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

SUN PATENT TRUST, Plaintiff, v. HTC CORPORATION, Defendant.	CIVIL ACTION NO. 2:20-CV-00286 JURY TRIAL DEMANDED

AMENDED COMPLAINT

Plaintiff Sun Patent Trust ("SPT") files this Amended Complaint against Defendant HTC Corporation ("HTC") 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 based upon information and belief with respect to all others' actions, as follows:

THE PARTIES

1. Sun Patent Trust is a Delaware statutory trust with its principal place of business at 437 Madison Avenue, 35th Floor, New York, New York 10022.

2. Defendant HTC Corporation is a Taiwanese corporation with its principal place of business at No. 88, Section 3, Zhongxing Road, Xindian District, New Taipei City 231, Taiwan.

JURISDICTION AND VENUE

3. 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 subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

4. This Court has personal jurisdiction over HTC. HTC, directly and/or through the control or direction of its subsidiaries, has sufficient minimum contacts with the forum as a result of business conducted within the State of Texas and within the Eastern District of Texas.

5. HTC offers for sale and sells products or services within the State of Texas and within the Eastern District of Texas that directly or indirectly infringe the Asserted Patents (described below). HTC purposefully and voluntarily places its infringing products into the stream of commerce with both the expectation and the knowledge that those products will be purchased and used by consumers in the Eastern District of Texas.

6. For example, while HTC is a Taiwanese entity, on information and belief it operates a United States-focused website (www.htc.com/us/), including website pages that advertise the Accused Instrumentalities (described below). *See, e.g.*, https://www.htc.com/us/comparison/; https://www.htc.com/us/5g/htc-5g-hub/. HTC's United States-focused website contains copyright notices and Terms of Use attributing the website to "HTC Corporation" (the defendant in this case). *See* https://www.htc.com/us/terms/terms-of-use/#topic-2-23. This demonstrates that HTC Corporation knows and intends that its products will reach customers throughout the United States, including in this District, or that HTC at least reasonably could have foreseen that a termination point of its distribution channel is Texas.

7. Further, on information and belief, HTC controls the activities of HTC America, Inc., its wholly owned subsidiary, within the United States and this District. *See, e.g.*, *HTC Corp. et al. v. Telefonaktiebolaget LM Ericsson et al.*, Case No. 6:18-CV-00243, Dkt. No. 2 (E.D. Tex. Apr. 6, 2017), *transferred from* 2:16-CV-534 (W.D. Wash.) (attached as Exhibit E, HTC's corporate disclosure statement showing HTC owns 100% of HTC America). On information and belief, HTC exports and sells its smartphones through a distribution channel it established with

HTC America, which includes third-party distributors such as Verizon, Sprint, AT&T, and T-Mobile, with knowledge that the Accused Products will be sold nationwide, including in Texas. *See AGIS Software Development LLC v. HTC Corp.*, Case No. 2:17-CV-00514-JRG, Dkt. No. 77 at 7-11, (E.D. Tex. Sep. 28, 2018) (attached as Exhibit F).

8. For example, on information and belief, HTC was not only aware of this distribution channel, HTC intentionally formed it for that purpose. *See id.* On information and belief, HTC created HTC America to sell products in the United States (including Texas and this District), and HTC's own personnel—not HTC America—executed the various agreements with the United States carriers. *See id.*

9. As another example, on information and belief, HTC has knowledge of studies demonstrating that cities in Texas (including the Dallas-Fort Worth metroplex, which encompasses cities in this District) are among the top markets for HTC products. *See id.*

10. Further, assertion of personal jurisdiction over HTC would not be unfair or unreasonable, particularly given HTC's concerted efforts to serve the United States market, including Texas. *See id.*

11. In previously describing its manufacturing and distribution channels, HTC demonstrated that it knows and intends for its products to be shipped and delivered to the United States:

> Pursuant to licenses and other rights provided by its component manufacturers, HTC issues purchase orders for finished component chipsets, which are drop-shipped to HTC in Taiwan. HTC then incorporates these chipsets and software code updates into an ever-evolving portfolio of HTC smartphones assembled in Taiwan or China. Finally, HTC ships and delivers finished HTC smartphones from Asia to commercial customers worldwide, including the United States.

See Brief for HTC Corporation and HTC America, Inc., as Amici Curiae in Support of Petitioner at 6, *Impression Prods., Inc. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523 (2017) (No. 15-1189) (attached as Exhibit Q).

12. Venue is proper under 28 U.S.C. § 1391(b) and (c)(3), and 1400(b). HTC is a foreign corporation not residing in the United States. Therefore, venue is proper as to HTC in this District. *See In re HTC Corp.*, 889 F.3d 1349, 1354, 1356 (Fed. Cir. 2018).

THE ASSERTED PATENTS

13. On May 21, 2013, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,446,870 ("the '870 Patent"), entitled "Wireless Communication Base Station Device, Wireless Communication Terminal Device, and Channel Allocation Method." SPT is the owner of the '870 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 026052/0510, 033033/0163, and 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=8446870&type=patNum. A copy of the '870 Patent is attached as Exhibit A.

14. On March 25, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,681,602 ("the '602 Patent"), entitled "Terminal Device and Retransmission Control Method." SPT is the owner of the '602 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 028593/0684, 033033/0163, and 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=8681602&type=patNum. A copy of the '602 Patent is attached as Exhibit B.

15. On June 9, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,055,535 ("the '535 Patent"), entitled "Wireless Communication Device and Method for Controlling Transmission Power." SPT is the owner of the '535 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 029800/0826, 033033/0163, and 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=9055535&type=patNum. A copy of the '535 Patent is attached as Exhibit C.

16. On December 27, 2016, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,532,320 ("the '320 Patent"), entitled "Power-Limit Reporting in a Communication System Using Carrier Aggregation." SPT is the owner of the '320 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 028248/0775, 033033/0163, 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=9532320&type=patNum; https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=8811322&type=patNum. A copy of the '320 Patent is attached as Exhibit D.

17. On July 12, 2016, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,392,594 ("the '594 Patent"), entitled "Resource assignment for single and multiple cluster transmission." SPT is the owner of the '594 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 032133/0761, 033033/0163, 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=9392594&type=patNum. A copy of the '594 Patent is attached as Exhibit R.

18. On November 7, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,814,032 (“the ’032 Patent”), entitled “Resource assignment for single and multiple cluster transmission.” SPT is the owner of the ’032 Patent by assignment with the relevant assignment records having been publicly recorded with the Patent Office at reel/frame numbers 038299/0156. *See* https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=8446870&type=patNum; https://assignment.uspto.gov/patent/index.html#/patent/search/resultAbstract?id=14930285&type=applNum. A copy of the ’032 Patent is attached as Exhibit S.

FACTUAL ALLEGATIONS

19. Sun Patent Trust was formed in December 2015 to license patents assigned to it by Panasonic Corporation (“Panasonic”) and its subsidiaries. *See* www.sun-ip.com. Sun Patent Trust has licensed its patent portfolios by licensing in patent pools and through individual licensing transactions. *See id.*

20. SPT owns a portfolio of Standard Essential Patents (“SEP”) and applications related to the 3rd Generation Partnership Project’s (“3GPP”) LTE-Advanced standards. This portfolio includes the Asserted Patents.

21. Many of these patents were acquired from Panasonic. Since at least 2005, Panasonic has participated in and submitted numerous contributions to the standardization process for the 3GPP standards by way of its participation and contributions to the 3GPP member standards organization called the European Telecommunication Standards Institute’s (“ETSI”).

