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

HUAWEI TECHNOLOGIES CO. LTD., Plaintiff, v. VERIZON COMMUNICATIONS, INC., VERIZON BUSINESS NETWORK SERVICES, INC., VERIZON ENTERPRISE SOLUTIONS, LLC, CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, INC., VERIZON DATA SERVICES LLC, VERIZON BUSINESS GLOBAL, LLC, AND VERIZON SERVICES CORP. Defendants.	CIVIL ACTION NO. 2:20-cv-00030 JURY TRIAL DEMANDED

ORIGINAL COMPLAINT

Plaintiff Huawei Technologies Co. Ltd. ("Huawei") files this Original Complaint against Defendants Verizon Communications, Inc., Verizon Business Network Services, Inc., Verizon Enterprise Solutions LLC, Cellco Partnership d/b/a Verizon Wireless, Inc., Verizon Data Services LLC, Verizon Business Global, LLC, and Verizon Services Corp. (collectively "Defendants" or "Verizon") for patent infringement under 35 U.S.C. § 271. Plaintiff alleges, based on its own personal knowledge with respect to its own actions and based upon information and belief with respect to all others' actions, as follows:

THE PARTIES

1. Huawei Technologies Co. Ltd. is a Chinese corporation with its principal place of business at Bantian, Longgang District, Shenzhen, People's Republic of China.

2. Defendant Verizon Communications, Inc. is a Delaware corporation with

its principal place of business at 1095 Avenue of the Americas, New York, NY 10036. Verizon Communications, Inc. has designated The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 as its agent for service of process.

3. Defendant Verizon Business Network Services, Inc. is a Delaware corporation with its principal place of business at 22001 Loudoun County Parkway, Ashburn, Virginia 20147. Verizon Business Network Services, Inc. has designated CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201 as its agent for service of process.

4. Defendant Verizon Enterprise Solutions LLC is a Delaware limited liability company with its principal place of business at One Verizon Way, Basking Ridge, New Jersey 07920. Verizon Enterprise Solutions LLC has designated The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 as its agent for service of process.

5. Defendant Cellco Partnership d/b/a Verizon Wireless, Inc. is a General Partnership with its principal place of business at One Verizon Way, Basking Ridge, New Jersey 07920. Cellco Partnership d/b/a Verizon Wireless, Inc. has designated The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 as its agent for service of process.

6. Defendant Verizon Data Services LLC is a Delaware limited liability company with its principal place of business at One East Telecom Parkway, B3E, Temple Terrace, Florida 33637. Verizon Data Services LLC has designated CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201 as its agent for service of

process.

7. Defendant Verizon Business Global, LLC is a Delaware corporation with its principal place of business at One Verizon Way, Basking Ridge, New Jersey. Verizon Business Global, LLC may be served with process via its registered agent Corporation Trust Company, Corporation Trust Company Center, 1209 Orange Street, Wilmington, Delaware 19801.

8. Defendant Verizon Services Corp. is a Delaware corporation with its principal place of business at 1717 Arch Street, 21st Floor, Philadelphia, PA 19103. Verizon Services Corp. may be served with process via its registered agent CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

9. On information and belief, Verizon Business Network Services, Inc., Verizon Enterprise Solutions LLC, Cellco Partnership d/b/a Verizon Wireless, Inc., Verizon Data Services LLC, Verizon Business Global, LLC, and Verizon Services Inc. are direct or indirect subsidiaries of Verizon Communications Inc. On information and belief, Verizon Communications Inc. directs or controls the actions of these entities including by inducing and contributing to the actions complained of herein.

JURISDICTION AND VENUE

10. This action includes a claim of patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 1 *et seq*. This Court has jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

11. This Court has personal jurisdiction over Defendants. Defendants conduct business and have committed acts of patent infringement and have induced acts of patent infringement by others in this district and have contributed to patent infringement by others in this district, the State of Texas, and elsewhere in the United States.

12. Venue is proper in this district pursuant to 28 U.S.C. § 1400(b) because,

defendants have committed acts of infringement and have regular and established places of business in this judicial district.

ASSERTED PATENTS

13. On September 18, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,270,433 ("the '433 patent"), entitled "Sending Method, Receiving and Processing Method and Apparatus for Adapting Payload Bandwidth for Data Transmission." A copy of the '433 patent is attached as Exhibit A.

14. On April 21, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,014,151 ("the '151 patent"), entitled "Method and Apparatus for Transmitting Low-Rate Traffic Signal in Optical Transport Network." A copy of the '151 patent is attached as Exhibit B.

15. On March 26, 2013, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,406,236 ("the '236 patent"), entitled "Method and Apparatus for Transporting Client Signal in Optical Transport Network." A copy of the '236 patent is attached as Exhibit C.

16. On September 2, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,824,505 ("the '505 patent"), entitled "Method and Apparatus for Transporting Client Signals in an Optical Transport Network." A copy of the '505 patent is attached as Exhibit D.

17. On April 12, 2016, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,312,982 ("the '982 patent"), entitled "Method and Apparatus for Mapping and De-Mapping in an Optical Transport Network." A copy of the '982 patent is attached as Exhibit E.

FACTUAL ALLEGATIONS

18. By way of background, Huawei was founded in 1987 and has become a global leader of information and communication technology. Huawei's telecom network equipment, IT products and solutions, and smart devices, such as telepresence products, transport and core network equipment, fixed and radio access products, and fiber infrastructure products, are deployed and used in 170 countries and regions and serve more than three billion people around the world. Indeed, together with telecom carriers, Huawei has built over 1,500 networks. In fiscal year 2019, Huawei was recognized as a world technology leader with over $100 billion in sales, ranking in the top 61 of the Global Fortune 500 in 2019.

19. Huawei has heavily invested in research and development ("R&D"), routinely spending over 10% of its annual revenue on innovation. In 2018 alone, Huawei invested over $14 billion in research and development. About 45% of Huawei's global workforce – over 80,000 employees in 2018 – work in R&D. And, in the past decade through 2018, Huawei has invested near $73 billion in research and development.

20. Huawei's dedication to R&D in the telecommunications industry over the past three decades has been a major contributor to telecommunication advances from the Wired Communication Age, into the Wireless Age, and developing from 2G to 3G to 4G to 5G.

21. Similarly, Huawei has dedicated significant R&D resources in the optical networking field for over 20 years. As a result, Huawei has developed an end-to-end wavelength division multiplexing ("WDM") and OTN intelligent optical transport solution that is applicable to the backbone core layer, metro core layer, metro aggregation layer, and metro edge access layer along with Data Center Interconnect (DCI) scenarios.

Huawei's WDM / OTN solution allows carriers to provide a variety of services and can support 200G–600G ultra-high rates, 200G 5000 km ultra-long transmission, new Super C-band spectrum, OXC/ROADM all-optical grooming, single-subrack 64T (over 100T in clusters) ultra-large electrical cross-connect capacity. In 2018, Huawei introduced the industry's first ultra-large-capacity all-optical cross-connect architecture, which enables networks to carry 10 times as much data as with the traditional electric cross-connect architecture. The all-optical cross-connect architecture also uses 10 times less energy, meaning a 100-fold improvement in overall energy efficiency. Huawei has maintained the largest market share in the WDM domain and in 100G+ high-speed networks for a number of years and was the first in the world to deploy a 600G commercial network. Huawei has also contributed as a key leader in the standardization of wavelength switched optical network ("WSON") and automatically switched optical network ("ASON") technologies.

22. Indeed, R&D has been at the core of Huawei's business. Huawei started its business reselling third-party telecommunication products, but shortly thereafter Huawei chose to shift its focus by expanding its own R&D and developing its own products. As a result, Huawei has been identified as one of the top 5 companies in the world for R&D as reported in *The 2019 EU Industrial R&D Investment Scoreboard*.

23. Specifically, Huawei has been recognized for its innovation and achievements in the optical network industry, as a result of Huawei's substantial R&D investments, including for example in the past three years:

- in 2017, winning the Best New Cloud-Optical Solution award at the SDN NFV World Congress;
- in 2018, winning the Best Single-Channel Programmable 400G Product Award at the 20th Next Generation Optical Networking

("NGON"), and in 2019, winning the Best All Rounder Award for Huawei's Optical Networking 2.0 ("ON2.0") solution;

- in 2019, winning three "Outstanding Innovation" optical network awards at the Optical Fiber Communication Conference and Exhibition for its 600G, Optical Cross Connection, and Optical Intelligence solutions.

24. During the past 20 years, Huawei has driven the information and communications technology industry forward through collaborations on commercialization, innovation, and standardization. Huawei actively contributes to network-related standards through its participation in worldwide Standard Setting Organizations ("SSOs"), such as ETSI/3GPP, IETF, ITU-T, OIF, IEEE, GSMA, CCSA, IMTC, SIP Forum, MSF, NGMN, OMA, 3GPP2, and oneM2M.

25. By the end of 2018, Huawei was engaged in over 400 SSOs, industry alliances, and open source communities. In 2018 alone, Huawei submitted more than 5,000 proposals, bringing its total number of submissions to nearly 60,000. *See* (Huawei's 2018 Annual Report at 59). In addition, Huawei has obtained more than 400 key positions, such as chairs, rapporteurs, and editors, in these network technology related SSOs.

26. As a result of its investments in innovation and contributions to the industry, Huawei and its affiliates have developed a substantial patent portfolio of over 85,000 issued patents worldwide, including around 40,000 granted patents in US and Europe.

27. In particular, since 2005, Huawei has participated in and submitted

contributions to the standardization process for the Telecommunication Standardization Sector of the International Telecommunications Union ("ITU-T"), including the ITU-T's *G.709: Interfaces for the optical transport network* standard ("G.709" or "the G.709 Standard"). *See* Ex. F (ITU-T G.709/Y.1331 (06/2016)). The G.709 Standard relates to optical transport networks. More specifically, "[R]ecommendation ITU-T G.709/Y.1331 defines the requirements for the optical transport network (OTN) interface signals of the optical transport network, in terms of:

> – OTN hierarchy
>
> – functionality of the overhead in support of multi-wavelength optical networks
>
> – frame structures
>
> – bit rates
>
> – formats for mapping client signals."

See (G.709 Standard) at page i.

28. As part of its standardization efforts, Huawei made a number of contributions to the G.709 standardization process that were adopted by ITU-T and became part of the G.709 Standard.

29. Some of Huawei's contributions that were adopted in the G.709 Standard were Huawei inventions, described in patents and/or patent applications.

30. Consistent with the ITU-T's Common Patent Policy, Huawei declared that it was willing to negotiate licenses on a nondiscriminatory basis on reasonable terms and conditions for its granted patents and/or pending applications, the use of which would be required to implement the G.709 Standard.

31. The Asserted Patents are required to implement the G.709 Standard.

32. Verizon has committed and continues to commit acts of infringement under 35 U.S.C. § 271. Verizon has made, used, sold, offered to sell and/or imported into the United States systems and/or devices that comply with the G.709 Standard in connection with Verizon's optical transport network systems, including systems relying on or using Verizon's various types of networks such as optical backbone network, metro fiber-optic network, mobile backhaul network, packet-optical network, and/or devices involved in providing services such as Wavelength Services, FiOS, IntelliLight Optical Transport Service, Metro Wavelength Services, Optical Wave Service, U.S. Wavelength Service, Metro Private Line Optical Wave Service, Ethernet Private Line Service, and Dedicated Internet Services. (collectively as to the optical transport network systems and the devices they employ, "Accused G.709 Instrumentalities"). As a result, Verizon has infringed Huawei's patents that are required to implement the G.709 Standard.

33. Optical network transport technology, including the technology of the patents-in-suit, has become a key component in meeting the modern demand for high speed, reliable communication over various type of networks (e.g., long-haul networks). Verizon uses this technology to transmit massive amounts of data in a stable and safe way from numerous base stations or access points to remote destinations. Thus, the technology is important to the core of Verizon's business—enabling individuals and businesses to place calls, access the Internet, and transport data safely, reliably, and quickly.

34. Upon information and belief, Verizon has also sold or provided and continues to sell or provide the Accused G.709 Instrumentalities, directly and/or indirectly, to third parties, including but not limited to customers (e.g., Metro Network customers, mobile backhaul customers, Optical Networking customers, Private Line customers, FiOS customers, Wavelength Services customers), users, distributors, and/or

resellers (collectively, "downstream parties").

35. Upon information and belief, the downstream parties directly infringe one or more claims of the Asserted Patents by making, using, offering to sell, selling (directly or through intermediaries), importing, and/or supplying Accused G.709 Instrumentalities in this District and elsewhere in the United States.

36. Verizon has induced and/or contributed to the infringement of the downstream parties by advertising, encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities.

37. Prior to filing this lawsuit, Huawei took specific steps to protect its intellectual property in light of Verizon's infringement.

38. In particular, on February 7, 2019, Huawei contacted Verizon to discuss Verizon's need for a license to Huawei's patents. Huawei specifically identified patents from its portfolio and specific services offered by Verizon that infringed Huawei's patents, including those at issue in this case.

39. On March 28, 2019, Huawei representatives from China met in person with Verizon representatives to discuss Verizon's need for a license to Huawei's patents. Huawei further explained its intellectual property rights and also identified additional patents from its portfolio and services offered by Verizon that require a license to Huawei's patents.

40. On March 29, 2019, Huawei provided a number of claim charts to Verizon with even more detailed information regarding Verizon's infringement. Those claim charts included the '433 Patent, the '151 Patent, the '236 Patent, the '505 Patent and the '982 Patent.

41. Thus, to the extent Verizon was not already aware of Huawei's intellectual property rights, Verizon has been aware of the '433, '151, '236, '505 and'982 Patents, and Huawei's infringement allegations related to those patents, at least as early as March 29,

2019.

42. On June 4th and 5th, 2019, Huawei representatives from China again met in-person with representatives from Verizon in New York and discussed claim charts selected by Verizon concerning a variety of technologies.

43. On June 18, 2019, Huawei representatives spoke with Verizon representatives via telephone. Verizon committed to identifying issues and concerns regarding the claim charts discussed during the June 4th and 5th meeting. Huawei agreed to travel for yet another in-person meeting in New York, and Verizon advised it would identify more Huawei claim charts to be discussed at their next meeting.

44. On July 30-31, 2019, and September 3-4, 2019, and November 21-22, 2019, Huawei representatives from China met in-person with representatives from Verizon in New York and discussed the additional claim charts. Those claim charts included the '151 Patent discussed on November 21.

45. On January 21, 2020, Huawei representatives from China met in-person with representatives from Verizon in New York again, but there was no substantial progress and thus no licensing agreement was reached.

46. Throughout this year-long process, Huawei has offered to license its patents that are required to implement the G.709 Standard (including the Asserted Patents) to Verizon on terms that comply with its ITU-T Patent Statement and Licensing Declaration. Despite Huawei's good faith efforts to resolve this matter, Verizon has not entered into a license with respect to Huawei's patent portfolio including the Asserted Patents. Thus, Huawei doesn't see any hope of making substantial progress via negotiation, and it must now seek relief from the Court for Verizon's infringing conduct.

47. In light of Verizon's knowledge and the history between the parties, Verizon's infringement of the Asserted Patents is willful. Verizon continues to commit acts of infringement despite a high likelihood that its actions constitute infringement, and Verizon knew or should have known that its actions constituted an unjustifiably high risk

of infringement.

48. In accordance with 35 U.S.C. § 287, Verizon has had actual notice and knowledge of all of the Patents-in-Suit and its infringement no later than the filing of this Complaint and/or the date this Complaint was served upon Verizon. Moreover, Verizon had actual notice of all the Patents-in-Suit and its infringement as early as March 2019, when Huawei provided Verizon with claim charts mapped to the G.709 Standard, including charts for all of the Patents-in-Suit. On information and belief, Verizon continues without license to make, use, import/export into/from, market, offer for sale, and/or sell in the United States products that infringe the Patents-in-Suit.

