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced.

91. On information and belief, T-Mobile, T-Mobile Cellular Networks, and T-Mobile Cellular Products and Services employ and provide a method for using resources in a communication system wherein if the transceiving node set has more than one communication node, two or more communication nodes included in the transceiving node set transceive different information from/to the user terminal by using the same network resource for each of the two or more communication nodes.



See e.g., https://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced.

92. On information and belief, T-Mobile directly infringes at least claim 1 of the '365 patent, and is in violation of 35 U.S.C. § 271(a) by making, using, selling, and offering to sell the T-Mobile Cellular Products and Services and making, using, selling access to, and offering to sell access to the T-Mobile Cellular Networks.

93. T-Mobile's direct infringement has damaged Solstice and caused it to suffer and continue to suffer irreparable harm and damages.

JURY DEMANDED

94. Pursuant to Federal Rule of Civil Procedure 38(b), Solstice hereby requests a trial by jury on all issues so triable.

PRAYER FOR RELIEF

Solstice respectfully requests this Court to enter judgment in Solstice's favor and against T-Mobile as follows:

a. finding that T-Mobile has infringed one or more claims of the '999 patent under 35 U.S.C. §§ 271(a);

b. finding that T-Mobile has infringed one or more claims of the '994 patent under 35 U.S.C. §§ 271(a);

c. finding that T-Mobile has infringed one or more claims of the '365 patent under 35 U.S.C. §§ 271(a);

d. awarding Solstice damages under 35 U.S.C. § 284, or otherwise permitted by law, including supplemental damages for any continued post-verdict infringement;

e. awarding Solstice pre-judgment and post-judgment interest on the damages award and costs;

f. awarding cost of this action (including all disbursements) and attorney fees pursuant to 35 U.S.C. § 285, or as otherwise permitted by the law; and

g. awarding such other costs and further relief that the Court determines to be just and equitable.

Dated: August 24, 2022

Respectfully submitted,

/s/Raymond W. Mort, III

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