22. Panasonic has been recognized as having one of the top portfolios of 4G-LTE SEPs. For example, in a 2012 report, an independent consulting firm called iRunway listed Panasonic as a top-three patent holder of 4G-LTE patents:

Company Name	Count of All 4G-LTE patents	Share of All 4G-LTE patents	Count of Seminal 4G-LTE patents	Share of Seminal 4G-LTE patents
Samsung	1177	9.36%	79	12.15%
Qualcomm	710	5.65%	81	12.46%
Panasonic Corporation	389	3.1%	13	2%
InterDigital	336	2.67%	23	3.54%
Nokia Corporation	293	2.33%	27	4.15%
Ericsson	247	1.97%	29	4.46%
LG Corp.	224	1.78%	26	4%
Motorola Solutions, Inc.	192	1.53%	13	2%
Motorola Mobility Holdings, Inc.	32	0.25%	12	1.85%
Sony Corporation	189	1.5%	14	2.15%
NEC America Inc.	180	1.43%	3	0.46%
Texas Instruments	173	1.38%	6	0.92%
Harris Corporation	160	1.27%	6	0.92%
Nortel Networks Corporation	152	1.21%	11	1.69%
Intel Corporation	145	1.15%	36	5.54%

Company	Patent Distribution across Categories							Total
	Power Management	Communication Reliability	Network Security	Network Coverage	Spectral Efficiency	Network Deployment	Data Transfer Rate	
Samsung	16	10	0	6	678	16	451	**1177**
Qualcomm	4	4	4	12	424	2	260	**710**
Panasonic Corporation	6	12	0	0	253	4	114	**389**
InterDigital	6	0	3	0	87	8	232	**336**
Nokia Corporation	3	1	11	1	121	9	147	**293**
Ericsson	7	2	6	2	108	17	105	**247**
LG Corp.	1	0	0	2	103	1	117	**224**
Motorola Solutions, Inc.	0	2	0	2	110	10	68	**192**
Motorola Mobility Inc.	0	0	0	0	20	1	11	**32**
Sony Corporation	0	1	0	1	154	1	32	**189**
NEC America Inc.	1	3	1	1	104	3	67	**180**
Texas Instruments	3	2	0	0	110	1	57	**173**
Harris Corporation	1	0	0	0	22	0	137	**160**
Nortel Networks Corporation	0	0	0	1	76	3	72	**152**
Intel Corporation	0	0	1	0	92	5	47	**145**
Grand Total	**48**	**37**	**26**	**28**	**2462**	**81**	**1917**	**4599**

See Patent & Landscape Analysis of 4G-LTE Technology, IRUNWAY at 9–10 (2012) (attached as Exhibit G).

23. As another example, in 2016, a different survey conducted for the European Union by an independent consulting firm called IPlytics confirmed that Panasonic was a top owner of 4G-LTE SEPs, even when splitting 4G-LTE technologies into different sectors:

G06F OR G10L (IT Sector)		H04W OR H04L (ICT Sector)	
Applicant/Assignee	**SEP families**	**Applicant/Assignee**	**SEP families**
Nokia Corporation	190	Huawei Technologies	1,301
ALCOMM Incorporated	141	Nokia Corporation	1,297
Ericsson	115	Samsung Electronics Co. Ltd.	1,262
Samsung Electronics Co. Ltd.	114	QUALCOMM Incorporated	1,253
Huawei Technologies	95	Ericsson	1,078
LG Electronics Inc.	93	InterDigital, Inc.	708
Google	80	LG Electronics Inc.	635
InterDigital, Inc.	64	Nokia Siemens Networks SA	627
Panasonic Corporation	63	ZTE Corp.	582
Sony Corporation	63	Motorola Solutions, Inc.	466
Fraunhofer	48	NTT DOCOMO, Inc.	415
NEC Corporation	29	Panasonic Corporation	335
Hewlett-Packard Oy	27	Siemens Aktiengesellschaft	284
Digital Fountain, Inc.	8	Sharp Corporation	262
Sun Microsystems AB	7	NEC Corporation	256
Dolby Laboratories, Inc.	6	BlackBerry Limited	179

See Dr. Tim Pohlmann & Dr. Knut Blind, *Landscaping study on Standard Essential Patents (SEPs)*, IPLYTICS at 17 (2016) (attached as Exhibit H).

24. Many of the inventions claimed by Panasonic's SEPs, including the Asserted Patents owned by SPT, are incorporated into the 3GPP LTE-Advanced standards. These include, but are not limited to, various portions of the following reports and specifications: 3GPP TR 25.814, 3GPP TS 36.101, 3GPP TS 36.211, 3GPP TS 36.212, 3GPP TS 36.213, 3GPP TS 36.300, 3GPP TS 36.321, and 3GPP TR 36.912.

25. 3GPP TR 25.814 v7.1.0 (2006-09), titled "Physical layer aspects for evolved Universal Terrestrial Radio Access (UTRA)," is a technical report created to help "define and

describe the potential physical layer evolution under consideration and compare the benefits of each evolution techniques[.]" TR 25.814 at 9. The report considers the "long term evolution of the 3GPP radio-access technology" with respect to "reduced latency, higher user data rates, improved system capacity and coverage, and reduced cost for the operator." *Id.* at 12. A copy of TR 25.814 is attached as Exhibit I.

26. 3GPP TS 36.101 v10.20.0 (2015-09), titled "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception," describes and sets the "minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE)." TS 36.101 at 14. This description includes the characteristics of both the transmitter and receiver, *id.* at §§ 6–7, as well as the operating bands and channel arrangement connecting the two. *See id.* at § 5. A copy of TS 36.101 is attached as Exhibit J.

27. 3GPP TS 36.211 v10.7.0 (2013-02), titled "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation," explains the "physical channels for evolved UTRA." TS 36.211 at 7. Both downlink and uplink transmissions have physical channels described in the standard. *See id.* at 12, 50. A copy of TS 36.211 is attached as Exhibit K.

28. 3GPP TS 36.212 v10.8.0 (2013-06), titled "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding," discloses the "coding, multiplexing, and mapping to physical channels for E-UTRA." TS 36.212 at 6. As described in the standard, "[c]hannel coding scheme is a combination of error detection, error correcting, rate matching, interleaving, and transport channel or control information mapping[.]" *Id.* at 8. A copy of TS 36.212 is attached as Exhibit L.

29. 3GPP TS 36.213 v10.12.0 (2014-03), titled "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures," "specifies and establishes the characteristics of the physicals layer procedures" in different modes of E-UTRA. TS 36.213 at 6. A copy of TS 36.213 is attached as Exhibit M.

30. 3GPP TS 36.300 v10.11.0 (2013-09), titled "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall Descriptions; Stage 2," is a foundational standard specification, providing "an overview and overall description of the E-UTRAN radio interface protocol architecture." TS 36.300 at 13. In part, the standard establishes a scheduling function used "[i]n order to utilise the SCH resources efficiently," describing the scheduler operation, signaling, and measurements to support its operation. *Id.* at 92–95. A copy of TS 36.300 is attached as Exhibit N.

31. 3GPP TS 36.321 v10.10.0 (2013-12), titled "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification," "specifies the E-UTRA MAC protocol." TS 36.321 at 6. As described in the standard, the MAC sublayer supports the following functions:

- "mapping between logical channels and transport channels;
- multiplexing of MAC SDUs from one or different logical channels onto transport blocks (TB) to be delivered to the physical layer on transport channels;
- demultiplexing of MAC SDUs from one or different logical channels from transport blocks (TB) delivered from the physical layer on transport channels;
- scheduling information reporting;
- error correction through HARQ;
- priority handling between UEs by means of dynamic scheduling;
- priority handling between logical channels of one UE;
- Logical Channel prioritisation;

- transport format selection."

Id. at 10. A copy of TS 36.321 is attached as Exhibit O.

32. 3GPP TR 36.912 v10.0.0 (2011-03), titled "Feasibility Study for Further Advancements for E-UTRA (LTE-Advanced)," is a technical report which "involves the Radio Access work area of the 3GPP studies and has impacts both on the Mobile Equipment and Access Network of the 3GPP systems." TR 36.912 at 7. The standard describes, among other things, general principles related to carrier aggregation and downlink and uplink control signaling. *Id.* at 8-10. A copy of TR 36.912 is attached as Exhibit T.

33. As part of its standardization efforts, Panasonic made a number of contributions to the LTE-Advanced standardization process that were adopted by the 3GPP and became part of the LTE-Advanced standard.