49. In the interest of providing detailed averments of infringement, Huawei has identified below at least one claim per patent to demonstrate infringement. However, the selection of claims should not be considered limiting, and additional claims of the Patents-in-Suit (including method, system, and apparatus claims) that are infringed by Verizon will be disclosed in compliance with the Court's rules related to infringement contentions.

COUNT ONE: INFRINGEMENT OF THE '433 PATENT

50. Huawei incorporates by reference the preceding paragraphs as if fully set forth herein.

51. U.S. Patent No. 8,270,433 ("the '433 patent"), entitled "Sending Method, Receiving and Processing Method and Apparatus for Adapting Payload Bandwidth for Data Transmission," was legally and duly issued on September 18, 2012, naming Zhangzhen Jiang as the inventor. *See* (the '433 patent).

52. The '433 patent is valid and enforceable. *See generally* (the '433 patent).

53. The ’433 patent is directed to patentable subject matter. *See generally* (the ’433 patent); (the G.709 Standard).

54. Huawei owns all rights, title, and interest in the ’433 patent, and holds all substantial rights pertinent to this suit, including the right to sue and recover for all past, current, and future infringement.

55. Verizon has and continues to directly infringe and/or indirectly infringe by inducement and/or contributory infringement, literally and/or under the doctrine of equivalents, the ’433 patent under 35 U.S.C. § 271.

56. Verizon directly infringes the ’433 patent because it has made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States.

57. The Accused G.709 Instrumentalities comply with the G.709 Standard.

58. The ’433 patent is required to implement the G.709 Standard.

59. The Accused G.709 Instrumentalities infringe one or more claims of the ’433 patent, including, for example, claim 1 of the ’433 patent.

60. Claim 1 of the ’433 patent recites:

> 1. A sending method for adapting a payload bandwidth for data transmission, comprising:
>
> > acquiring N 66B coding blocks each of which contains 64B, wherein the N 66B coding blocks are obtained through a 64B/66B encoding scheme, N is an integer and $5 \leqq N \leqq 8$;
> >
> > encoding the acquired N 66B coding blocks into a (64*N+1)B coding block; and
> >
> > sending the (64*N+1)B coding block obtained by encoding;
> >
> > wherein encoding the acquired N 66B coding blocks into the (64*N+1)B coding block comprises:

decoding the N 66B coding blocks to obtain data blocks containing data only and different types of control blocks each of which contains at least one control characters;

placing the control blocks into a control block buffer as a control block group, setting a first identifier to identify the control block group, setting a second identifier to identify a last control block in the control block group, and placing the data blocks, as a data block group, into a data block buffer;

setting a third identifier by using four bits of each control block to identify a block type of each of the control blocks; and

setting a fourth identifier by using a space smaller than or equal to three bits of each control block to identify positions of each of the control blocks in the N 66B coding blocks.

61. To the extent the preamble is considered a limitation, the Accused G.709 Instrumentalities meet the preamble of claim 1 of the '433 patent that recites "A sending method for adapting a payload bandwidth for data transmission, comprising." *See, e.g.*,:

17.7.4.1 40GBASE-R multi-lane processing and transcoding
The 40GBASE-R client signal (64B/66B encoded, nominal aggregate bit-rate of 41 250 000 kbit/s, ±100 ppm) is recovered using the process described in Annex E for parallel 64B/66B interfaces. The lane(s) of the physical interface are bit-disinterleaved, if necessary, into four streams of 10 312 500 kbit/s. 66B block lock and lane alignment marker lock are acquired on each PCS lane, allowing the 66B blocks to be de-skewed and reordered.

The resulting sequence is descrambled and transcoded according to the process described in Annex B into 513B code blocks. Each pair of two 513B code blocks is combined according to the process described in Annex F into a 1027B block, resulting in a bit stream of 1027/1024×40 000 000 kbit/s±100 ppm (40,117,187.500 kbit/s±100 ppm). This process is referred to as "timing transparent transcoding (TTT)", mapping a bit stream which is 1027/1056 times the bit-rate of the aggregate Ethernet signal.

(G.709 Standard) at section 17.7.

17.8.2 Mapping an FC-1200 signal into OPU2e
The nominal line rate for FC-1200 is 10 518 750 kbit/s ± 100 ppm, and must therefore be compressed to a suitable rate to fit into an OPU2e.

> The adaptation of the 64B/66B encoded FC-1200 client is done by transcoding a group of eight 66B blocks into one 513B block (as described in Annex B), assembling eight 513B blocks into one 516-octet superblock and encapsulating seventeen 516-octet superblocks into an 8800 octet GFP frame as illustrated in Figure 17-17. The GFP frame consists of 2200 rows with 32 bits per row. The first row contains the GFP core header, the second row the GFP payload header.

(G.709 Standard) at section 17.8.

> **Annex B**
>
> **Adapting 64B/66B encoded clients via transcoding into 513B code blocks**
>
> (This annex forms an integral part of this Recommendation.)

(G.709 Standard) at Annex B.

62. The Accused G.709 Instrumentalities meet the first element of claim 1 of the ’433 patent that recites “acquiring N 66B coding blocks each of which contains 64B, wherein the N 66B coding blocks are obtained through a 64B/66B encoding scheme, N is an integer and 5≦N≦8.” *See, e.g.*,:

> **B.3 Transcoding from 66B blocks to 513B blocks**
>
> The transcoding process at the encoder operates on an input sequence of 66B code blocks.
>
> 66B control blocks (after descrambling) follow the format shown in Figure B.2.
>
> A group of eight 66B blocks is encoded into a single 513B block. The format is illustrated in Figure B.3.

Input Data	SYNC		Block Payload									
Bit Position / Data Block Format	0	1	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65									
D0D1D2D3D4D5D6D7	0	1	D0	D1	D2	D3	D4	D5	D6	D7		
Control block formats			Block type field									4-bit code
C0C1C2C3C4C5C6C7	1	0	0x1e	C0	C1	C2	C3	C4	C5	C6	C7	0001
C0C1C2C3O4D5D6D7	1	0	0x2d	C0	C1	C2	C3	O4	D5	D6	D7	0010
C0C1C2C3S4D5D6D7	1	0	0x33	C0	C1	C2	C3		D5	D6	D7	0111
O0D1D2D3S4D5D6D7	1	0	0x66	D1	D2	D3	O0		D5	D6	D7	1011
O0D1D2D3O4D5D6D7	1	0	0x55	D1	D2	D3	O0	O4	D5	D6	D7	1101
S0D1D2D3D4D5D6D7	1	0	0x78	D1	D2	D3	D4	D5	D6	D7		1110
O0D1D2D3C4C5C6C7	1	0	0x4b	D1	D2	D3	O0	C4	C5	C6	C7	1000
T0C1C2C3C4C5C6C7	1	0	0x87		C1	C2	C3	C4	C5	C6	C7	0011
D0T1C2C3C4C5C6C7	1	0	0x99	D0		C2	C3	C4	C5	C6	C7	0101
D0D1T2C3C4C5C6C7	1	0	0xaa	D0	D1		C3	C4	C5	C6	C7	1001
D0D1D2T3C4C5C6C7	1	0	0xb4	D0	D1	D2		C4	C5	C6	C7	1010
D0D1D2D3T4C5C6C7	1	0	0xcc	D0	D1	D2	D3		C5	C6	C7	1100
D0D1D2D3D4T5C6C7	1	0	0xd2	D0	D1	D2	D3	D4		C6	C7	0110
D0D1D2D3D4D5T6C7	1	0	0xe1	D0	D1	D2	D3	D4	D5		C7	0000
D0D1D2D3D4D5D6T7	1	0	0xff	D0	D1	D2	D3	D4	D5	D6		1111

Figure B.2 – 66B Block coding

(G.709 Standard) Annex B.

> **17.7.4.1 40GBASE-R multi-lane processing and transcoding**
> The 40GBASE-R client signal (64B/66B encoded, nominal aggregate bit-rate of 41 250 000 kbit/s, ± 100 ppm) is recovered using the process described in Annex E for parallel 64B/66B interfaces. The lane(s) of the physical interface are bit-disinterleaved, if necessary, into four streams of 10 312 500 kbit/s. 66B block lock and lane alignment marker lock are acquired on each PCS lane, allowing the 66B blocks to be de-skewed and reordered.

(G.709 Standard) section 17.7.

> **17.8.2 Mapping an FC-1200 signal into OPU2e**
> The nominal line rate for FC-1200 is 10 518 750 kbit/s ± 100 ppm, and must therefore be compressed to a suitable rate to fit into an OPU2e.
>
> The adaptation of the 64B/66B encoded FC-1200 client is done by transcoding a group of eight 66B blocks into one 513B block (as described in Annex B), assembling eight 513B blocks into one 516-octet superblock and encapsulating seventeen 516-octet superblocks into an 8800 octet GFP frame as illustrated in Figure 17-17. The GFP frame consists of 2200 rows with 32 bits per row. The first row contains the GFP core header, the second row the GFP payload header.

(G.709 Standard) at section 17.8.

63. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’433 patent that recites “encoding the acquired N 66B coding blocks into a

(64*N+1)B coding block; and sending the (64*N+1)B coding block obtained by encoding; wherein encoding the acquired N 66B coding blocks into the (64*N+1)B coding block comprises." *See, e.g.,*:

B.3 Transcoding from 66B blocks to 513B blocks
The transcoding process at the encoder operates on an input sequence of 66B code blocks.

66B control blocks (after descrambling) follow the format shown in Figure B.2.
A group of eight 66B blocks is encoded into a single 513B block. The format is illustrated in Figure B.3.

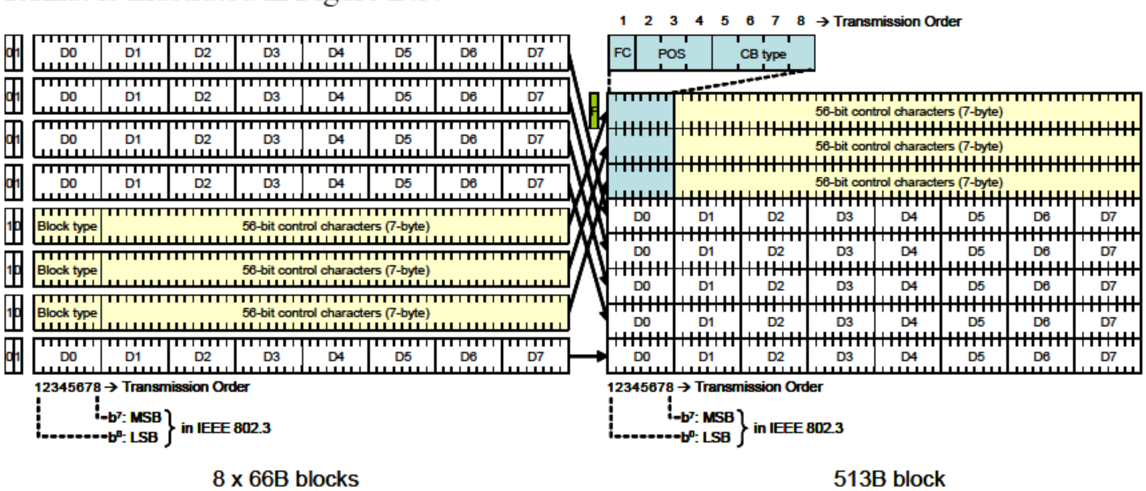

Figure B.3 – 513B block code format

(G.709 Standard) Annex B.

Table 17-10 –m, n and C_{nD} for CBR clients into OPU3

Client signal	Nominal bit rate (kbit/s)	Bit rate tolerance (ppm)	m	n	C_{nD}
Transcoded 40GBASE-R (see clause 17.7.4.1)	1027/1024 × 64/66 × 41250 000	±100	256	8	Yes

(G.709 Standard) at section 17.

17.8.2 Mapping an FC-1200 signal into OPU2e
The nominal line rate for FC-1200 is 10 518 750 kbit/s ± 100 ppm, and must therefore be compressed to a suitable rate to fit into an OPU2e.

(G.709 Standard) at section 17.8.

> **11 Optical transport unit (OTU)**
> The OTUk[V] conditions the ODUk for transport over an OCh network connection. The OTUk frame structure, including the OTUk FEC is completely standardized.

(G.709 Standard) at section 11.

64. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '433 patent that recites "decoding the N 66B coding blocks to obtain data blocks containing data only and different types of control blocks each of which contains at least one control characters." *See, e.g.,*:

> **B.3 Transcoding from 66B blocks to 513B blocks**
> The transcoding process at the encoder operates on an input sequence of 66B code blocks.
>
> 66B control blocks (after descrambling) follow the format shown in Figure B.2. A group of eight 66B blocks is encoded into a single 513B block. The format is illustrated in Figure B.3.

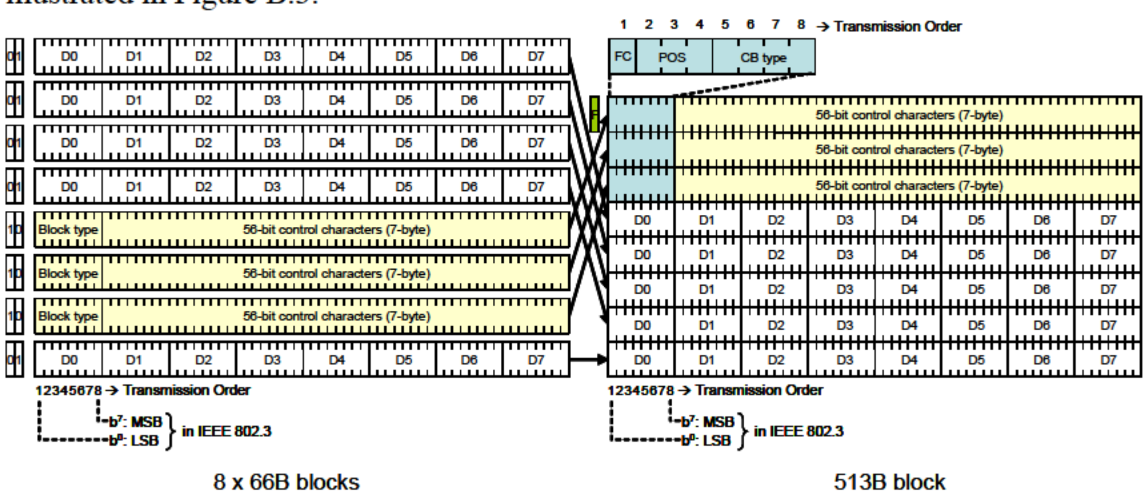

Figure B.3 – 513B block code format

Input Data	SYNC		Block Payload									
Bit Position / Data Block Format	0	1	2–65									
D0D1D2D3D4D5D6D7	0	1	D0	D1	D2	D3	D4	D5	D6	D7		
Control block formats			Block type field									4-bit code
C0C1C2C3C4C5C6C7	1	0	0x1e	C0	C1	C2	C3	C4	C5	C6	C7	0001
C0C1C2C3O4D5D6D7	1	0	0x2d	C0	C1	C2	C3	O4	D5	D6	D7	0010
C0C1C2C3S4D5D6D7	1	0	0x33	C0	C1	C2	C3		D5	D6	D7	0111
O0D1D2D3S4D5D6D7	1	0	0x66	D1	D2	D3	O0		D5	D6	D7	1011
O0D1D2D3O4D5D6D7	1	0	0x55	D1	D2	D3	O0	O4	D5	D6	D7	1101
S0D1D2D3D4D5D6D7	1	0	0x78	D1	D2	D3	D4	D5	D6	D7		1110
O0D1D2D3C4C5C6C7	1	0	0x4b	D1	D2	D3	O0	C4	C5	C6	C7	1000
T0C1C2C3C4C5C6C7	1	0	0x87		C1	C2	C3	C4	C5	C6	C7	0011
D0T1C2C3C4C5C6C7	1	0	0x99	D0		C2	C3	C4	C5	C6	C7	0101
D0D1T2C3C4C5C6C7	1	0	0xaa	D0	D1		C3	C4	C5	C6	C7	1001
D0D1D2T3C4C5C6C7	1	0	0xb4	D0	D1	D2		C4	C5	C6	C7	1010
D0D1D2D3T4C5C6C7	1	0	0xcc	D0	D1	D2	D3		C5	C6	C7	1100
D0D1D2D3D4T5C6C7	1	0	0xd2	D0	D1	D2	D3	D4		C6	C7	0110
D0D1D2D3D4D5T6C7	1	0	0xe1	D0	D1	D2	D3	D4	D5		C7	0000
D0D1D2D3D4D5D6T7	1	0	0xff	D0	D1	D2	D3	D4	D5	D6		1111

Figure B.2 – 66B Block coding

(G.709 Standard) Annex B.

65. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’433 patent that recites “placing the control blocks into a control block buffer as a control block group, setting a first identifier to identify the control block group.” *See, e.g.*,:

B.3 Transcoding from 66B blocks to 513B blocks

The transcoding process at the encoder operates on an input sequence of 66B code blocks.

66B control blocks (after descrambling) follow the format shown in Figure B.2. A group of eight 66B blocks is encoded into a single 513B block. The format is illustrated in Figure B.3:

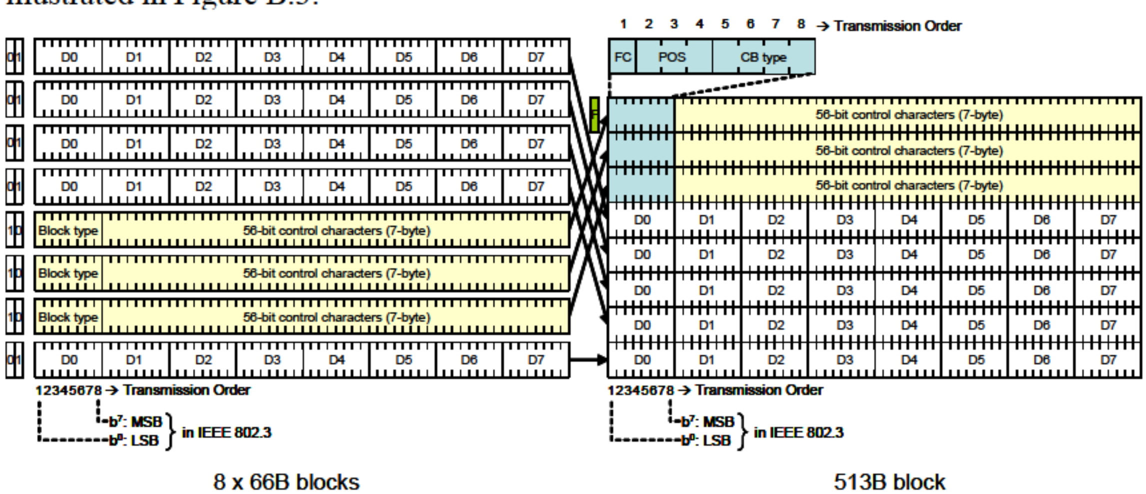

Figure B.3 – 513B block code format

Each of the 66B blocks is encoded into a row of the 8-byte by 8-row structure. Any 66B control blocks (CBi) are placed into the uppermost rows of the structure in the order received, while any all-data 66B blocks (DBi) are placed into the lowermost rows of the structure in the order received.

The flag bit "F" is 1 if the 513B structure contains at least one 66B control block, and 0 if the 513B structure contains eight all-data 66B blocks. Because the 66B control blocks are placed into the uppermost rows of the 513B block, if the flag bit "F" is 1, then the first row will contain a mapping of a 66B control block.

(G.709 Standard) Annex B.

66. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’433 patent that recites “setting a second identifier to identify a last control block in the control block group, and placing the data blocks, as a data block group, into a data block buffer; setting a third identifier by using four bits of each control block to identify a block type of each of the control blocks; and setting a fourth identifier by using a space smaller than or equal to three bits of each control block to identify positions of each of the control blocks in the N 66B coding blocks.” *See, e.g.*,:

B.3 Transcoding from 66B blocks to 513B blocks

A 66B control block is encoded into a row of the structure shown in Figure B.3 as follows: The sync header of "10" is removed. The byte representing the block type field (see Figure B.2) is replaced by the structure shown in Figure B.4:

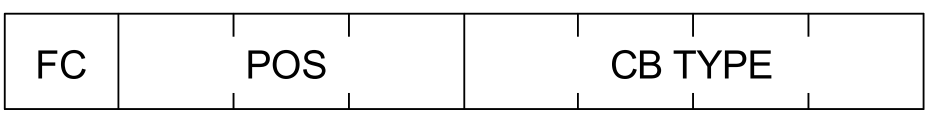

Figure B.4 – 513B block’s control block header

The byte indicating the control block type (one of 15 legal values) is translated into a 4-bit code according to the rightmost column of Figure B.2. The 3-bit POS field is used to encode the position in which this control block was received in the sequence of eight 66B blocks. The flag continuation bit "FC" will be set to a 0 if this is the final 66B control block or PCS lane alignment marker encoded in this 513B block, or to a 1 if one or more 66B control blocks or PCS lane alignment markers follow this one.

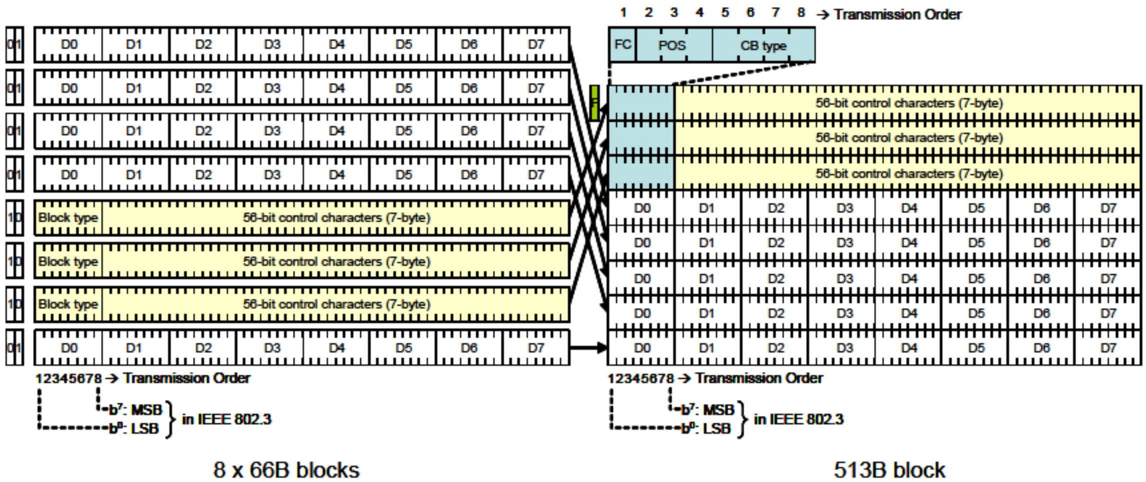

Figure B.3 – 513B block code format

> Each of the 66B blocks is encoded into a row of the 8-byte by 8-row structure. Any 66B control blocks (CBi) are placed into the uppermost rows of the structure in the order received, while any all-data 66B blocks (DBi) are placed into the lowermost rows of the structure in the order received.

(G.709 Standard) Annex B.

67. Verizon indirectly infringes the ’433 patent because it has induced third parties, including the downstream parties, to make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

68. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’433 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities.

69. Verizon induced these third parties’ direct infringement by advertising, encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities for or on behalf of such third parties, including the downstream

parties.

70. Verizon took the above actions intending to cause infringing acts by these third parties.

71. Verizon has been on notice of the ’433 patent since at least March 2019, and in any event, by no later than the filing and/or service of this Complaint.

72. If Verizon did not know that the actions it encouraged constituted infringement of the ’433 patent, Verizon nevertheless subjectively believed there was a high probability that others would infringe the ’433 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

73. Verizon indirectly infringes the ’433 patent because it has contributed to the infringement by third parties, including the downstream parties, who were able, with Verizon’s contributions, make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

74. Verizon contributed to these third parties’ direct infringement by providing access to the use of the Accused G.709 Instrumentalities, including via hardware or software components for using, operating, and/or interacting with the Accused G.709 Instrumentalities. The software components include, for example, portals or dashboards for configuring a network making use of the Accused G.709 Instrumentalities, or applications to operate the Accused G.709 Instrumentalities. The hardware components include, for example, networking devices or appliances.

75. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’433 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for

example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities via the software components.

76. Verizon took the above actions knowing that these software components were especially made or adapted for use in the infringing Accused G.709 Instrumentalities. Verizon knew that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

77. Alternatively, Verizon subjectively believed there was a high probability that these components were especially made or especially adapted for use in infringing the ’433 patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

78. Huawei has been damaged and continues to be damaged by Verizon’s infringement of the ’433 patent.

COUNT TWO: INFRINGEMENT OF THE ’151 PATENT

79. Huawei incorporates by reference the preceding paragraphs as if fully set forth herein.

80. U.S. Patent No. 9,014,151 (“the ’151 patent”), entitled “Method and Apparatus for Transmitting Low-Rate Traffic Signal in Optical Transport Network,” was issued on April 21, 2015, naming Shimin Zou as inventor. *See* (the ’151 patent).

81. The ’151 patent is valid and enforceable. *See generally* (the ’151 patent).

82. The ’151 patent is directed to patentable subject matter. *See generally* (the ’151 patent); (the G.709 Standard).

83. Huawei owns all rights, title, and interest in the ’151 patent, and holds all

substantial rights pertinent to this suit, including the right to sue and recover for all past, current, and future infringement.

84. Verizon has and continues to directly infringe and/or indirectly infringe by inducement and/or contributory infringement, literally and/or under the doctrine of equivalents, the '151 patent under 35 U.S.C. § 271.

85. Verizon directly infringes the '151 patent because it has made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States.

86. The Accused G.709 Instrumentalities comply with the G.709 Standard.

87. The '151 patent is required to implement the G.709 Standard.

88. The Accused G.709 Instrumentalities infringe one or more claims of the '151 patent, including, for example, claim 1 of the '151 patent.

89. Claim 1 of the '151 patent recites:

> 1. A method for transmitting a low-rate traffic signal in an Optical Transport Network (OTN), comprising:
>
> > mapping a single low-rate traffic signal, for transmission on the OTN, to a single low-rate traffic Optical channel Payload Unit (OPU), wherein the single low-rate traffic OPU includes a payload that has a size of 4×3,808 bytes and a bit rate of 1,238,954.31 Kbps±20 ppm, the single low-rate traffic signal is a Gigabit Ethernet (GE) signal or a Fiber Connection (FC) signal with a rate of 1.06 Gbit/s, and the mapping the single low-rate traffic signal to the single low-rate traffic OPU is performed using a General Framing Procedure (GFP) or other adaptation protocols;
> >
> > generating one or more overhead bytes for end to end managing the single low-rate traffic signal and filling the overhead bytes in an overhead section of a low-rate traffic Optical Channel Data Unit (ODU), wherein the low-rate traffic ODU contains the single low-rate traffic OPU and the overhead section of the low-rate traffic ODU, and the low-rate traffic ODU has a size of 4×3,824 bytes with a bit rate of 1,244,160 Kbps ±20 ppm;

multiplexing at least the one low-rate traffic ODU to an ODUk with a rate rank of the OTN; and

transmitting the ODUk via the OTN.

90. To the extent the preamble is considered a limitation, the Accused G.709 Instrumentalities meet the preamble of claim 1 of the '151 patent that recites "A method for transmitting a low-rate traffic signal in an Optical Transport Network (OTN), comprising." *See, e.g.*,:

Interfaces for the optical transport network
(G.709 Standard) at cover page.

17.7.1 Mapping a sub-1.238 Gbit/s CBR client signal into OPU0
…

Table 17-4 – m, n and C_{nD} for sub-1.238G clients into OPU0

Client signal	Nominal bit rate (kbit/s)	Bit rate tolerance (ppm)	m	n	C_{nD}
Transcoded 1000BASE-X (see clause 17.7.1.1)	15/16 × 1 250 000	±100	8	8	No
STM-1	155 520	±20	8	1	Yes
STM-4	622 080	±20	8	1	Yes
FC-100	1 062 500	±100	8	8	No
SBCON/ESCON	200 000	±200	8	8	No
DVB-ASI	270 000	±100	8	8	No
SDI	270 000	±2.8	8	TBD	TBD

(G.709 Standard) at section 17.7.

91. The Accused G.709 Instrumentalities meet the first element of claim 1 of the '151 patent that recites "mapping a single low-rate traffic signal, for transmission on the OTN, to a single low-rate traffic Optical channel Payload Unit (OPU)." *See, e.g.*,:

17.7.1 Mapping a sub-1.238 Gbit/s CBR client signal into OPU0

…

Table 17-4 – m, n and C_{nD} for sub-1.238G clients into OPU0

Client signal	Nominal bit rate (kbit/s)	Bit rate tolerance (ppm)	m	n	C_{nD}
Transcoded 1000BASE-X (see clause 17.7.1.1)	15/16 × 1 250 000	±100	8	8	No
STM-1	155 520	±20	8	1	Yes
STM-4	622 080	±20	8	1	Yes
FC-100	1 062 500	±100	8	8	No
SBCON/ESCON	200 000	±200	8	8	No
DVB-ASI	270 000	±100	8	8	No
SDI	270 000	±2.8	8	TBD	TBD

(G.709 Standard) at section 17.7.

92. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '151 patent that recites "wherein the single low-rate traffic OPU includes a payload that has a size of 4×3,808 bytes and a bit rate of 1,238,954.31 Kbps±20 ppm." *See, e.g.,*:

17.7.1 Mapping a sub-1.238 Gbit/s CBR client signal into OPU0

The OPU0 payload for this mapping consists of 4 × 3808 bytes. The bytes in the OPU0 payload area are numbered from 1 to 15232. The OPU0 payload byte numbering for GMP 1-byte (8-bit) blocks is illustrated in Figure 17-11. In row 1 of the OPU0 frame the first byte will be labelled 1, the next byte will be labelled 2, etc.

(G.709 Standard) at section 17.7.

Table 7-3 – OPU types and bit rates

OPU type	OPU payload nominal bit rate	OPU payload bit-rate tolerance
OPU0	238/239 × 1 244 160 kbit/s	±20 ppm
OPU1	2 488 320 kbit/s	
OPU2	238/237 × 9 953 280 kbit/s	
OPU3	238/236 × 39 813 120 kbit/s	

Table 7-3 – OPU types and bit rates

OPU type	OPU payload nominal bit rate	OPU payload bit-rate tolerance
OPU4	238/227 × 99 532 800 kbit/s	
OPUCn	n × 238/226 × 99 532 800 kbit/s	
OPU2e	238/237 × 10 312 500 kbit/s	±100 ppm
OPUflex for CBR client signals	client signal bit rate	client signal bit-rate tolerance, with a maximum of ±100 ppm
OPUflex for GFP-F mapped client signals	238/239 × ODUflex signal rate	±100 ppm
OPUflex for IMP mapped client signals	s × 5 156 250 kbit/s s = 2, 8, n × 5 with n ≥ 1 (Note 2)	±100 ppm
OPUflex for FlexE-aware client signals	103 125 000 × 240/239 × n/20 kbit/s ($n = n_1 + n_2 + .. + n_p$)	± 100 ppm
NOTE 1 – The nominal OPU payload rates are approximately: 1 238 954.310 kbit/s (OPU0 Payload), 2 488 320.000 kbit/s (OPU1 Payload), 9 995 276.962 kbit/s (OPU2 Payload), 40 150 519.322 kbit/s (OPU3 Payload), 104 355 975.330 (OPU4 Payload), 10 356 012.658 kbit/s (OPU2e Payload), n × 104 817 727.434 kbit/s (OPUCn Payload). NOTE 2 – Refer to 12.2.6 for considerations on the values of "s".		