34. Some of Panasonic's contributions that were adopted in the LTE-A standard were Panasonic inventions, described in patents and/or patent applications.

35. Consistent with ETSI's IPR Policy, Panasonic declared that it is willing to grant licenses on fair, reasonable, and nondiscriminatory ("FRAND") terms and conditions for any of its intellectual property rights ("IPR") to the extent such IPRs are or become, and remain essential to practice the LTE-Advanced standard or its related technical specifications. A copy of this declaration is attached as Exhibit U.

36. Likewise, after acquiring its patent portfolio from Panasonic, SPT has declared that it is willing to grant licenses on fair, reasonable, and nondiscriminatory terms and conditions for any of its IPR to the extent such IPRs are or become, and remain essential to practice the LTE-Advanced standard or its related technical specifications. SPT has made general and specific declarations (i.e., in an IPR Information Statement and Licensing Declaration) to ETSI

on September 21, 2018 and September 23, 2019. A copy of these declarations is attached as Exhibit P.

37. The Asserted Patents are required to implement the 3GPP LTE-Advanced standard. The applications for the Asserted Patents were declared as standard essential to ETSI in the September 21, 2018 declaration. *See* Exhibit P.

38. HTC has identified a non-exhaustive listing of its products with LTE functionality that includes the following products: "Windows Phone 8X by HTC, HTC Titan II, HTC ThunderBolt, HTC Vivid, HTC Rezound, HTC One ® X, HTC One® X+, Droid Incredible 4G LTE by HTC, HTC One® SV, HTC 8XT, HTC EVO 4G LTE, Droid DNA by HTC, HTC One® (M7), HTC One® Mini, HTC One® Max, HTC One® (M8), HTC One ® (M8) For Windows, HTC One ® (E8), HTC One® remix, HTC One® M9, HTC One® (Harman Kardon® edition), HTC One® A9, HTC Desire®, HTC Desire® 510, HTC Desire® 512, HTC Desire® 520, HTC Desire® 526, HTC Desire®610, HTC Desire® 612, HTC Desire 626, HTC Desire 816, HTC Desire EYE, Google Nexus 9, HTC Bolt, HTC 10, HTC U ULTRA, HTC U11, HTC U11 life, and HTC U12+." *See* Virtual Patent Marking | HTC United States, *available at* https://www.htc.com/us/virtual-patent-marking/.

39. HTC has committed and continues to commit acts of infringement under 35 U.S.C. § 271 as to the Asserted Patents. HTC has made, used, sold, offered to sell and/or imported into the United States devices that comply with the 3GPP LTE-Advanced standard, including the Windows Phone 8X by HTC, Droid Incredible 4G LTE by HTC, HTC One® SV, HTC 8XT, HTC EVO 4G LTE, Droid DNA by HTC, HTC One® (M7), HTC One® Mini, HTC One® Max, HTC One® (M8), HTC One ® (M8) For Windows, HTC One ® (E8), HTC One® remix, HTC One® M9, HTC One® (Harman Kardon® edition), HTC One® A9, HTC

Desire®, HTC Desire® 510, HTC Desire® 512, HTC Desire® 520, HTC Desire® 526, HTC Desire®610, HTC Desire® 612, HTC Desire 626, HTC Desire 816, HTC Desire EYE, Google Nexus 9, Google Pixel, Google Pixel XL, Google Pixel 2, HTC Bolt, HTC 10, HTC U ULTRA, HTC U PLAY, HTC U11, HTC U11 life, HTC U12+, HTC 5G Hub, HTC EXODUS 1, HTC EXODUS 1s, and HTC EXODUS (Binance Edition) (collectively, the "Accused Instrumentalities").

40. The Accused Instrumentalities carry out the claimed methods in the Asserted Patents without user intervention or involvement. Software and/or firmware within the Accused Instrumentalities (i.e., user equipment or UE) automatically perform the claimed methods to transmitting, and receive information with cellular network infrastructure (i.e., an eNodeB or base station). HTC designs the Accused Instrumentalities to be compliant with the LTE-Advanced standard and to be so without intervention or involvement on behalf of the users. Each step of the claimed methods is carried out by software and/or firmware residing within HTC's Accused Instrumentalities. As a result, HTC has infringed the method claims of SPT's patents that are required to implement the 3GPP LTE-Advanced standards.

41. By way of further illustration, according to HTC's website, HTC U11, HTC U12+, and HTC U11 life comply with the 3GPP LTE-A Standards:

htc PRODUCTS SUPPORT

COMPARISON

Smartphones

HTC U11	HTC U12+	HTC U11 life
Get Details	Get Details	Get Details

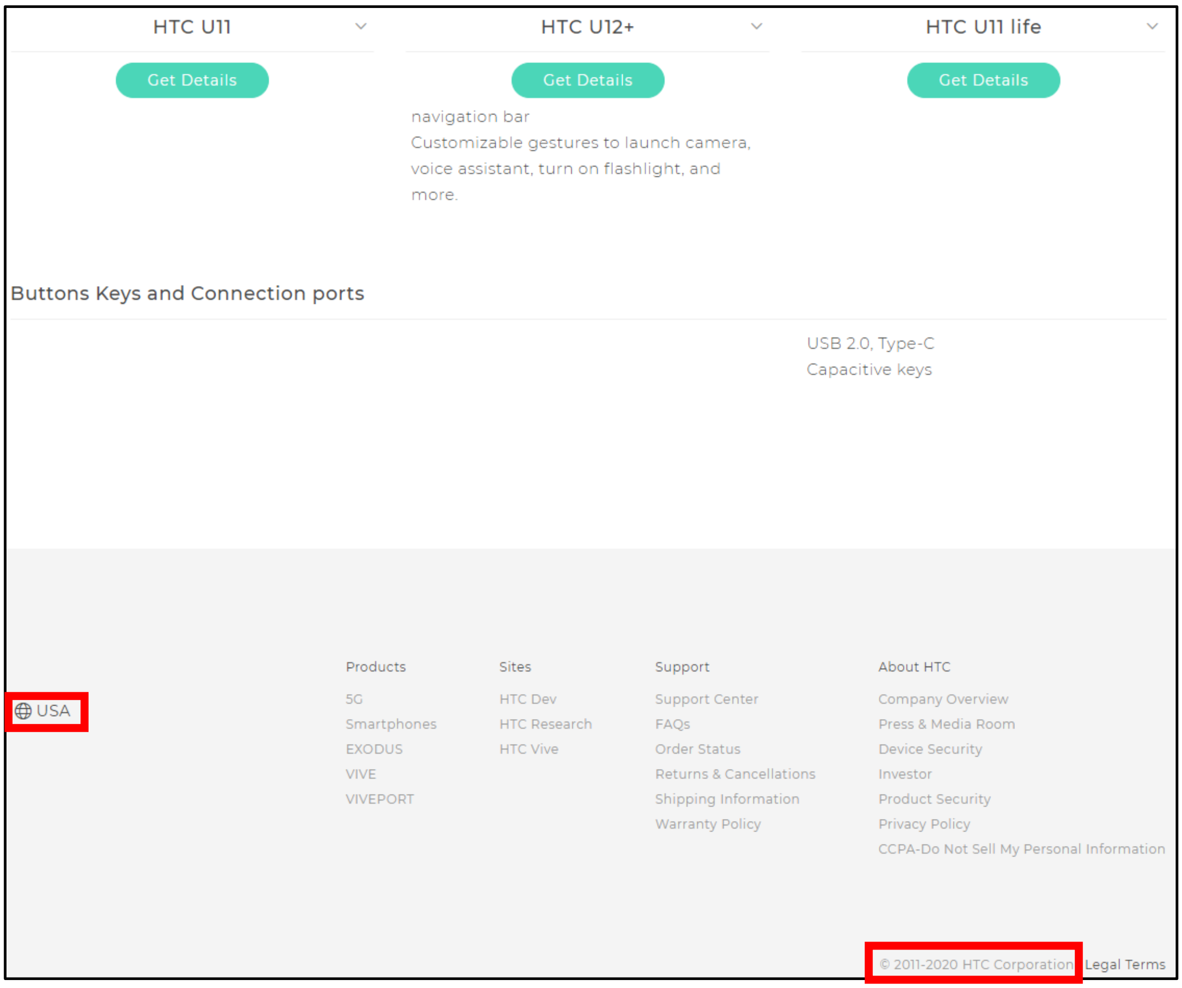
Dimensions and Weight

HTC U11	HTC U12+	HTC U11 life
153.9 x 75.9 x 7.9, 169g	Height: 156.6mm Width: 73.9mm Depth: 8.7 mm - 9.7mm (camera height included) Weight: 188g	149.09 x 72.9 x 8.1, 142g