(G.709 Standard) at section 7.3.

93. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “the single low-rate traffic signal is a Gigabit Ethernet (GE) signal or a Fiber Connection (FC) signal with a rate of 1.06 Gbit/s.” *See, e.g.*,:

17.7.1 Mapping a sub-1.238 Gbit/s CBR client signal into OPU0

…

Table 17-4 – m, n and C_{nD} for sub-1.238G clients into OPU0

Client signal	Nominal bit rate (kbit/s)	Bit rate tolerance (ppm)	m	n	C_{nD}
Transcoded 1000BASE-X (see clause 17.7.1.1)	15/16 × 1 250 000	±100	8	8	No
STM-1	155 520	±20	8	1	Yes
STM-4	622 080	±20	8	1	Yes

Client signal	Nominal bit rate (kbit/s)	Bit rate tolerance (ppm)	m	n	C_{nD}
FC-100	1 062 500	±100	8	8	No
SBCON/ESCON	200 000	±200	8	8	No
DVB-ASI	270 000	±100	8	8	No
SDI	270 000	±2.8	8	TBD	TBD

(G.709 Standard) at section 17.7.

94. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “and the mapping the single low-rate traffic signal to the single low-rate traffic OPU is performed using a General Framing Procedure (GFP) or other adaptation protocols.” *See, e.g.*:

17.7.1.1 1000BASE-X transcoding

The 1000BASE-X signal (8B/10B coded, nominal bit rate of 1 250 000 kbit/s and a bit-rate tolerance up to ±100 ppm) is synchronously mapped into a 75-octet GFP-T frame stream with a bit rate of 15/16 × 1 250 000 kbit/s ±100 ppm (approximately 1 171 875 kbit/s ±100 ppm). This process is referred to as "timing transparent transcoding (TTT)".
The 15/16 × 1 250 000 kbit/s ±100 ppm signal is then mapped into an OPU0 by means of the generic mapping procedure as specified in clause 17.7.1 and Annex D.
For 1000BASE-X client mapping, 1-bit timing information (C_1) is not needed, so OPU0 JC4/JC5/JC6 OH value will be fixed to all-0s.
The mapping of the 1000BASE-X signal into GFP-T is performed as specified in [ITU-T G.7041] with the following parameters:

– Each GFP-T frame contains one superblock
– The 65B_PAD character is not used
– GFP idle frames are not used
– The GFP frame pFCS is not used.

(G.709 Standard) at section 17.7.

95. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “generating one or more overhead bytes for end to end managing the single low-rate traffic signal and filling the overhead bytes in an overhead

section of a low-rate traffic Optical Channel Data Unit (ODU)." *See, e.g.*,:

12.1 ODU frame structure

The ODU frame structure is shown in Figure 12-1. It is organized in an octet-based block frame structure with four rows and 3824 columns.
The ODUk (k=0,1,2,2e,3,4,flex) frame structure contains one instance of the ODU frame structure. The ODUCn frame structure contains n frame and multi-frame synchronous instances of the ODU frame structures, numbered 1 to n (ODU #1 to ODU #n).

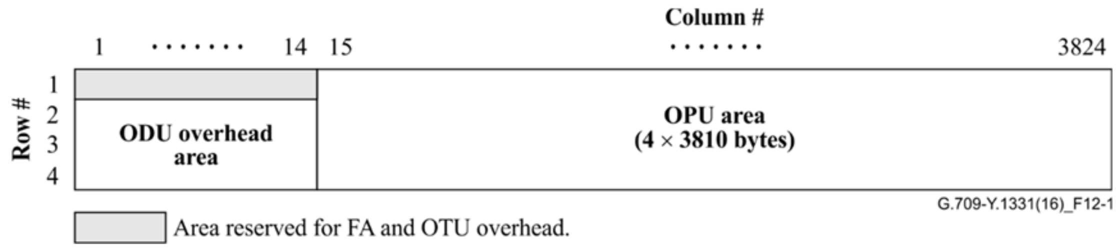

Figure 12-1 – ODU frame structure

The two main areas of the ODU frame are:

– ODU overhead area

– OPU area.

Columns 1 to 14 of the ODU are dedicated to ODU overhead area.

NOTE – Columns 1 to 14 of row 1 are reserved for a frame alignment and OTU specific overhead.
Columns 15 to 3824 of the ODU are dedicated to OPU area.

(G.709 Standard) at section 12.1.

15.1.2 Optical data unit overhead (ODU OH)

ODU OH information is added to the ODU information payload to create an ODU. It includes information for maintenance and operational functions to support ODU connections. The ODU OH consists of portions dedicated to the end-to-end ODU path and to six levels of tandem connection monitoring. The ODU path OH is terminated where the ODU is assembled and disassembled. The TC OH is added and terminated at the source and sink of the corresponding tandem connections, respectively. The specific OH format and coding is defined in clauses 15.6 and 15.8.

(G.709 Standard) at section 15.1.

96. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '151 patent that recites "wherein the low-rate traffic ODU contains the single low-rate traffic OPU and the overhead section of the low-rate traffic ODU." *See, e.g.*,:

12.1 ODU frame structure

The ODU frame structure is shown in Figure 12-1. It is organized in an octet-based block frame structure with four rows and 3824 columns.

The ODUk (k=0,1,2,2e,3,4,flex) frame structure contains one instance of the ODU frame structure. The ODUCn frame structure contains n frame and multi-frame synchronous instances of the ODU frame structures, numbered 1 to n (ODU #1 to ODU #n).

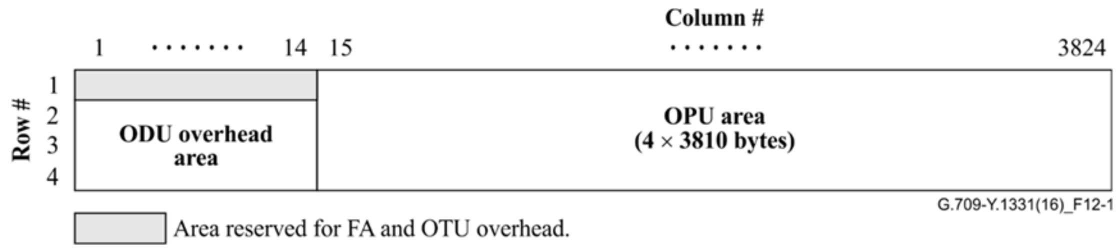

Figure 12-1 – ODU frame structure

The two main areas of the ODU frame are:

– ODU overhead area

– OPU area.

Columns 1 to 14 of the ODU are dedicated to ODU overhead area.

NOTE – Columns 1 to 14 of row 1 are reserved for a frame alignment and OTU specific overhead.

Columns 15 to 3824 of the ODU are dedicated to OPU area.

(G.709 Standard) at section 12.1.

97. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “and the low-rate traffic ODU has a size of 4×3,824 bytes with a bit rate of 1,244,160 Kbps ±20 ppm.” *See, e.g.*,:

12.1 ODU frame structure

The ODU frame structure is shown in Figure 12-1. It is organized in an octet-based block frame structure with four rows and 3824 columns.

The ODUk (k=0,1,2,2e,3,4,flex) frame structure contains one instance of the ODU frame structure. The ODUCn frame structure contains n frame and multi-frame synchronous instances of the ODU frame structures, numbered 1 to n (ODU #1 to ODU #n).

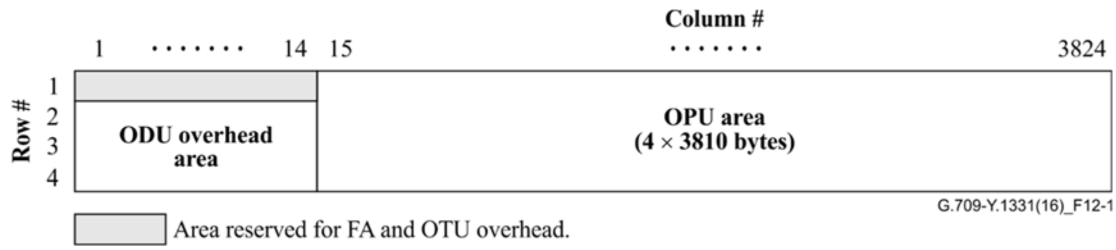

Figure 12-1 – ODU frame structure

The two main areas of the ODU frame are:

– ODU overhead area

– OPU area.

Columns 1 to 14 of the ODU are dedicated to ODU overhead area.

NOTE – Columns 1 to 14 of row 1 are reserved for a frame alignment and OTU specific overhead.

Columns 15 to 3824 of the ODU are dedicated to OPU area.

(G.709 Standard) at section 12.1.

Table 7-2 – ODU types and bit rates

ODU type	ODU nominal bit rate	ODU bit-rate tolerance
ODU0	1 244 160 kbit/s	±20 ppm
ODU1	239/238 × 2 488 320 kbit/s	
ODU2	239/237 × 9 953 280 kbit/s	
ODU3	239/236 × 39 813 120 kbit/s	
ODU4	239/227 × 99 532 800 kbit/s	
ODUCn	n × 239/226 × 99 532 800 kbit/s	
ODU2e	239/237 × 10 312 500 kbit/s	±100 ppm
ODUflex for CBR client signals	239/238 × client signal bit rate	±100 ppm (Notes 2, 3)

ODU type	ODU nominal bit rate	ODU bit-rate tolerance
ODUflex for GFP-F mapped client signals	Configured bit rate (see Table 7-8)	±100 ppm
ODUflex for IMP mapped client signals	s × 239/238 × 5 156 250 kbit/s s = 2, 8, n × 5 with n ≥ 1 (Note 4)	±100 ppm
ODUflex for FlexE-aware client signals	103 125 000 × 240/238 × n/20 kbit/s ($n = n_1 + n_2 + .. + n_p$)	± 100 ppm
NOTE 1 – The nominal ODU rates are approximately: 2 498 775.126 kbit/s (ODU1), 10 037 273.924 kbit/s (ODU2), 40 319 218.983 kbit/s (ODU3), 104 794 445.815 kbit/s (ODU4), 10 399 525.316 kbit/s (ODU2e), n × 105 258 138.053 kbit/s (ODUCn). NOTE 2 – The bit-rate tolerance for ODUflex(CBR) signals is specified as ±100 ppm. This value may be larger than the tolerance for the client signal itself (e.g., ±20 ppm). For such case, the tolerance is determined by the ODUflex(CBR) maintenance signals, which have a tolerance of ±100 ppm. NOTE 3 – For ODUflex(CBR) signals with nominal bit rates close to the maximum ODTUk.ts payload bit rate and client rate tolerances less than ±100 ppm (e.g., ±10 ppm), the ODUflex(CBR) maintenance signal bit rates may exceed the ODTUk.ts payload bit rate. For such cases either an additional tributary slot may be used (i.e., ODTUk.(ts+1)), or the nominal bit rate of the ODUflex(CBR) signal may be artificially reduced to a value of 100 ppm below the maximum ODUflex(CBR) signal bit rate. NOTE 4 – Refer to clause 12.2.6 for considerations on the values of "s".		

(G.709 Standard) at section 7.3.

98. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “multiplexing at least the one low-rate traffic ODU to an ODUk with a rate rank of the OTN.” *See, e.g.*,:

7.3 Bit rates and capacity

Table 7-1 – OTU types and bit rates

OTU type	OTU nominal bit rate	OTU bit-rate tolerance
OTU1	255/238 × 2 488 320 kbit/s	±20 ppm
OTU2	255/237 × 9 953 280 kbit/s	
OTU3	255/236 × 39 813 120 kbit/s	
OTU4	255/227 × 99 532 800 kbit/s	
OTUCn	n × 239/226 × 99 532 800 kbit/s	

NOTE 1 – The nominal OTU rates are approximately: 2 666 057.143 kbit/s (OTU1), 10 709 225.316 kbit/s (OTU2), 43 018 413.559 kbit/s (OTU3), 111 809 973.568 kbit/s (OTU4) and n × 105 258 138.053 kbit/s (OTUCn).

NOTE 2 – OTU0, OTU2e and OTUflex are not specified in this Recommendation. ODU0 signals are to be transported over ODU1, ODU2, ODU3, ODU4 or ODUCn signals, ODU2e signals are to be transported over ODU3, ODU4 and ODUCn signals and ODUflex signals are transported over ODU2, ODU3, ODU4 and ODUCn signals.

NOTE 3 – The OTUk (k=1,2,3,4) signal bit rates include the FEC overhead area. The OTUCn signal bit rates do not include a FEC overhead area.

(G.709 Standard) at section 7.3.

19 Mapping ODUj signals into the ODTU signal and the ODTU into the OPUk tributary slots

This clause specifies the multiplexing of:

– ODU0 into OPU1, ODU1 into OPU2, ODU1 and ODU2 into OPU3 using client/server specific asynchronous mapping procedures (AMP);

– other ODUj into OPUk using a client agnostic generic mapping procedure (GMP).

(G.709 Standard) at section 19.

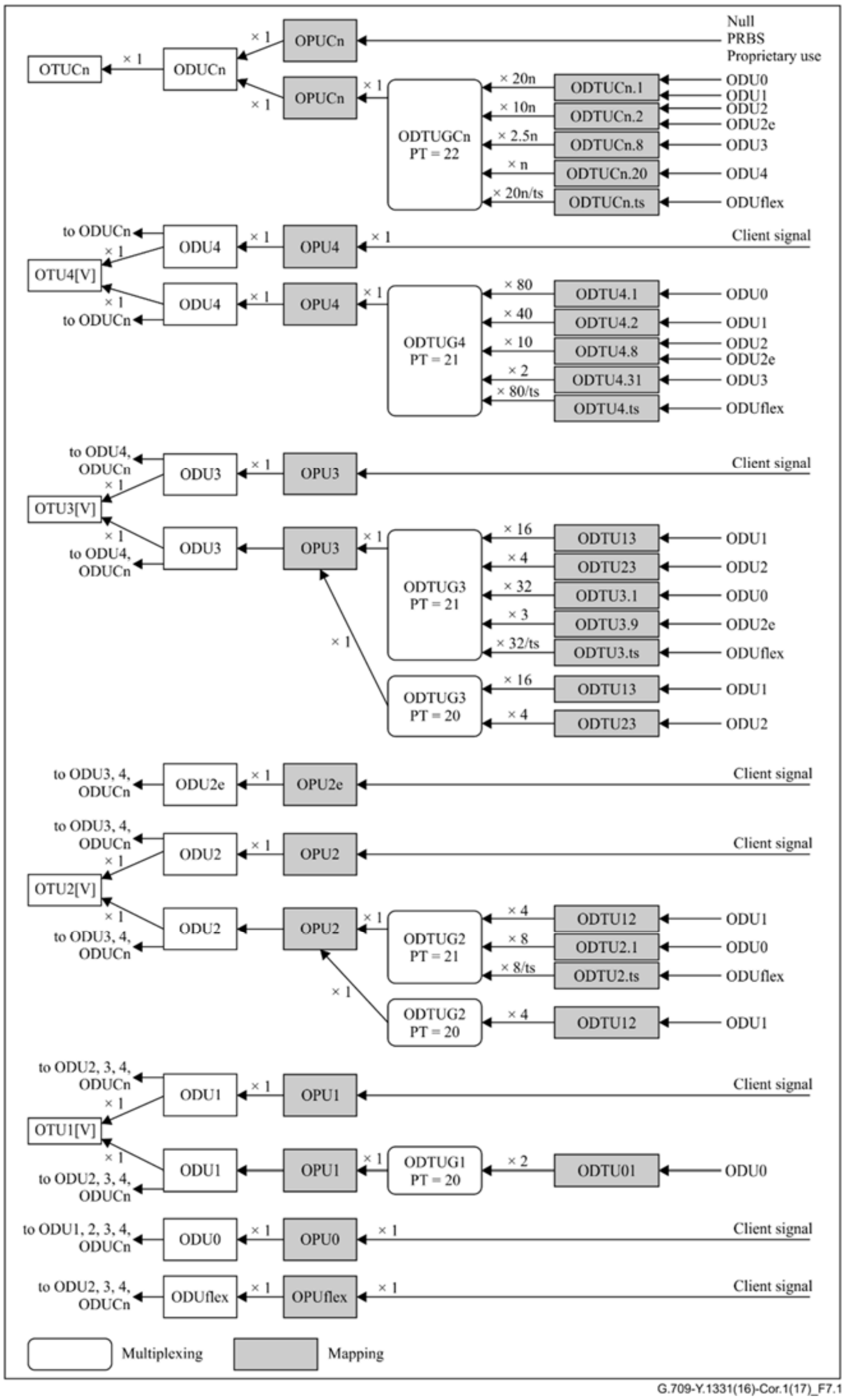

Figure 7-1 – OTN multiplexing and mapping structures

(G.709 Standard) at section 7.

99. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’151 patent that recites “and transmitting the ODUk via the OTN.” *See, e.g.*,:

6.1 Basic signal structure

The basic structure is shown in Figures 6-1 and 6-2 and consists of a digital and an optical structure.

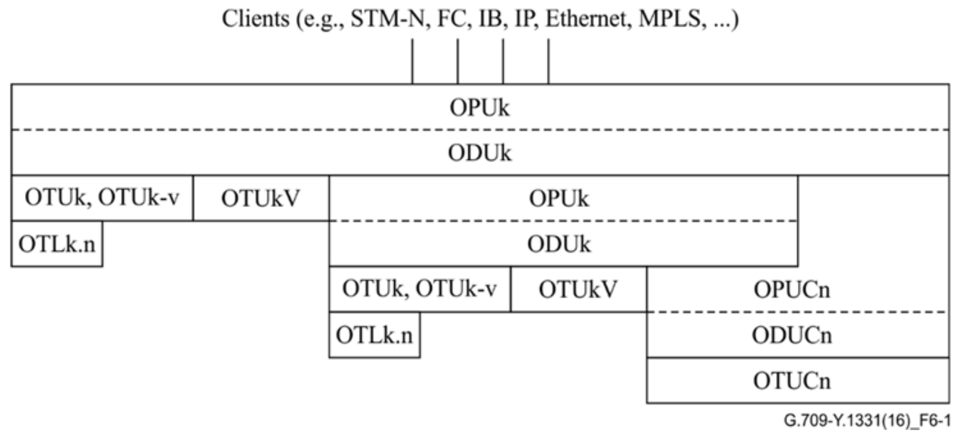

Figure 6-1 – Digital structure of the OTN interfaces

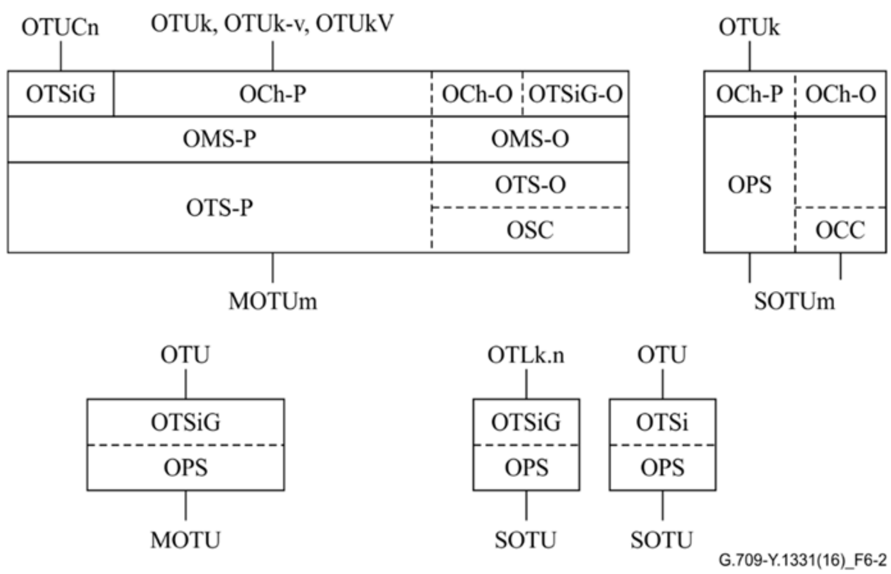

Figure 6-2 – Optical structure of the OTN interfaces

(G.709 Standard) at section 6.1.

100. Verizon indirectly infringes the ’151 patent because it has induced third parties, including the downstream parties, to make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

101. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’151 patent by having made, used, sold, offered to sell

and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities.

102. Verizon induced these third parties' direct infringement by advertising, encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities for or on behalf of such third parties, including the downstream parties.

103. Verizon took the above actions intending to cause infringing acts by these third parties.

104. Verizon has been on notice of the '151 patent since at least March 2019, and in any event, by no later than the filing and/or service of this Complaint.

105. If Verizon did not know that the actions it encouraged constituted infringement of the '151 patent, Verizon nevertheless subjectively believed there was a high probability that others would infringe the '151 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

106. Verizon indirectly infringes the '151 patent because it has contributed to the infringement by third parties, including the downstream parties, who were able, with Verizon's contributions, make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

107. Verizon contributed to these third parties' direct infringement by providing access to the use of the Accused G.709 Instrumentalities, including via software or hardware components for using, operating, and/or interacting with the Accused G.709 Instrumentalities. The software components include, for example, portals

or dashboards for configuring a network making use of the Accused G.709 Instrumentalities, or applications to operate the Accused G.709 Instrumentalities. The hardware components include, for example, networking devices or appliances.

108. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’151 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities via the software components.

109. Verizon took the above actions knowing that these software components were especially made or adapted for use in the infringing Accused G.709 Instrumentalities. Verizon knew that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

110. Alternatively, Verizon subjectively believed there was a high probability that these components were especially made or especially adapted for use in infringing the ’151 patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

111. Huawei has been damaged and continues to be damaged by Verizon’s infringement of the ’151 patent.

COUNT THREE: INFRINGEMENT OF THE ’236 PATENT

112. Huawei incorporates by reference the preceding paragraphs as if fully set forth herein.

113. U.S. Patent No. 8,406,236 (“the ’236 patent”), entitled “Method and

Apparatus for Transporting Client Signal in Optical Transport Network," was issued on March 26, 2013 naming Limin Dong and Qiuyou Wu as the inventors. *See* (the '236 patent).

114. The '236 patent is valid and enforceable. *See generally* (the '236 patent).

115. The '236 patent is directed to patentable subject matter. *See generally* (the '236 patent); (the G.709 Standard).

116. Huawei owns by assignment all rights, title, and interest in the '236 patent, and holds all substantial rights pertinent to this suit, including the right to sue and recover for all past, current, and future infringement.

117. Verizon has and continues to directly infringe and/or indirectly infringe by inducement and/or contributory infringement, literally and/or under the doctrine of equivalents, the '236 patent under 35 U.S.C. § 271.

118. Verizon directly infringes the '236 patent because it has made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States.

119. The Accused G.709 Instrumentalities comply with the G.709 Standard.

120. The '236 patent is required to implement the G.709 Standard.

121. The Accused G.709 Instrumentalities infringe one or more claims of the '236 patent, including, for example, claim 1 of the '236 patent.

122. Claim 1 of the '236 patent recites:

> 1. A method for transmitting a client signal in an optical transport network (OTN), comprising:
>
> acquiring the client signal;
>
> extracting a client signal clock from the client signal;
>
> generating a client signal byte number Cn transported in an OTN

> frame period according to a client signal clock and a system clock;
> if the Cn transported in the OTN frame needs to be increased, reversing, values of a first series of bit positions of a second area in an optical channel payload unit-k (OPUk) of the OTN frame, and filling values of a second series of bit positions of the second area in the OPUk with a Cn filled in a previous OTN frame;
> if the Cn transported in the OTN frame needs to be decreased, reversing, values of the second series of bit positions of the second area in the OPUk overhead field of the OTN frame, and filling values of the first series of bit positions of the second area in the OPUk with the Cn filled in the previous OTN frame.

123. To the extent the preamble is considered a limitation, the Accused G.709 Instrumentalities meet the preamble of claim 1 of the '236 patent that recites "A method for transmitting a client signal in an optical transport network (OTN), comprising." *See, e.g.*, (G.709 Standard) at cover page i.

124. The Accused G.709 Instrumentalities meet the first element of claim 1 of the '236 patent that recites "acquiring the client signal." *See, e.g.*,

(G.709 Standard) at cover page i (identifying formats for mapping client signals).

125. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '236 patent that recites "extracting a client signal clock from the client signal." *See, e.g.*, (G.709 Standard) Annex D, including:

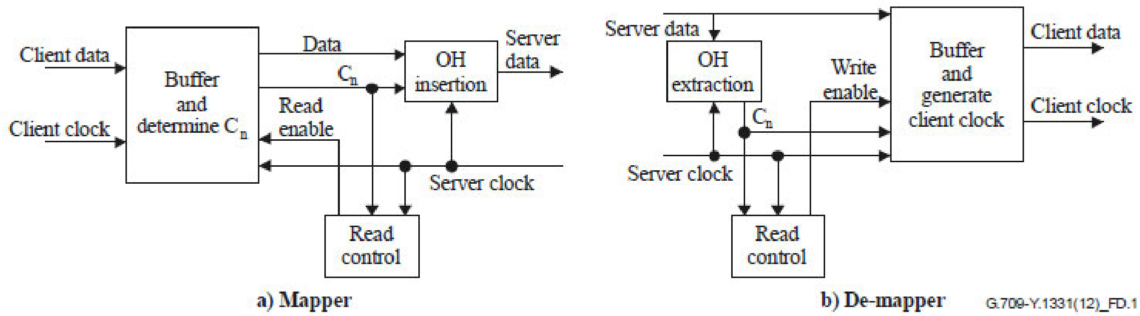

Figure D.1 – Generic functionality of a mapper/de-mapper circuit

126. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '236 patent that recites "generating a client signal byte number Cn transported in an OTN frame period according to a client signal clock and a system clock." *See, e.g.*, (G.709 Standard) Annex D:

D.1 Basic principle

For any given CBR client signal, the number of n-bit (e.g., n = 1/8, 1, 8) data entities that arrive during one server frame or server multiframe period is defined by:

$$c_n = \left(\frac{f_{client}}{n} \times T_{server}\right) \quad \text{(D-1)}$$

f_{client}: client bit rate

T_{server}: frame period of the server frame or server multiframe

c_n: number of client n-bit data entities per server frame or server multiframe

As only an integer number of n-bit data entities can be transported per server frame or multiframe, the integer value $C_n(t)$ of c_n has to be used. Since it is required that no client information is lost, the rounding process to the integer value has to take care of the truncated part, e.g., a c_n with a value of 10.25 has to be represented by the integer sequence 10,10,10,11.

$$C_n(t) = \text{int}\left(\frac{f_{client}}{n} \times T_{server}\right) \quad \text{(D-2)}$$

$C_n(t)$: number of client n-bit data entities per server frame t or server multiframe t (integer)

For the case c_n is not an integer, $C_n(t)$ will vary between:

$$C_n(t) = floor\left(\frac{f_{client}}{n} \times T_{server}\right) \quad \text{(D-3)}$$

and

$$C_n(t) = ceiling\left(\frac{f_{client}}{n} \times T_{server}\right) = 1 + floor\left(\frac{f_{client}}{n} \times T_{server}\right) \quad \text{(D-4)}$$

The server frame or multiframe rate is defined by the server bit rate and the number of bits per server frame or multiframe:

$$T_{server} = \frac{B_{server}}{f_{server}} \quad \text{(D-5)}$$

f_{server}: server bit rate

B_{server}: bits per server frame or multiframe

Combining (D-5) with (D-1) and (D-2) results in:

$$c_n = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{n}\right) \quad \text{(D-6)}$$

and

$$C_n(t) = \text{int}\left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{n}\right) \quad \text{(D-7)}$$

127. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '236 patent that recites "if the Cn transported in the OTN frame needs to be increased, reversing, values of a first series of bit positions of a second area in an optical channel payload unit-k (OPUk) of the OTN frame, and filling values of a second series of bit positions of the second area in the OPUk with a Cn filled in a previous OTN frame; if the Cn transported in the OTN frame needs to be decreased, reversing, values of the second series of bit positions of the second area in the OPUk overhead field of the OTN frame, and filling values of the first series of bit positions of the second area in the OPUk with the Cn filled in the previous OTN frame." *See, e.g.*, (G.709 Standard) Annex D:

D.2 Applying GMP in OTN

Clauses 17.7, 19.6 and 20.5 specify GMP as the asynchronous generic mapping method for the mapping of CBR client signals into OPUk, the mapping of ODUk signals into a server OPUk (via the ODTUk.ts) and the mapping of ODUk signals into an OPUCn (via ODTUCn.ts).

The insertion of CBR client data into the payload area of the OPUk frame and the insertion of ODUj data into the payload area of the ODTUk.ts multiframe at the mapper is performed in M-byte (or m-bit, m = 8 x M) data entities, denoted as $C_m(t)$. The remaining $C_{nD}(t)$ data entities are signalled in the justification overhead as additional timing/phase information.

$$c_m = \left(\frac{n \times c_n}{m}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{m}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{8 \times M}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}/8}{M}\right) \quad \text{(D-12)}$$

As only an integer number of m-bit data entities can be transported per server frame or multiframe, the integer value $C_m(t)$ of cm has to be used. Since it is required that no information is lost, the rounding process to the integer value has to take care of the truncated part, e.g., a c_m with a value of 10.25 has to be represented by the integer sequence 10,10,10,11.

$$C_m(t) = \text{int}(c_m) = \text{int}\left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}/8}{M}\right) \quad \text{(D-13)}$$

D.3 C_m(t) encoding and decoding

$C_m(t)$ is encoded in the ODTUk.ts justification control bytes JC1, JC2 and JC3 specified in clause 19.4 for the 14-bit count and clause 20.4 for the 10-bit count field. $C_m(t)$ is an L-bit binary count of the number of groups of m OPU payload bits that carry m client bits; it has values between Floor(C_m,min) and Ceiling(C_m,max), which are client specific. The Ci (i=1..L) bits that comprise $C_m(t)$ are used to indicate whether the $C_m(t)$ value is incremented or decremented from the value in the previous frame, that is indicated by $C_m(t-1)$. Tables D.2 and D.3 show the inversion patterns for the Ci bits of $C_m(t-1)$ that are inverted to indicate an increment or decrement of the $C_m(t)$ value. Table D.2 shows the inversion patterns for the 14-bit count and Table D.3 shows the inversion patterns for the 10-bit count. An "I" entry in the table indicates an inversion of that bit. The bit inversion patterns apply to the $C_m(t-1)$ value, prior to the increment or decrement operation that is signalled by the inversion pattern when $|C_m(t) – C_m(t-1)| \leq 2$ (except $C_m(t) – C_m(t-1) = 0$). The incremented or decremented $C_m(t)$ value becomes the base value for the next GMP overhead transmission.