HTC U11	HTC U12+	HTC U11 life
Get Details	Get Details	Get Details
AT&T Unlocked: 2G-GSM: (850/900/1800/1900) 3G UMTS: 900/850AWS/1900/2100 (1/2/4/5/8) 4G LTE FDD: Bands B1/B2/B3/B4/B5/B7/B8/B12/B13/B20/B25/B26/E TDD: Bands B41 With 2CA, 3CA Sprint: 2G-GSM: (850/900/1800/1900) 3G UMTS: 900/850/AWS/1900/2100 (1/2/4/5/8); CDMA Band Class 0/1/10 4G LTE FDD: Bands B2/B3/B4/B5/B7/B12/B13/B25/B26 TDD: Bands B41 With 2CA, 3CA and 4x4 MIMO VoLTE & VoWiFi calling T-Mobile Unlocked: 2G-GSM: (850/900/1800/1900) 3G UMTS: 900/850/AWS/1900/2100 (1/2/4/5/8) 4G LTE FDD: Bands B1/B2B3/B4/B5/B7/B8/B12/B13/B20/B25/B26/B: TDD: Bands B41 With 2CA, 3CA VoLTE & VoWiFi calling Verizon Unlocked: 2G-GSM: (850/900/1800/1900) 3G UMTS: 900/850/1900/2100 (1/2/5/8) 4G LTE FDD: Bands B13	Dual LTE (both SIM supports LTE) Cat. 18 Gigabit LTE, download up to 1.2 Gbps, upload up to 150 Mbps (up to 5CA Carrier Aggregation and 4x4 MIMO), Carrier dependent 2G/2.5G - GSM/GPRS/EDGE 850/900/1800/1900 MHz 3G UMTS AWS/850/900/1900/2100 (B4/B5/B8/B2/B1); HSDPA 42, HSUPA 5.76 4G LTE FDD: Bands B4/B12/B17/B28/B20/B5/B8/B3/B1/B7/B32/B2/E TDD: Bands B39/B40/B38/B41 with 2CA, 3CA, 4CA Carrier Aggregation VoLTE, Wi-Fi Calling	2G/2.5G - GSM/GPRS/EDGE 850/900/1800/1900 MHz 3G UMTS 900/850/AWS/1900/2100 (B8/B5/B4/B2/B1), HSDPA 42, HSUPA 5.76 4G LTE FDD: B1/B2/B3/B4/B5/B7/B12/B17/B13/B28/B20/B66 with 2CA, 3CA (T-Mobile and VoLTE,Wi-Fi Calling (T-Mobile and MetroPCS only) Device capable of support Cat 9 LTE, download up to 450Mbps, upload up to 50 Mbps

See Comparison | HTC United States, *available at* https://www.htc.com/us/comparison/.

42. HTC U11, HTC U12+, and HTC U11 life are used, sold, offered for sale, marketed, or imported into the United States. For example, the HTC comparison website page that is marketing HTC U11, HTC U12+, and HTC U11 life is specific as to and directed to the United States and bears a copyright in the name of "HTC Corporation":



See Comparison | HTC United States, *available at* https://www.htc.com/us/comparison/.

43. Similarly, the individual HTC website pages marketing the HTC U11, HTC U12+, and HTC U11 life are each specific as to and directed to the United States and each bear a copyright in the name of "HTC Corporation." *See* https://www.htc.com/us/smartphones/htc-u11/;

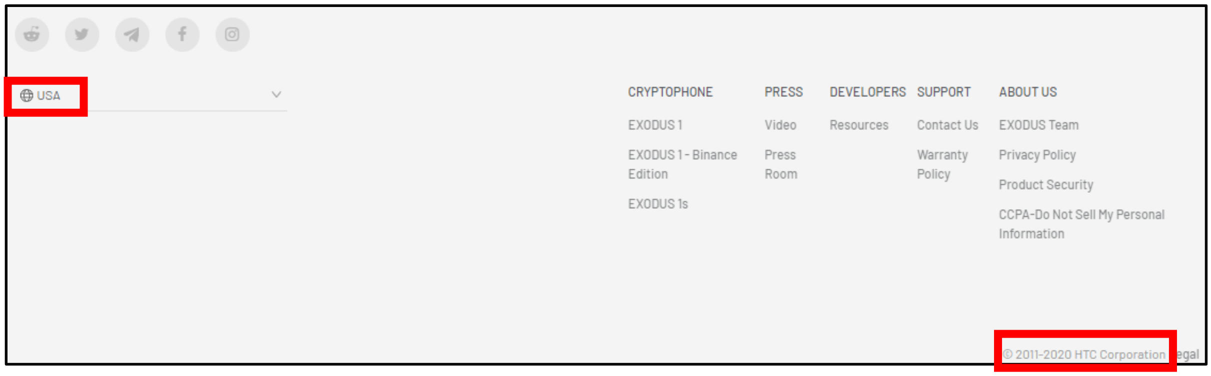
https://www.htc.com/us/smartphones/htc-u11-life/; https://www.htc.com/us/smartphones/htc-u12-plus/).

44. As further illustration, HTC EXODUS 1 is another HTC device that complies with the 3GPP LTE-A Standards:

Audio	HTC BoomSound™ Hi-Fi edition HTC USonic with Active Noise Cancellation	
Edge Sense 2	Edge Sense 2 for one-handed convenience	
Performance	Android O. Qualcomm® Snapdragon™ 845 IP68 6GB - DDR4x RAM	128GB - UFS2.1 Storage Fast charging support Zion Wallet
SIM Card And Mobile Networking	Single Nano SIM Cat. 18 Gigabit LTE, download up to 1.2 Gbps, upload up to 150 Mbps (up to 5CA Carrier Aggregation and 4x4 MIMO), 2G/2.2G/2.5G - GSM/GPRS/EDGE 850/900/1800/1900 MHz 3G UMTS AWS/850/900/1900/2100 (B4/B5/B8/B2/B1); HSDPA 42, HSUPA 5.76	4G LTE FDD: Bands B4/B12/B17/B28/B20/B5/B8/B3/B1/B7/B32/B2/B13/B66 TDD: Bands B39/B40/B38/B41 VoLTE, Wi-Fi Calling

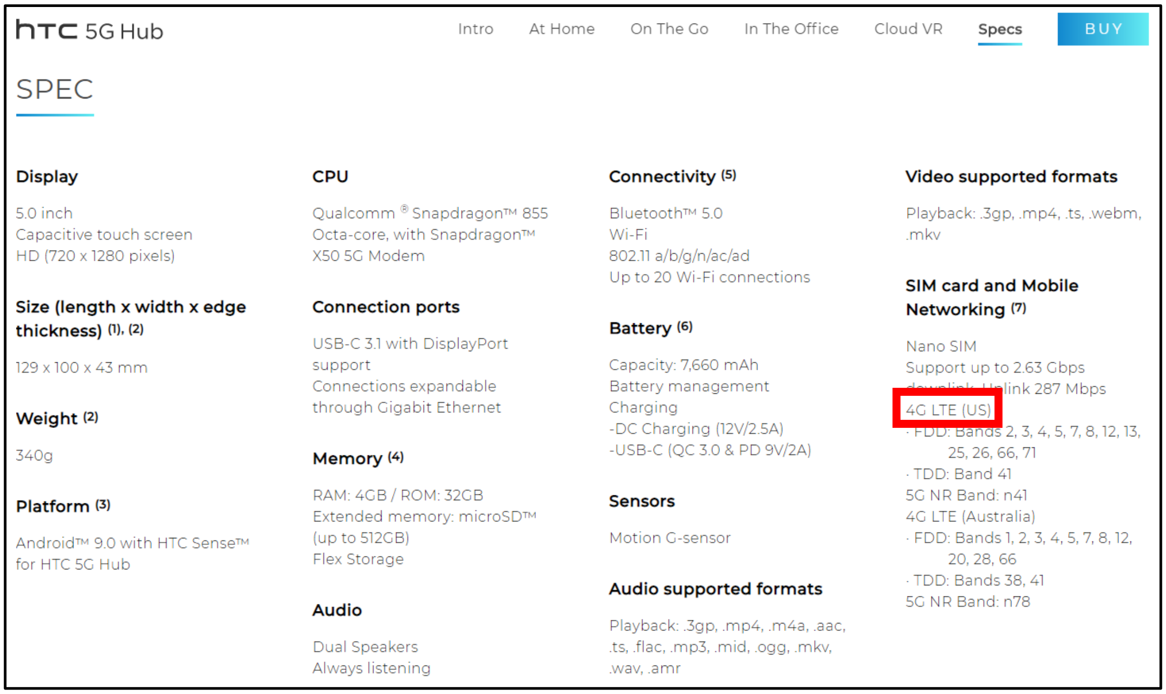
See EXODUS 1, *available at* https://www.htcexodus.com/us/cryptophone/exodus1/. HTC EXODUS 1s and HTC EXODUS 1 (Binance Edition) are other HTC devices that also comply with the 3GPP LTE-A Standards. *See* https://www.htcexodus.com/us/cryptophone/exodus1-binance/; https://www.htcexodus.com/us/cryptophone/exodus1s/.

45. HTC EXODUS, HTC EXODUS 1s, and HTC EXODUS 1 (Binance Edition) are used, sold, offered for sale, marketed, or imported into in the United States. For example, the HTC website page marketing the HTC EXODUS 1 is specific as to and directed to the United States and bears a copyright in the name of "HTC Corporation":



See EXODUS 1, *available at* https://www.htcexodus.com/us/cryptophone/exodus1/. Similarly, the HTC website pages marketing the HTC EXODUS 1s, and HTC EXODUS 1 (Binance Edition) are each specific as to and directed to the United States and each bear a copyright in the name of "HTC Corporation." *See* https://www.htcexodus.com/us/cryptophone/exodus1-binance/; https://www.htcexodus.com/us/cryptophone/exodus1s/.

46. As yet further illustration, HTC 5G Hub is another HTC device that complies with the 3GPP LTE-A Standards:



See 5G Hub, *available at* https://www.htc.com/us/5g/htc-5g-hub/.

47. HTC 5G Hub is used, sold, offered for sale, marketed, or imported into in the United States. For example, the HTC website page marketing the HTC 5G Hub is specific as to and directed to the United States and bears a copyright in the name of "HTC Corporation":

See 5G Hub, *available at* https://www.htc.com/us/5g/htc-5g-hub/.

48. On information (such as that illustrated above) and belief, other HTC Accused Instrumentalities were or are used, sold, offered for sale, marketed, or imported into in the United States. As an additional example, in an *amicus curiae* brief to the Supreme Court, HTC represented that "HTC ships and delivers finished HTC smartphones from Asia to commercial

customers worldwide, including the United States." Brief for HTC Corporation and HTC America, Inc., as *Amici Curiae* in Support of Petitioner at 6, *Impression Prods., Inc. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523 (2017) (attached as Exhibit N).

49. Prior to filing this lawsuit, SPT took steps to license its patents essential to the 3GPP LTE-Advanced standard, including the Asserted Patents, to HTC in light of HTC's infringement. In particular, SPT offered to license its patents essential to the 3GPP LTE-Advanced standard, including the Asserted Patents, to HTC on FRAND terms and conditions that comply with its ETSI IPR Licensing Declarations.

50. Nonetheless, HTC has not entered into a license with respect to the Asserted Patents and has refused to pay an appropriate royalty for SPT's standard essential patents.

51. On information and belief, HTC has had actual notice of its infringement of the Asserted Patents since at least September 21, 2018, when SPT declared the applications for the Asserted Patents standard essential in an IPR Information Statement and Licensing Declaration filed with ETSI.

52. On information and belief, HTC is or has been a 3rd Generation Partnership Project ("3GPP") member organization, or affiliated with a 3GPP member organization, and, whether as a member organization or not, has actively participated in ETSI's activities as late as November 2019.

53. Further, on February 24, 2019, SPT wrote a letter to HTC in good-faith to begin licensing discussions on SPT's LTE-Advanced standard essential patents. The Asserted Patents were all identified in an attachment to this letter.

54. On July 10, 2019, SPT met with HTC representatives in Taiwan. At this meeting, SPT provided a specific claim chart as to the '602 Patent and a specific claim chart as to the '594

Patent. At this same initial meeting, SPT offered HTC a license to patents, including the Asserted Patents, on FRAND terms.

55. To the extent HTC was not already aware of SPT's intellectual property rights, HTC has been aware of the Asserted Patents at least as early as July 10, 2019.

56. On March 10, 2020, SPT provided many claim charts for SPT's broad patent portfolio, including specific claim charts as to other Asserted Patents (the '870, '535, and '320 Patents), further detailing HTC's infringement.

57. After making the July 10, 2019 FRAND licensing offer, SPT continued to engage in good-faith negotiations with HTC to license the Asserted Patents. These negotiations continued until June 15, 2020, when HTC ceased communications with SPT. To date, HTC has yet to respond to the July 10, 2019 FRAND licensing offer.

58. In light of HTC's knowledge of SPT's essential patents and SPT's corresponding infringement theories, and unwillingness to take a license from SPT on FRAND terms, HTC's infringement of the Asserted Patents is willful. HTC knew or should have known that its actions constituted an unjustifiably high risk of infringement, yet HTC continues to commit these acts.

59. HTC has had actual notice and knowledge of all of the Asserted Patents and its infringement no later than the filing of this Amended Complaint and/or the date this Amended Complaint was served upon HTC. HTC also had actual notice of the Asserted Patents and its infringement as early as September 1, 2020, when SPT filed the Original Complaint (Dkt. No. 1) with its infringement theories as to the '602, '870, '535, and '320 Patents. HTC also had actual notice of the Asserted Patents and its infringement as early as July 10, 2019, at which time HTC was presented with SPT's infringement theories as to the '602 and '594 Patents, and as early as March 10, 2020, at which time HTC was presented with SPT's infringement theories as to the

’870, ’535, and ’320 Patents. HTC also had actual notice of the Asserted Patents as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

60. On information and belief, HTC continues without license to make, use, import into, market, offer for sale, and/or sell in the United States products that infringe the Asserted Patents.

61. In each of the Counts below, SPT has identified a representative claim for each patent to demonstrate infringement. The selections of claims, however, should not be considered limiting. SPT will disclose additional claims of the Asserted Patents that are infringed by HTC in compliance with the Court’s rules related to infringement contentions.