– When $0 < C_m(t) – C_m(t-1) \leq 2$, indicating an increment of +1 or +2, a subset of the Ci bits containing $C_m(t-1)$ is inverted as specified in Table D.2 or Table D.3 and the increment indicator (II) bit is set to 1.
– When $0 > C_m(t) – C_m(t-1) \geq -2$, indicating a decrement of -1 or -2, a subset of Ci bits containing $C_m(t-1)$ is inverted as specified in Table D.2 or Table D.3 and the decrement indicator (DI) bit is set to 1.
– When the value of $C_m(t)$ is changed with a value larger than +2 or –2 from the value of $C_m(t-1)$, both the II and DI bits are set to 1 and the Ci bits contain the new $C_m(t)$ value. The associated CRC in JC3 verifies whether the $C_m(t)$ value has been received correctly.
– When the value of $C_m(t)$ is unchanged from the value of $C_m(t-1)$, both the II and DI bits are set to 0.

Table D.2 – 14-bit $C_m(t)$ increment and decrement indicator patterns

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	II	DI	Change
U	U	U	U	U	U	U	U	U	U	U	U	U	U	0	0	0
I	U	I	U	I	U	I	U	I	U	I	U	I	U	1	0	+1
U	I	U	I	U	I	U	I	U	I	U	I	U	I	0	1	–1
U	I	I	U	U	I	I	U	U	I	I	U	U	I	1	0	+2
I	U	U	I	I	U	U	I	I	U	U	I	I	U	0	1	–2
binary value														1	1	More than +2/–2

NOTE
– I indicates inverted Ci bit
– U indicates unchanged Ci bit

Table D.3 – 10-bit $C_m(t)$ increment and decrement indicator patterns

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	II	DI	Change
U	U	U	U	U	U	U	U	U	U	0	0	0
I	U	I	U	I	U	I	U	I	U	1	0	+1
I	U	U	I	U	I	I	U	U	I	0	1	–1
U	I	U	I	I	U	U	I	U	I	1	0	+2
U	I	I	U	U	I	U	I	I	U	0	1	–2
binary value										1	1	More than +2/–2
NOTE – I indicates inverted Ci bit – U indicates unchanged Ci bit												

128. As noted above $C_m(t)$ is encoded in accordance with section 19.4 and 20.4:

19.4 OPUk multiplex overhead and ODTU justification overhead

The OPUk (k=1,2,3,4) multiplex overhead consists of a multiplex structure identifier (MSI) and an ODTU overhead. The OPUk (k=4) multiplex overhead contains an OPU multiframe identifier (OMFI).

The OPUk MSI overhead locations are shown in Figures 19-14A, 19-14B and 19-14C and the OMFI overhead location is shown in Figure 19-14C.

ODTUk.ts overhead

The ODTUk.ts overhead carries the GMP justification overhead consisting of 3 bytes of justification control (JC1, JC2, JC3) which carry the 14-bit GMP C_m information and client/ODU specific 3 bytes of justification control (JC4, JC5, JC6) which carry the 10-bit GMP ΣC_{8D} information.

The JC1, JC2, JC3, JC4, JC5 and JC6 overhead locations are shown in Figure 19-14C.

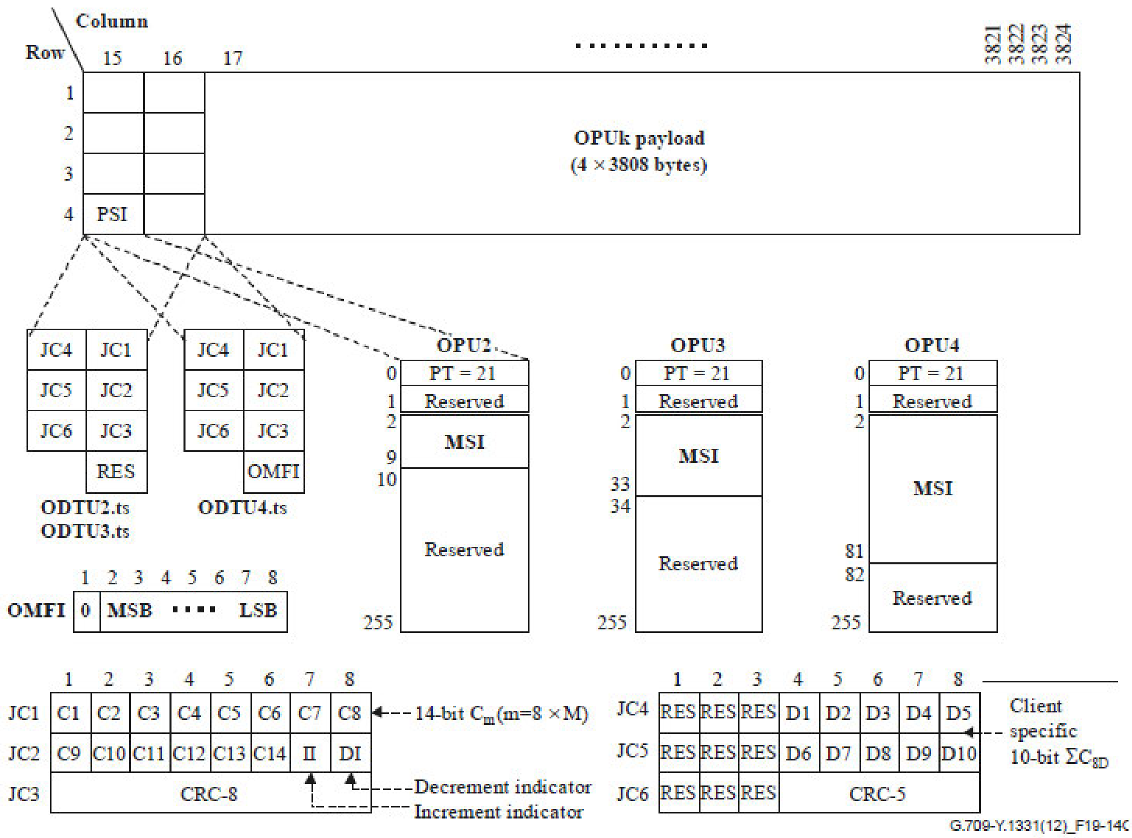

Figure 19-14C – OPUk (k=2,3,4) multiplex overhead associated with an ODTUk.ts (payload type = 21)

20.4 OPUCn multiplex overhead and ODTU justification overhead

The OPUCn multiplex overhead consists of a multiplex structure identifier (MSI), an OPU multiframe identifier (OMFI), an ODTU overhead and bytes reserved for future international standardization.

The OPUCn MSI, OMFI and RES overhead locations are shown in Figure 20-7.

ODTUCn.ts overhead

The ODTUCn.ts overhead carries the GMP justification overhead consisting of 18 bits of justification control (JC1[3-8], JC2[3-8], JC3[3-8]) which carry the 10-bit GMP C_m information and ODUk (k=0,1,2,2e,3,4,flex) specific 30 bits of justification control (JC1[1-2], JC2[1-2], JC3[1-2], JC4, JC5, JC6) which carry the 18-bit GMP ΣC_{8D} information.

The JC1, JC2, JC3, JC4, JC5 and JC6 overhead locations are shown in Figure 20-7.

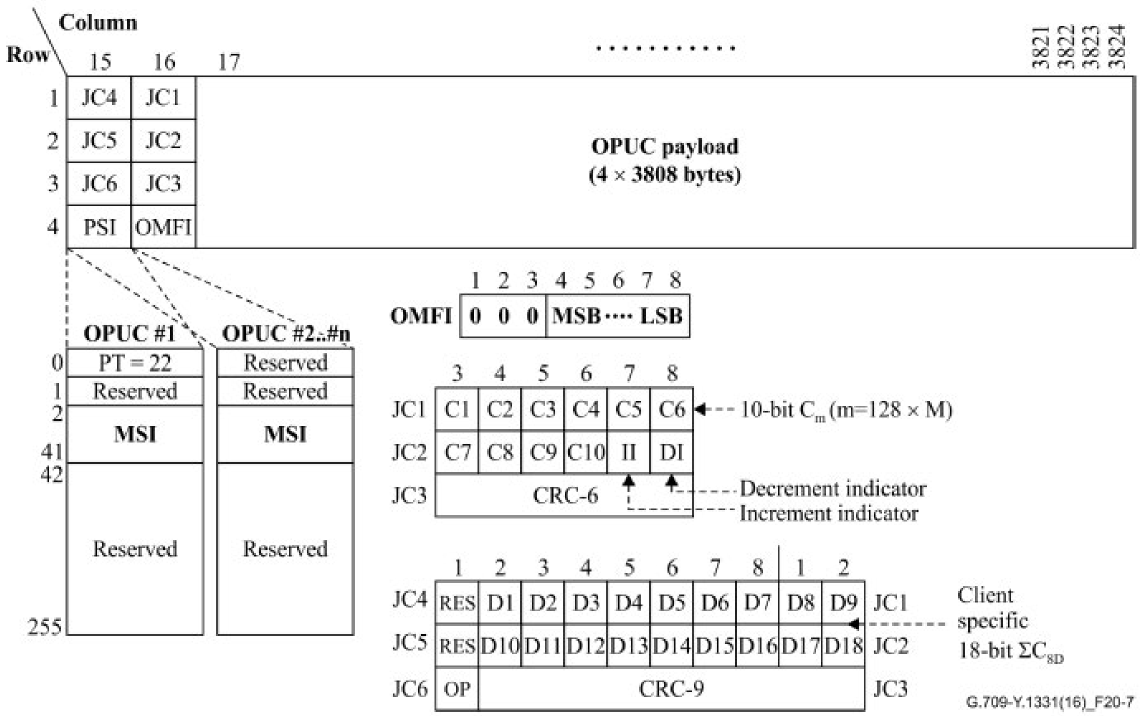

Figure 20-7 – OPU*Cn* multiplex overhead (payload type = 22)

129. Verizon indirectly infringes the ’236 patent because it has induced third parties, including the downstream parties, to make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

130. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’236 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities.

131. Verizon induced these third parties’ direct infringement by advertising,

encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities for or on behalf of such third parties, including the downstream parties.

132. Verizon took the above actions intending to cause infringing acts by these third parties.

133. Verizon has been on notice of the ’236 patent since at least March 2019, and in any event, by no later than the filing and/or service of this Complaint.

134. If Verizon did not know that the actions it encouraged constituted infringement of the ’236 patent, Verizon nevertheless subjectively believed there was a high probability that others would infringe the ’236 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

135. Verizon indirectly infringes the ’236 patent because it has contributed to the infringement by third parties, including the downstream parties, who were able, with Verizon’s contributions, make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

136. Verizon contributed to these third parties’ direct infringement by providing access to the use of the Accused G.709 Instrumentalities, including via software or hardware components for using, operating, and/or interacting with the Accused G.709 Instrumentalities. The software components include, for example, portals or dashboards for configuring a network making use of the Accused G.709 Instrumentalities, or applications to operate the Accused G.709 Instrumentalities. The hardware components include, for example, networking devices or appliances.

137. Upon information or belief, third parties, including the downstream

parties, have directly infringed the ’236 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities via the software components.

138. Verizon took the above actions knowing that these software components were especially made or adapted for use in the infringing Accused G.709 Instrumentalities. Verizon knew that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

139. Alternatively, Verizon subjectively believed there was a high probability that these components were especially made or especially adapted for use in infringing the ’236 patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

140. Huawei has been damaged and continues to be damaged by Verizon’s infringement of the ’236 patent.

COUNT FOUR: INFRINGEMENT OF THE ’505 PATENT

141. Huawei incorporates by reference the preceding paragraphs as if fully set forth herein.

142. U.S. Patent No. 8,824,505 (“the ’505 patent”), entitled “Method and Apparatus for Transporting Client Signals in an Optical Transport Network,” was issued on September 2, 2014, naming Limin Dong and Qiuyou Wu as the inventors. *See* (the ’505 patent).

143. The ’505 patent is valid and enforceable. *See generally* (the ’505 patent).

144. The ’505 patent is directed to patentable subject matter. *See generally* (the ’505 patent); (the G.709 Standard).

145. Huawei owns all rights, title, and interest in the ’505 patent, and holds all substantial rights pertinent to this suit, including the right to sue and recover for all past, current, and future infringement.

146. Verizon has and continues to directly infringe and/or indirectly infringe by inducement and/or contributory infringement, literally and/or under the doctrine of equivalents, the ’505 patent under 35 U.S.C. § 271.

147. Verizon directly infringes the ’505 patent because it has made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States.

148. The Accused G.709 Instrumentalities comply with the G.709 Standard.

149. The ’505 patent is required to implement the G.709 Standard.

150. The Accused G.709 Instrumentalities infringe one or more claims of the ’505 patent, including, for example, claim 1 of the ’505 patent.

151. Claim 1 of the ’505 patent recites:

> 1. A method for transmitting client signals in an Optical Transport Network (OTN), comprising:
>
> > receiving a client signal;
> >
> > determining a quantity of n-bit data units of the client signal based on a clock of the client signal and a local clock;
> >
> > mapping information of the quantity of n-bit data units of the client signal to an overhead of a first Optical Channel Data Tributary Unit (ODTU) frame;
> >
> > mapping the n-bit data units of the client signal to a payload area of a second ODTU frame next to the first ODTU frame according to the information of the quantity of n-bit data units mapped in the overhead of the first ODTU frame;

> mapping each byte of the second ODTU frame to at least one Optical Channel Payload Unit-k Tributary Slot (OPUk TS) in an OPUk frame, wherein the OPUk frame includes an overhead containing a tributary slot MultiFrame Indicator (MFI-TS) byte, which increases by 1 for every frame until its number is the same as the number of the OPUk TSs in the OPUk frame; and
>
> forming an Optical Channel Transport Unit-k (OTUk) frame including the OPUk frame for transmission.

152. To the extent the preamble is considered a limitation, the Accused G.709 Instrumentalities meet the preamble of claim 1 of the ’505 patent that recites “A method for transmitting client signals in an Optical Transport Network (OTN), comprising.” *See, e.g.*,:

> **Summary**
> Recommendation ITU-T G.709/Y.1331 defines the requirements for the optical transport network (OTN) interface signals of the optical transport network, in terms of:
> – OTN hierarchy
> – functionality of the overhead in support of multi-wavelength optical networks
> – frame structures
> – bit rates
> – formats for mapping client signals.

(G.709 Standard) at page i.

153. The Accused G.709 Instrumentalities meet the first element of claim 1 of the ’505 patent that recites “receiving a client signal.” *See, e.g.*,:

> Figure 7-1 shows the relationship between various information structure elements and illustrates the multiplexing structure and mappings for the OTU.
> ….