COUNT ONE: INFRINGEMENT OF THE ’870 PATENT

62. SPT incorporates by reference the preceding paragraphs as if fully set forth herein.

63. U.S. Patent No. 8,446,870 (“the ’870 Patent”), entitled “Wireless Communication Base Station Device, Wireless Communication Terminal Device, and Channel Allocation Method,” was legally and duly issued on May 21, 2013. *See* Exhibit A (the ’870 Patent)

64. The ’870 Patent is valid and enforceable. *See generally* Exhibit A (the ’870 Patent).

65. The inventions claimed in the ’870 Patent include methods that, in part, “improve the use efficiency of frequency in a case where communication bandwidths are asymmetric between uplink and downlink.” *Id.* at 4:56–58; *see also id.* at 4:1–9. This improvement allows for desired downlink speeds and overall performance without inefficient use of communication resources. *See id.* at 1:61–67, 2:1–4. The patent further discusses the need for LTE-Advanced

base stations to support LTE devices (or "terminals") that can use one or multiple component bands:

> An LTE+ base station supports an LTE+ system support terminal (hereinafter LTE+ terminal"). LTE+ terminals include a terminal that can perform communication using only one component band (hereinafter "type-1 LTE+ terminal") and a terminal that can perform communication using a plurality of component bands (hereinafter "type-2 LTE+ terminal"). Also, the LTE+ base station needs to support not only the above LTE+ terminal but also a terminal that supports the LTE system and that can perform communication using only one component band (hereinafter "LTE terminal"). That is, the LTE+ system is designed to be able to assign a plurality of component bands to single communication, and follows the LTE system in which single communication is independently assigned to each component band.

Id. at 2:23–36.

66. The '870 Patent is directed to patentable subject matter. *See generally* Exhibit A (the '870 Patent); Exhibit K (3GPP TS 36.211); Exhibit L (3GPP TS 36.212); Exhibit M (3GPP TS 36.213); Exhibit N (3GPP TS 36.300).

67. The '870 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the '870 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for example, by using particular resource allocations where communication bandwidths are

asymmetric between uplink and downlink. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

68. Claim 8 of the ’870 Patent is reproduced below:

> 8. A reception method to be performed by a user equipment, the method comprising:
>
> receiving downlink resource allocation information directed to the user equipment for a first downlink component carrier, which is one of a plurality of downlink component carriers used for downlink data reception, and uplink resource allocation information directed to the user equipment for one or more uplink component carrier(s) used for uplink data transmission, from information included in a first channel of the first downlink component carrier,
>
> receiving downlink resource allocation information directed to the user equipment for a second downlink component carrier, which is one of the plurality of downlink component carriers and is different from the first downlink component carrier, from information included in a second channel of the second downlink component carrier,
>
> receiving the downlink data on the first downlink component carrier in accordance with the downlink resource allocation information included in the first channel of the first downlink component carrier,
>
> receiving the downlink data on the second downlink component carrier in accordance with the downlink resource allocation information included in the second channel of the second downlink component carrier,
>
> transmitting the uplink data on the one or more uplink component carrier(s) in accordance with the uplink resource allocation information included in the first channel of the first downlink component carrier, a number of the one or more uplink component carrier(s) used for the uplink transmission being less than a number of the plurality of downlink component carriers used for the downlink data reception, and
>
> receiving, after the uplink data transmission on the one or more uplink component carrier(s), a response signal for the uplink data on the first downlink component carrier but not on the second downlink component carrier.

69. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 8 that recites “A reception method to be performed

by a user equipment, the method comprising." *See, e.g.*, Exhibit N (3GPP TS 36.300) at § 5.5 (describing UE receiving information on one or multiple Component Carriers (CCs)).

70. The Accused Instrumentalities meet the first element of Claim 8, which recites "receiving downlink resource allocation information directed to the user equipment for a first downlink component carrier, which is one of a plurality of downlink component carriers used for downlink data reception, and uplink resource allocation information directed to the user equipment for one or more uplink component carrier(s) used for uplink data transmission, from information included in a first channel of the first downlink component carrier." *See, e.g.*,:

> ## 6.8 Physical downlink control channel
>
> ### 6.8.1 PDCCH formats
>
> The physical downlink control channel carries scheduling assignments and other control information. A physical control channel is transmitted on an aggregation of one or several consecutive control channel elements (CCEs), where a control channel element corresponds to 9 resource element groups. The number of resource-element groups not assigned to PCFICH or PHICH is N_{REG}. The CCEs available in the system are numbered from 0 to $N_{\text{CCE}} - 1$, where $N_{\text{CCE}} = \lfloor N_{\text{REG}} / 9 \rfloor$. The PDCCH supports multiple formats as listed in Table 6.8.1-1. A PDCCH consisting of n consecutive CCEs may only start on a CCE fulfilling $i \bmod n = 0$, where i is the CCE number.

See Exhibit K (3GPP TS 36.211) at 66, § 6.8.1.

> ### 5.3.3 Downlink control information
>
> A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

See Exhibit L (3GPP TS 36.212) at 56, § 5.3.3.

5.5 Carrier Aggregation

In Carrier Aggregation (CA), two or more Component Carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz. A UE may simultaneously receive or transmit on one or multiple CCs depending on its capabilities:

- A Rel-10 UE with reception and/or transmission capabilities for CA can simultaneously receive and/or transmit on multiple CCs corresponding to multiple serving cells;
- A Rel-8/9 UE can receive on a single CC and transmit on a single CC corresponding to one serving cell only.

CA is supported for both contiguous and non-contiguous CCs with each CC limited to a maximum of 110 Resource Blocks in the frequency domain using the Rel-8/9 numerology.

It is possible to configure a UE to aggregate a different number of CCs originating from the same eNB and of possibly different bandwidths in the UL and the DL.

- The number of DL CCs that can be configured depends on the DL aggregation capability of the UE;
- The number of UL CCs that can be configured depends on the UL aggregation capability of the UE;
- It is not possible to configure a UE with more UL CCs than DL CCs;
- In typical TDD deployments, the number of CCs and the bandwidth of each CC in UL and DL is the same.

CCs originating from the same eNB need not to provide the same coverage.

CCs shall be LTE Rel-8/9 compatible. Nevertheless, existing mechanisms (e.g. barring) may be used to avoid Rel-8/9 UEs to camp on a CC.

The spacing between centre frequencies of contiguously aggregated CCs shall be a multiple of 300 kHz. This is in order to be compatible with the 100 kHz frequency raster of Rel-8/9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing. Depending on the aggregation scenario, the $n \times 300$ kHz spacing can be facilitated by insertion of a low number of unused subcarriers between contiguous CCs.

7.5 Carrier Aggregation

When CA is configured, the UE only has one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC).

Depending on UE capabilities, Secondary Cells (SCells) can be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC).

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 57, 92–93, §§ 5.5, 7.5, 11.1.

71. The Accused Instrumentalities meet the second element of Claim 8, which recites "receiving downlink resource allocation information directed to the user equipment for a second downlink component carrier, which is one of the plurality of downlink component carriers and is different from the first downlink component carrier, from information included in a second channel of the second downlink component carrier." *See, e.g.*,:

6.8 Physical downlink control channel

6.8.1 PDCCH formats

The physical downlink control channel carries scheduling assignments and other control information. A physical control channel is transmitted on an aggregation of one or several consecutive control channel elements (CCEs), where a control channel element corresponds to 9 resource element groups. The number of resource-element groups not assigned to PCFICH or PHICH is N_{REG}. The CCEs available in the system are numbered from 0 to $N_{\text{CCE}} - 1$, where $N_{\text{CCE}} = \lfloor N_{\text{REG}} / 9 \rfloor$. The PDCCH supports multiple formats as listed in Table 6.8.1-1. A PDCCH consisting of n consecutive CCEs may only start on a CCE fulfilling $i \bmod n = 0$, where i is the CCE number.

See Exhibit K (3GPP TS 36.211) at 66, § 6.8.1.

5.3.3 Downlink control information

A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

See Exhibit L (3GPP TS 36.212) at 56, § 5.3.3.

5.5 Carrier Aggregation

In Carrier Aggregation (CA), two or more Component Carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz. A UE may simultaneously receive or transmit on one or multiple CCs depending on its capabilities:

- A Rel-10 UE with reception and/or transmission capabilities for CA can simultaneously receive and/or transmit on multiple CCs corresponding to multiple serving cells;
- A Rel-8/9 UE can receive on a single CC and transmit on a single CC corresponding to one serving cell only.

CA is supported for both contiguous and non-contiguous CCs with each CC limited to a maximum of 110 Resource Blocks in the frequency domain using the Rel-8/9 numerology.

It is possible to configure a UE to aggregate a different number of CCs originating from the same eNB and of possibly different bandwidths in the UL and the DL.

- The number of DL CCs that can be configured depends on the DL aggregation capability of the UE;
- The number of UL CCs that can be configured depends on the UL aggregation capability of the UE;
- It is not possible to configure a UE with more UL CCs than DL CCs;
- In typical TDD deployments, the number of CCs and the bandwidth of each CC in UL and DL is the same.

CCs originating from the same eNB need not to provide the same coverage.

CCs shall be LTE Rel-8/9 compatible. Nevertheless, existing mechanisms (e.g. barring) may be used to avoid Rel-8/9 UEs to camp on a CC.

The spacing between centre frequencies of contiguously aggregated CCs shall be a multiple of 300 kHz. This is in order to be compatible with the 100 kHz frequency raster of Rel-8/9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing. Depending on the aggregation scenario, the $n \times 300$ kHz spacing can be facilitated by insertion of a low number of unused subcarriers between contiguous CCs.

7.5 Carrier Aggregation

When CA is configured, the UE only has one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC).

Depending on UE capabilities, Secondary Cells (SCells) can be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC).

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 57, 92–93, §§ 5.5, 7.5, 11.1.

72. The Accused Instrumentalities meet the third element of Claim 8, which recites "receiving the downlink data on the first downlink component carrier in accordance with the downlink resource allocation information included in the first channel of the first downlink component carrier." *See, e.g.*,:

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 92–93, § 11.1.

73. The Accused Instrumentalities meet the fourth element of Claim 8, which recites "receiving the downlink data on the second downlink component carrier in accordance with the downlink resource allocation information included in the second channel of the second downlink component carrier." *See, e.g.*,:

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;

- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 92–93, § 11.1.

74. The Accused Instrumentalities meet the fifth element of Claim 8, which recites "transmitting the uplink data on the one or more uplink component carrier(s) in accordance with the uplink resource allocation information included in the first channel of the first downlink component carrier, a number of the one or more uplink component carrier(s) used for the uplink transmission being less than a number of the plurality of downlink component carriers used for the downlink data reception." *See, e.g.*,:

5.5 Carrier Aggregation

In Carrier Aggregation (CA), two or more Component Carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz. A UE may simultaneously receive or transmit on one or multiple CCs depending on its capabilities:

- A Rel-10 UE with reception and/or transmission capabilities for CA can simultaneously receive and/or transmit on multiple CCs corresponding to multiple serving cells;
- A Rel-8/9 UE can receive on a single CC and transmit on a single CC corresponding to one serving cell only.

CA is supported for both contiguous and non-contiguous CCs with each CC limited to a maximum of 110 Resource Blocks in the frequency domain using the Rel-8/9 numerology.

It is possible to configure a UE to aggregate a different number of CCs originating from the same eNB and of possibly different bandwidths in the UL and the DL.

- The number of DL CCs that can be configured depends on the DL aggregation capability of the UE;
- The number of UL CCs that can be configured depends on the UL aggregation capability of the UE;
- It is not possible to configure a UE with more UL CCs than DL CCs;
- In typical TDD deployments, the number of CCs and the bandwidth of each CC in UL and DL is the same.

CCs originating from the same eNB need not to provide the same coverage.

CCs shall be LTE Rel-8/9 compatible. Nevertheless, existing mechanisms (e.g. barring) may be used to avoid Rel-8/9 UEs to camp on a CC.

The spacing between centre frequencies of contiguously aggregated CCs shall be a multiple of 300 kHz. This is in order to be compatible with the 100 kHz frequency raster of Rel-8/9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing. Depending on the aggregation scenario, the $n \times 300$ kHz spacing can be facilitated by insertion of a low number of unused subcarriers between contiguous CCs.

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 92–93, §§ 5.5, 11.1.

75. The Accused Instrumentalities meet the sixth element of Claim 8, which recites "receiving, after the uplink data transmission on the one or more uplink component carrier(s), a response signal for the uplink data on the first downlink component carrier but not on the second downlink component carrier." *See, e.g.*,:

6.9 Physical hybrid ARQ indicator channel

The PHICH carries the hybrid-ARQ ACK/NACK. Multiple PHICHs mapped to the same set of resource elements constitute a PHICH group, where PHICHs within the same PHICH group are separated through different orthogonal sequences. A PHICH resource is identified by the index pair $\left(n_{\mathrm{PHICH}}^{\mathrm{group}}, n_{\mathrm{PHICH}}^{\mathrm{seq}}\right)$, where $n_{\mathrm{PHICH}}^{\mathrm{group}}$ is the PHICH group number and $n_{\mathrm{PHICH}}^{\mathrm{seq}}$ is the orthogonal sequence index within the group.

See Exhibit K (3GPP TS 36.211) at 68, § 6.9.

9.1.2 PHICH Assignment Procedure

For PUSCH transmissions scheduled from serving cell c in subframe n, a UE shall determine the corresponding PHICH resource of serving cell c in subframe $n+k_{PHICH}$, where k_{PHICH} is always 4 for FDD and is given in table 9.1.2-1 for TDD. For subframe bundling operation, the corresponding PHICH resource is associated with the last subframe in the bundle.

See Exhibit M (3GPP TS 36.213) at 95, § 9.1.2.

76. HTC directly infringes Claim 8 of the '870 Patent. The Accused Instrumentalities, by complying with TS 36.211, TS 36.212, TS 36.213, and TS 36.300, meet every element of Claim 8. Claim 8 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 8 without any initiation or involvement by the end user. *See SiRF Tech., Inc. v. ITC*, 601 F.3d 1319, 1329–31 (Fed. Cir. 2010). The Accused Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 8 because the Accused

Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

77. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

78. HTC also indirectly infringes Claim 8 of the '870 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 8 of the '870 Patent, in violation of 35 U.S.C. § 271(b).

79. HTC induced these third parties' direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 8 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused

Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

80. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’870 Patent and the fact that the ’870 Patent would be essential to the use of the applicable LTE standards. HTC was also aware as early as March 10, 2020 of SPT’s specific infringement theories as to the ’870 Patent when SPT presented HTC with specific claim charts, and in any event, by no later than the filing or service of the Original Complaint (Dkt. No. 1) on September 1, 2020. HTC also had actual notice of the ’870 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

81. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 8 of the ’870 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’870 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’870 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

82. For the same reasons, HTC’s infringement of the ’870 Patent has been willful. Despite its knowledge or willful blindness to the ’870 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT’s good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT’s rights.

83. SPT has been and continues to be damaged by HTC's infringement of the '870 Patent.

84. HTC's infringement of the '870 Patent is exceptional, and SPT is entitled to recover reasonable attorneys' fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

COUNT TWO: INFRINGEMENT OF THE '602 PATENT

85. SPT incorporates by reference the preceding paragraphs as if fully set forth herein.

86. U.S. Patent No. 8,681,602 ("the '602 Patent"), entitled "Terminal Device and Retransmission Control Method," was legally and duly issued on March 25, 2014. *See* Exhibit B (the '602 Patent).

87. The '602 Patent is valid and enforceable. *See generally* Exhibit B (the '602 Patent).

88. The '602 Patent describes inventive methods that improve the efficiency of uplink communication between a mobile terminal and a base station while still using a plurality of downlink unit bands to increase downlink performance. *Id.* at 6:57–67, 7:1–2. As illustrated in the patent, prior methods resulted in "wastefu[l] increases" of the "overhead of the uplink control channel (PUCCH)," because "three PUCCH resources among the four PUCCH resources are always not used in a certain sub frame." *Id.* at 6:55–56, 61–62. The '602 claims a "retransmission control method" "capable of suppressing an increase in the overhead of the uplink control channel (PUCCH)" while allowing for good downlink performance. *Id.* at 7:64–67, 8:1–2.