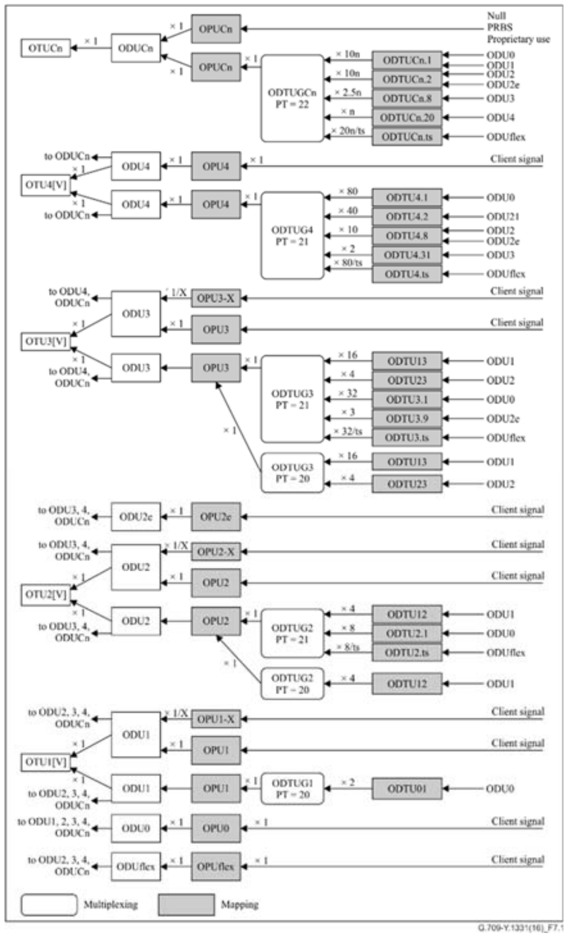

Figure 7-1 – OTN multiplexing and mapping structures

(G.709 Standard) at section 7.

19 Mapping ODUj signals into the ODTU signal and the ODTU into the OPUk tributary slots

This clause specifies the multiplexing of:

– ODU0 into OPU1, ODU1 into OPU2, ODU1 and ODU2 into OPU3 using client/server specific asynchronous mapping procedures (AMP);

– other ODUj into OPUk using a client agnostic generic mapping procedure (GMP).

This ODUj into OPUk multiplexing is performed in two steps:

1) asynchronous mapping of ODUj into optical channel data tributary unit (ODTU) using either AMP or GMP;

2) byte-synchronous mapping of ODTU into one or more OPUk tributary slots.

(G.709 Standard) at section 19.

19.6 Mapping of ODUj into ODTUk.ts

> The mapping of ODUj (j = 0, 1, 2, 2e, 3, flex) signals (with up to ±100 ppm bit-rate tolerance) into the ODTUk.ts (k = 2,3,4; ts = M) signal is performed by means of a generic mapping procedure as specified in Annex D.

(G.709 Standard) at section 19.6.

154. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '505 patent that recites "determining a quantity of n-bit data units of the client signal based on a clock of the client signal and a local clock." *See, e.g.,*:

> **D.1 Basic principle**
>
> For any given CBR client signal, the number of n-bit (e.g., n = 1/8, 1, 8) data entities that arrive during one server frame or server multiframe period is defined by:
>
> $$c_n = \left(\frac{f_{client}}{n} \times T_{server}\right) \qquad \text{(D-1)}$$
>
> f_{client}: client bit rate
> T_{server}: frame period of the server frame or server multiframe
> c_n: number of client n-bit data entities per server frame or server multiframe
>
> …
>
> The server frame or multiframe rate is defined by the server bit rate and the number of bits per server frame or multiframe:
>
> $$T_{server} = \frac{B_{server}}{f_{server}} \qquad \text{(D-5)}$$
>
> f_{server}: server bit rate
> B_{server}: bits per server frame or multiframe
>
> **D.2 Applying GMP in OTN**
>
> At the mapper, $C_n(t)$ is determined based on the client and server clocks. The client data is constantly written into the buffer memory. The read out is controlled by the value of $C_m(t)$.
>
> …
>
> The insertion of CBR client data into the payload area of the OPUk frame and the insertion of ODUj data into the payload area of the ODTUk.ts multiframe at the mapper is performed in M-byte (or m-bit, m = 8 × M) data entities, denoted as $C_m(t)$. The remaining $C_{nD}(t)$ data entities are signalled in the justification overhead as additional timing/phase information.

$$c_m = \left(\frac{n \times c_n}{m}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{m}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}}{8 \times M}\right) = \left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}/8}{M}\right) \quad \text{(D-12)}$$

As only an integer number of m-bit data entities can be transported per server frame or multiframe, the integer value $C_m(t)$ of c_m has to be used. Since it is required that no information is lost, the rounding process to the integer value has to take care of the truncated part, e.g., a c_m with a value of 10.25 has to be represented by the integer sequence 10,10,10,11.

$$C_m(t) = \text{int}(c_m) = \text{int}\left(\frac{f_{client}}{f_{server}} \times \frac{B_{server}/8}{M}\right) \quad \text{(D-13)}$$

(G.709 Standard) at Annex D.

155. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’505 patent that recites “mapping information of the quantity of n-bit data units of the client signal to an overhead of a first Optical Channel Data Tributary Unit (ODTU) frame.” *See, e.g.*,:

D.2 Applying GMP in OTN

The insertion of CBR client data into the payload area of the OPUk frame and the insertion of LO ODUj data into the payload area of the ODTUk.ts multiframe at the mapper is performed in M-byte (or m-bit, m =8 × M) data entities, denoted as $C_m(t)$. The remaining $C_{nD}(t)$ data entities are signalled in the justification overhead as additional timing/phase information.

As only an integer number of m-bit data entities can be transported per server frame or multiframe, the integer value $C_m(t)$ of c_m has to be used.

(G.709 Standard) at Annex D.

19.4.3.2 Generic mapping procedure (GMP)

The justification overhead (JOH) for the generic mapping procedure consists of two groups of three bytes of justification control; the general (JC1, JC2, JC3) and the client to ODU mapping specific (JC4, JC5, JC6). Refer to Figure 19-14C.

The JC1, JC2 and JC3 bytes consist of a 14-bit C_m field (bits C1, C2, .., C14), a 1-bit increment indicator (II) field, a 1-bit decrement indicator (DI) field and an 8-bit CRC-8 field which contains an error check code over the JC1, JC2 and JC3 fields.

(G.709 Standard) at section 19.

> **ODTUk.ts overhead**
> The ODTUk.ts overhead carries the GMP justification overhead consisting of 3 bytes of justification control (JC1, JC2, JC3) which carry the 14-bit GMP C_m information and client/ODU specific 3 bytes of justification control (JC4, JC5, JC6) which carry the 10-bit GMP ΣC_{8D} information.

(G.709 Standard) at section 19.

156. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '505 patent that recites "mapping the n-bit data units of the client signal to a payload area of a second ODTU frame next to the first ODTU frame according to the information of the quantity of n-bit data units mapped in the overhead of the first ODTU frame." *See, e.g.,:*

> $C_n(t)$ has to be determined first, then it has to be inserted into the overhead as $C_m(t)$ and $\Sigma C_{nD}(t)$ and afterwards $C_m(t)$ client data entities have to be inserted into the payload area of the server as shown in Figure D.5.

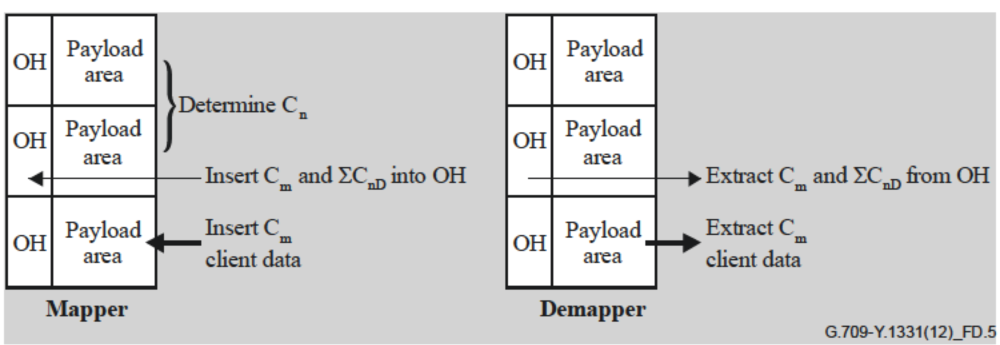

Figure D.5 – Processing flow for GMP in OTN

(G.709 Standard) at Annex D.

> The GMP sink uses the updated $C_m(t)$ value to extract the client data from the next OPU frame or ODTUk.ts multiframe.

(G.709 Standard) at Annex D.

157. The Accused G.709 Instrumentalities meet the next element of claim 1 of

the ’505 patent that recites “mapping each byte of the second ODTU frame to at least one Optical Channel Payload Unit-k Tributary Slot (OPUk TS) in an OPUk frame.” *See, e.g.,*:

> **19 Mapping ODUj signals into the ODTU signal and the ODTU into the OPUk tributary slots**
> This clause specifies the multiplexing of:
> – ODU0 into OPU1, ODU1 into OPU2, ODU1 and ODU2 into OPU3 using client/server specific asynchronous mapping procedures (AMP);
> – other ODUj into OPUk using a client agnostic generic mapping procedure (GMP).
>
> This ODUj into OPUk multiplexing is performed in two steps:
> 1) asynchronous mapping of ODUj into optical channel data tributary unit (ODTU) using
> either AMP or GMP;
> 2) byte-synchronous mapping of ODTU into one or more OPUk tributary slots.

(G.709 Standard) at section 19.

> **Optical data tributary unit k.ts**
> The optical data tributary unit k.ts (ODTUk.ts) is a structure which consists of an ODTUk.ts payload area and an ODTUk.ts overhead area (Figure 19-6). The ODTUk.ts payload area has j x ts columns and r rows (see Table 19-6) and the ODTUk.ts overhead area has one times 6 bytes. The ODTUk.ts is carried in "ts" 1.25G tributary slots of an OPUk.

(G.709 Standard) at section 19.

> **19.1 OPUk tributary slot definition**
> The OPUk is divided into a number of tributary slots (TS) and these tributary slots are interleaved within the OPUk. A tributary slot includes a part of the OPUk OH area and a part of the OPUk payload area. The bytes of the ODUj frame are mapped into the ODTU payload area and the ODTU bytes are mapped into the OPUk tributary slot or slots. The bytes of the ODTU justification overhead are mapped into the OPUk OH area.

(G.709 Standard) at section 19.

158. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’505 patent that recites “wherein the OPUk frame includes an overhead containing a tributary slot MultiFrame Indicator (MFI-TS) byte, which increases by 1 for every frame

until its number is the same as the number of the OPUk TSs in the OPUk frame; and."

See, e.g.,:

19.4.4 OPU multiframe identifier overhead (OMFI)
An OPU4 multiframe identifier (OMFI) byte is defined in row 4, column 16 of the OPU4 overhead (Figure 19-21). The value of bits 2 to 8 of the OMFI byte will be incremented each OPU4 frame to provide an 80 frame multiframe for the multiplexing of ODUj signals into the OPU4.

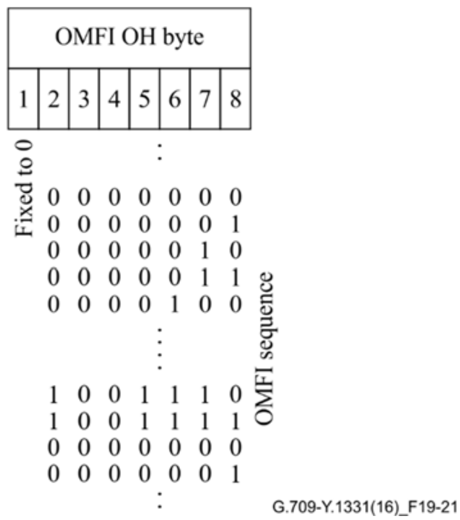

Figure 19-21 – OPU4 multiframe identifier (OMFI) overhead

(G.709 Standard) at section 19.

20.4.4 OPUCn multiframe identifier overhead (OMFI)
An OPUCn multiframe identifier (OMFI) byte is defined in row 4, column 16 of the OPUC #1 to #n overhead (Figure 20-10). The value of bits 4 to 8 of the OMFI byte will be incremented each OPUCn frame to provide a 20 frame multiframe for the multiplexing of ODUk signals into the OPUCn.

OMFI OH Byte

1	2	3	4	5	6	7	8
Fixed to 0	Fixed to 0	Fixed to 0	0	0	0	0	0
			0	0	0	0	1
			0	0	0	1	0
			0	0	0	1	1
			0	0	1	0	0
			0	0	1	0	1
			0	0	1	1	0
			0	0	1	1	1
			0	1	0	0	0
			0	1	0	0	1
			0	1	0	1	0
			0	1	0	1	1
			0	1	1	0	0
			0	1	1	0	1
			0	1	1	1	0
			0	1	1	1	1
			1	0	0	0	0
			1	0	0	0	1
			1	0	0	1	0
			1	0	0	1	1
			0	0	0	0	0
			0	0	0	0	1

OMFI sequence

Figure 20-10 OPUCn multiframe identifier (OMFI) overhead

(G.709 Standard) at section 20.

159. The Accused G.709 Instrumentalities meet the next element of claim 1 of the ’505 patent that recites “forming an Optical Channel Transport Unit-k (OTUk) frame including the OPUk frame for transmission.” *See, e.g.*,:

12.1 ODU frame structure

The ODU frame structure is shown in Figure 12-1.

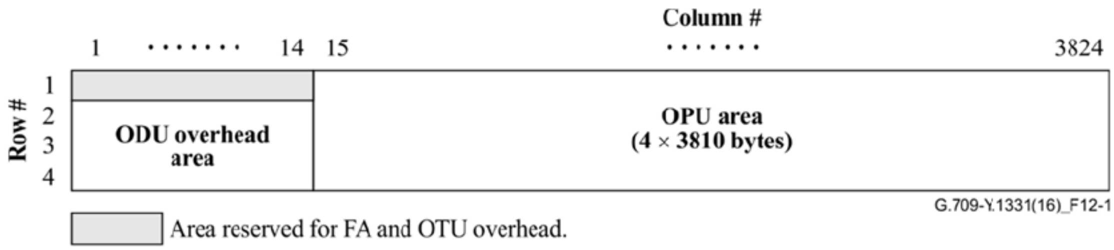

Figure 12-1 – ODU frame structure

The two main areas of the ODU frame are:

- ODU overhead area;
- OPU area.

(G.709 Standard) at section 12.1.

11.1 OTUk frame structure

The OTUk (k = 1,2,3,4) frame structure is based on the ODUk frame structure and extends it with a forward error correction (FEC) as shown in Figure 11-1.

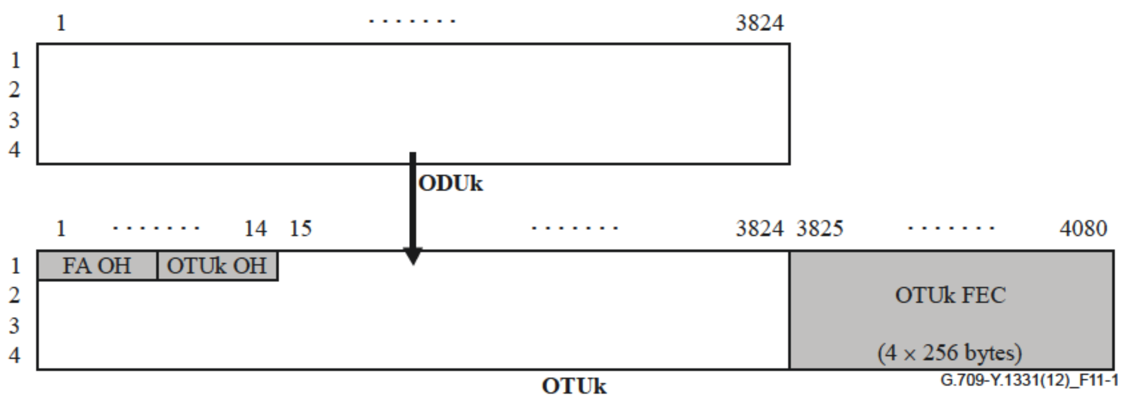

Figure 11-1 – OTUk frame structure

(G.709 Standard) at section 11.1.

160. Verizon indirectly infringes the ’505 patent because it has induced third parties, including the downstream parties, to make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

161. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’505 patent by having made, used, sold, offered to sell

and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities.

162. Verizon induced these third parties' direct infringement by advertising, encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities for or on behalf of such third parties, including the downstream parties.

163. Verizon took the above actions intending to cause infringing acts by these third parties.

164. Verizon has been on notice of the '505 patent since at least March 2019, and in any event, by no later than the filing and/or service of this Complaint.

165. If Verizon did not know that the actions it encouraged constituted infringement of the '505 patent, Verizon nevertheless subjectively believed there was a high probability that others would infringe the '505 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

166. Verizon indirectly infringes the '505 patent because it has contributed to the infringement by third parties, including the downstream parties, who were able, with Verizon's contributions, make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

167. Verizon contributed to these third parties' direct infringement by providing access to the use of the Accused G.709 Instrumentalities, including via software or hardware components for using, operating, and/or interacting with the Accused G.709 Instrumentalities. The software components include, for example, portals

or dashboards for configuring a network making use of the Accused G.709 Instrumentalities, or applications to operate the Accused G.709 Instrumentalities. The hardware components include, for example, networking devices or appliances.

168. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’505 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities via the software components.

169. Verizon took the above actions knowing that these software components were especially made or adapted for use in the infringing Accused G.709 Instrumentalities. Verizon knew that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

170. Alternatively, Verizon subjectively believed there was a high probability that these components were especially made or especially adapted for use in infringing the ’505 patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

171. Huawei has been damaged and continues to be damaged by Verizon’s infringement of the ’505 patent.

COUNT FIVE: INFRINGEMENT OF THE ’982 PATENT

172. Huawei incorporates by reference the preceding paragraphs as if fully set forth herein.

173. U.S. Patent No. 9,312,982 (“the ’982 patent”), entitled “Method and

Apparatus for Mapping and De-Mapping in an Optical Transport Network," was issued on April 12, 2016, naming Maarten Vissers, Qiuyou Wu, Xin Xiao and Wei Su as the inventors. *See* (the '982 patent).

174. The '982 patent is valid and enforceable. *See generally* (the '982 patent).

175. The '982 patent is directed to patentable subject matter. *See generally* (the '982 patent); (the G.709 Standard).

176. Huawei owns by assignment all rights, title, and interest in the '982 patent, and holds all substantial rights pertinent to this suit, including the right to sue and recover for all past, current, and future infringement.

177. Verizon has and continues to directly infringe and/or indirectly infringe by inducement and/or contributory infringement, literally and/or under the doctrine of equivalents, the '982 patent under 35 U.S.C. § 271.

178. Verizon directly infringes the '982 patent because it has made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States.

179. The Accused G.709 Instrumentalities comply with the G.709 Standard.

180. The '982 patent is required to implement the G.709 Standard.

181. The Accused G.709 Instrumentalities infringe one or more claims of the '982 patent, including, for example, claim 1 of the '982 patent.

182. Claim 1 of the '982 patent recites:

> 1. A method for processing data in an Optical Transport Network (OTN), comprising:
>
> > mapping, by a processor of an apparatus for processing data, a Lower Order Optical Channel Data Unit (LO ODU) signal into a payload area of an Optical Channel Data Tributary Unit (ODTU) signal in groups of M bytes, wherein M is equal to the number of time slots of a Higher Order Optical Channel Payload Unit (HO

OPU) that are to be occupied by the ODTU signal, and M is an integer larger than 1;

encapsulating overhead information to an overhead area of the ODTU signal; and

multiplexing the ODTU signal into the HO OPU.

183. To the extent the preamble is considered a limitation, the Accused G.709 Instrumentalities meet the preamble of claim 1 of the ’982 patent that recites “A mapping method used in an Optical Transport Network (OTN), comprising.” *See, e.g.*,: Interfaces for the Optical Transport Network (G.709 Standard) at cover page.

19 Mapping ODUj signals into the ODTU signal and the ODTU into the HO OPUk tributary slots

(G.709 Standard) at section 19.

184. The Accused G.709 Instrumentalities meet the first element of claim 1 of the ’982 patent that recites “mapping, by a processor of an apparatus for processing data, a Lower Order Optical Channel Data Unit (LO ODU) signal into a payload area of an Optical Channel Data Tributary Unit (ODTU) signal in groups of M bytes, wherein M is equal to the number of time slots of a Higher Order Optical Channel Payload Unit (HO OPU) that are to be occupied by the ODTU signal, and M is an integer larger than 1.” *See, e.g.*,:

Optical data tributary unit k.ts
The optical data tributary unit k.ts (ODTUk.ts) is a structure which consists of an ODTUk.ts payload area and an ODTUk.ts overhead area (Figure 19-6). The ODTUk.ts payload area has j x ts columns and r rows (see Table 19-6) and the ODTUk.ts overhead area has one times 6 bytes. The ODTUk.ts is carried in "ts" 1.25G tributary slots of an OPUk.

(G.709 Standard) at section 19.2.

19.4.3.2 Generic mapping procedure (GMP)
The value of 'm' in C_m is 8 × 'ts' (number of tributary slots occupied by the

ODTUk.ts).
The value of 'n' represents the timing granularity of the GMP C_n parameter, which is also present in ΣC_{nD}. The value of n is 8.

The value of C_m controls the distribution of groups of 'ts' ODUj data bytes into groups of 'ts' ODTUk.ts payload bytes. Refer to clause 19.6 and Annex D for further specification of this process.

(G.709 Standard) at section 19.4.

19.6 Mapping of ODUj into ODTUk.ts

The mapping of ODUj (j = 0, 1, 2, 2e, 3, flex) signals (with up to ±100 ppm bit-rate tolerance) into the ODTUk.ts (k = 2,3,4; ts = M) signal is performed by means of a generic mapping procedure as specified in Annex D.
The OPUk and therefore the ODTUk.ts (k = 2,3,4) signals are created from a locally generated clock (within the limits specified in Table 7-3), which is independent of the ODUj client signal.

The ODUj signal is extended with a frame alignment overhead as specified in clauses 15.6.2.1 and 15.6.2.2 and an all-0s pattern in the OTUj overhead field (see Figure 19-22).

The extended ODUj signal is adapted to the locally generated OPUk/ODTUk.ts clock by means of a generic mapping procedure (GMP) as specified in Annex D. The value of n in c_n and $C_n(t)$ and $C_{nD}(t)$ is specified in Annex D. The value of M is the number of tributary slots occupied by the ODUj; ODTUk.ts = ODTUk.M.

A group of 'M' successive extended ODUj bytes is mapped into a group of 'M' successive ODTUk.M bytes.

The generic mapping process generates for the case of ODUj (j = 0,1,2,2e,3,flex) signals once per ODTUk.M multiframe the $C_m(t)$ and $C_{nD}(t)$ information according to Annex D and encodes this information in the ODTUk.ts justification control overhead JC1/JC2/JC3 and JC4/JC5/JC6. The de-mapping process decodes $C_m(t)$ and $C_{nD}(t)$ from JC1/JC2/JC3 and JC4/JC5/JC6 and interprets $C_m(t)$ and $C_{nD}(t)$ according to Annex D. CRC-8 shall be used to protect against an error in JC1,JC2,JC3 signals. CRC-5 shall be used to protect against an error in JC4,JC5,JC6 signals.

(G.709 Standard) at section 19.6.

19.6.1 Mapping ODUj into ODTU2.M

Groups of M successive bytes of the extended ODUj (j = 0, flex) signal are mapped into a group of M successive bytes of the ODTU2.M payload area under control of the GMP data/stuff control mechanism. Each group of M bytes in the ODTU2.M payload area may either carry M ODU bytes, or carry M stuff bytes. The value of the stuff bytes is set to all-0s.

19.6.2 Mapping ODUj into ODTU3.M
Groups of M successive bytes of the extended ODUj (j = 0, 2e, flex) signal are mapped into a group of M successive bytes of the ODTU3.M payload area under control of the GMP data/stuff control mechanism. Each group of M bytes in the ODTU3.M payload area may either carry M ODU bytes, or carry M stuff bytes. The value of the stuff bytes is set to all-0s.

19.6.3 Mapping ODUj into ODTU4.M
Groups of M successive bytes of the extended ODUj (j = 0, 1, 2, 2e, 3, flex) signal are mapped into a group of M successive bytes of the ODTU4.M payload area under control of the GMP data/stuff control mechanism. Each group of M bytes in the ODTU4.M payload area may either carry M ODU bytes, or carry M stuff bytes. The value of the stuff bytes is set to all-0s.

(G.709 Standard) at section 19.6.

Figure 7-1 shows the relationship between various information structure elements and illustrates the multiplexing structure and mappings for the OTU.

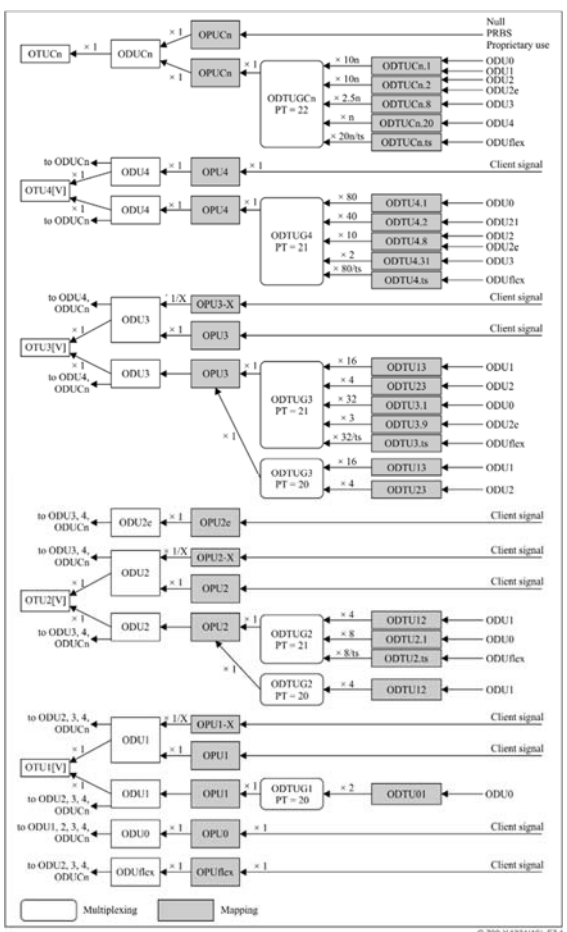

Figure 7-1 – OTN multiplexing and mapping structures

(G.709 Standard) at section 7.

185. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '982 patent that recites "encapsulating overhead information to an overhead area of the ODTU signal; and." *See, e.g.*,:

> **Optical data tributary unit k.ts**
>
> The optical data tributary unit k.ts (ODTUk.ts) is a structure which consists of an ODTUk.ts payload area and an ODTUk.ts overhead area (Figure 19-6). The ODTUk.ts payload area has j x ts columns and r rows (see Table 19-6) and the ODTUk.ts overhead area has one times 6 bytes. The ODTUk.ts is carried in "ts" 1.25G tributary slots of an OPUk.
>
> The location of the ODTUk.ts overhead depends on the OPUk tributary slot used when multiplexing the ODTUk.ts in the OPUk (see clauses 19.1.1, 19.1.2, 19.1.4). The single instance of ODTUk.ts overhead is located in the OPUk TSOH of the last OPUk tributary slot allocated to the ODTUk.ts.
>
> The ODTUk.ts overhead carries the GMP justification overhead as specified in clause 19.4.

(G.709 Standard) at section 19.2.

186. The Accused G.709 Instrumentalities meet the next element of claim 1 of the '982 patent that recites "multiplexing the ODTU signal into the HO OPU." *See, e.g.*,:

> **19.3 Multiplexing ODTU signals into the OPUk**
>
> …
>
> Multiplexing an ODTU2.ts signal into an OPU2 is realized by mapping the ODTU2.ts signal in ts (of the eight) arbitrary OPU2 1.25G tributary slots: OPU2 TSa, TSb, .. , TSp with $1 \leq a < b < .. < p \leq 8$.
>
> Multiplexing an ODTU3.ts signal into an OPU3 is realized by mapping the ODTU3.ts signal in ts (of the thirty-two) arbitrary OPU3 1.25G tributary slots: OPU3 TSa, TSb, .. , TSq with $1 \leq a < b < .. < q \leq 32$.
>
> Multiplexing an ODTU4.ts signal into an OPU4 is realized by mapping the ODTU4.ts signal in ts (of the eighty) arbitrary OPU4 1.25G tributary slots: OPU4 TSa, TSb, .. , TSr with $1 \leq a < b < .. < r \leq 80$.
>
> …

(G.709 Standard) at section 19.3.

187. Verizon indirectly infringes the ’982 patent because it has induced third parties, including the downstream parties, to make, use, sell, offer to sell and/or import the Accused G.709 Instrumentalities in the United States.

188. Upon information or belief, third parties, including the downstream parties, have directly infringed the ’982 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities.

189. Verizon induced these third parties’ direct infringement by advertising, encouraging, installing devices for, providing support for, and/or operating the Accused G.709 Instrumentalities for or on behalf of such third parties, including the downstream parties.

190. Verizon took the above actions intending to cause infringing acts by these third parties.

191. Verizon has been on notice of the ’982 patent since at least March 2019, and in any event, by no later than the filing and/or service of this Complaint.

192. If Verizon did not know that the actions it encouraged constituted infringement of the ’982 patent, Verizon nevertheless subjectively believed there was a high probability that others would infringe the ’982 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

193. Verizon indirectly infringes the ’982 patent because it has contributed to the infringement by third parties, including the downstream parties, who were able, with Verizon’s contributions, make, use, sell, offer to sell and/or import the Accused G.709

Instrumentalities in the United States.

194. Verizon contributed to these third parties' direct infringement by providing access to the use of the Accused G.709 Instrumentalities, including via software or hardware components for using, operating, and/or interacting with the Accused G.709 Instrumentalities. The software components include, for example, portals or dashboards for configuring a network making use of the Accused G.709 Instrumentalities, or applications to operate the Accused G.709 Instrumentalities. The hardware components include, for example, networking devices or appliances.

195. Upon information or belief, third parties, including the downstream parties, have directly infringed the '982 patent by having made, used, sold, offered to sell and/or imported the Accused G.709 Instrumentalities in the United States, including, for example, by configuring, operating, or interacting with a network making use or accessing the Accused G.709 Instrumentalities via the software components.

196. Verizon took the above actions knowing that these software components were especially made or adapted for use in the infringing Accused G.709 Instrumentalities. Verizon knew that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

197. Alternatively, Verizon subjectively believed there was a high probability that these components were especially made or especially adapted for use in infringing the '982 patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

198. Huawei has been damaged and continues to be damaged by Verizon's

infringement of the ’982 patent.

JURY DEMAND

Plaintiff hereby demands a trial by jury on all issues so triable.

PRAYER FOR RELIEF

WHEREFORE Plaintiff Huawei Technologies Co. Ltd. asks this Court for an order granting the following relief:

a. a judgment in favor of Plaintiff that Defendants have infringed, either literally and/or under the doctrine of equivalents, the patents-in-suit;

b. a judgment and order finding that Defendants’ infringement has been willful;

c. a judgment and order requiring Defendants to pay Plaintiff its damages, costs, expenses, and any enhanced damages to which Plaintiff is entitled for Defendants’ infringement;

d. a judgment and order requiring Defendants to provide an accounting and to pay supplemental damages to Plaintiff, including without limitation, pre-judgment and post-judgment interest;

e. a judgment and order requiring Defendants to pay on-going royalties;

f. a judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding Plaintiff its reasonable attorneys’ fees against Defendants; and

g. any and all other relief as the Court may deem appropriate and just under the circumstances.

DATED: February 5, 2020

Respectfully submitted,

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