89. The ’602 Patent is directed to patentable subject matter. *See generally* Exhibit B (the ’602 Patent); Exhibit K (3GPP TS 36.211); Exhibit L (3GPP TS 36.212); Exhibit M (3GPP TS 36.213); Exhibit N (3GPP TS 36.300); Exhibit O (3GPP TS 36.321).

90. The ’602 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the ’602 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for example, by minimizing increases in overhead and thus increasing downlink bandwidth. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

91. Claim 14 of the ’602 Patent is reproduced below:

> 14. A method for transmitting a response signal from a terminal configured with one or more downlink component carriers, the method comprising:
>
> detecting downlink assignment information indicating a resource for downlink data, the resource being assigned to each of the downlink component carriers;
>
> decoding the downlink data, which is transmitted in the resource indicated by the detected downlink assignment information;
>
> transmitting a response signal for the decoded downlink data; and
>
> transmitting a scheduling request (SR),
>
> wherein:

the response signal denotes an outcome of the decoding of the downlink data, or denotes a Discontinuous Transmission (DTX) representing that the outcome is not transmitted;

when a plurality of downlink component carriers are configured, response signals for a plurality of downlink data in the downlink component carriers are transmitted;

when the response signals are transmitted, the response signals are transmitted using a phase point and one of the uplink control channel resources for the response signals depending on an outcome of the decoding of each of the plurality of downlink data; and

when both the response signals and the SR are transmitted in a same sub-frame, the response signals are transmitted using the phase point and an uplink control channel resource for the SR depending on an outcome of the decoding of each of the plurality of downlink data.

92. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 14, which recites "A method for transmitting a response signal from a terminal configured with one or more downlink component carriers, the method comprising." *See, e.g.*,:

10.1.2 FDD HARQ-ACK feedback procedures

For FDD and for a UE transmitting HARQ-ACK using PUCCH format 1b with channel selection or PUCCH format 3, the UE shall determine the number of HARQ-ACK bits, O, based on the number of configured serving cells and the downlink transmission modes configured for each serving cell. The UE shall use two HARQ-ACK bits for a serving cell configured with a downlink transmission mode that support up to two transport blocks; and one HARQ-ACK bit otherwise.

A UE that supports aggregating at most 2 serving cells with frame structure type 1 shall use PUCCH format 1b with channel selection for transmission of HARQ-ACK when configured with more than one serving cell with frame structure type 1.

A UE that supports aggregating more than 2 serving cells with frame structure type 1 is configured by higher layers to use either PUCCH format 1b with channel selection or PUCCH format 3 for transmission of HARQ-ACK when configured with more than one serving cell with frame structure type 1.

The FDD HARQ-ACK feedback procedure for one configured serving cell is given in subclause 10.1.2.1 and procedures for more than one configured serving cell are given in subclause 10.1.2.2.

See Exhibit M (3GPP TS 36.213) at 101, § 10.1.2.

7.5 Carrier Aggregation

When CA is configured, the UE only has one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC).

Depending on UE capabilities, Secondary Cells (SCells) can be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC).

The configured set of serving cells for a UE therefore always consists of one PCell and one or more SCells:

- For each SCell the usage of uplink resources by the UE in addition to the downlink ones is configurable (the number of DL SCCs configured is therefore always larger than or equal to the number of UL SCCs and no SCell can be configured for usage of uplink resources only);

See Exhibit N (3GPP TS 36.300) at 57, § 7.5.

93. The Accused Instrumentalities meet the first element of Claim 14, which recites "detecting downlink assignment information indicating a resource for downlink data, the resource being assigned to each of the downlink component carriers." *See, e.g.*,:

5.3.3.1 DCI formats

The fields defined in the DCI formats below are mapped to the information bits a_0 to a_{A-1} as follows.

Each field is mapped in the order in which it appears in the description, including the zero-padding bit(s), if any, with the first field mapped to the lowest order information bit a_0 and each successive field mapped to higher order information bits. The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to a_0.

5.3.3.1.2 Format 1

DCI format 1 is used for the scheduling of one PDSCH codeword in one cell.

The following information is transmitted by means of the DCI format 1:

- Carrier indicator – 0 or 3 bits. This field is present according to the definitions in [3].
- Resource allocation header (resource allocation type 0 / type 1) – 1 bit as defined in section 7.1.6 of [3]

  If downlink bandwidth is less than or equal to 10 PRBs, there is no resource allocation header and resource allocation type 0 is assumed.

- Resource block assignment:

See Exhibit L (3GPP TS 36.212) at 57–58, § 5.3.3.1.2.

7.1 UE procedure for receiving the physical downlink shared channel

Except the subframes indicated by the higher layer parameter *mbsfn-SubframeConfigList*, a UE shall upon detection of a PDCCH of a serving cell with DCI format 1, 1A, 1B, 1C, 1D, 2, 2A, 2B or 2C intended for the UE in a subframe, decode the corresponding PDSCH in the same subframe with the restriction of the number of transport blocks defined in the higher layers.

7.1.6 Resource allocation

The UE shall interpret the resource allocation field depending on the PDCCH DCI format detected. A resource allocation field in each PDCCH includes two parts, a resource allocation header field and information consisting of the actual resource block assignment. PDCCH DCI formats 1, 2, 2A, 2B and 2C with type 0 and PDCCH DCI formats 1, 2, 2A,2B and 2C with type 1 resource allocation have the same format and are distinguished from each other via the single bit resource allocation header field which exists depending on the downlink system bandwidth (subclause 5.3.3.1 of [4]), where type 0 is indicated by 0 value and type 1 is indicated otherwise. PDCCH with DCI format 1A, 1B, 1C and 1D have a type 2 resource allocation while PDCCH with DCI format 1, 2, 2A, 2B and 2C have type 0 or type 1 resource allocation. PDCCH DCI formats with a type 2 resource allocation do not have a resource allocation header field.

See Exhibit M (3GPP TS 36.213) at 24, 29–30, §§ 7.1, 7.1.6.

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on SCell_n corresponds to downlink transmission on SCell_n;
- UL grant received on SCell_n corresponds to uplink transmission on SCell_n. If SCell_n is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 92–93, § 11.1.

94. The Accused Instrumentalities meet the second element of Claim 14, which recites "decoding the downlink data, which is transmitted in the resource indicated by the detected downlink assignment information." *See, e.g.*,:

> 5.3.3.1 DCI formats
>
> The fields defined in the DCI formats below are mapped to the information bits a_0 to a_{A-1} as follows.
>
> Each field is mapped in the order in which it appears in the description, including the zero-padding bit(s), if any, with the first field mapped to the lowest order information bit a_0 and each successive field mapped to higher order information bits. The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to a_0.

> 5.3.3.1.2 Format 1
>
> DCI format 1 is used for the scheduling of one PDSCH codeword in one cell.
>
> The following information is transmitted by means of the DCI format 1:
>
> - Carrier indicator – 0 or 3 bits. This field is present according to the definitions in [3].
>
> - Resource allocation header (resource allocation type 0 / type 1) – 1 bit as defined in section 7.1.6 of [3]
>
> If downlink bandwidth is less than or equal to 10 PRBs, there is no resource allocation header and resource allocation type 0 is assumed.
>
> - Resource block assignment:

See Exhibit L (3GPP TS 36.212) at 57–58, § 5.3.3.1.2.

> 7.1 UE procedure for receiving the physical downlink shared channel
>
> Except the subframes indicated by the higher layer parameter *mbsfn-SubframeConfigList*, a UE shall upon detection of a PDCCH of a serving cell with DCI format 1, 1A, 1B, 1C, 1D, 2, 2A, 2B or 2C intended for the UE in a subframe, decode the corresponding PDSCH in the same subframe with the restriction of the number of transport blocks defined in the higher layers.

See Exhibit M (3GPP TS 36.213) at 24, § 7.1.

95. The Accused Instrumentalities meet the third element of Claim 14, which recites "transmitting a response signal for the decoded downlink data; and transmitting a scheduling request (SR)." *See, e.g.*,:

7.3 UE procedure for reporting HARQ-ACK

For FDD with PUCCH format 1a/1b transmission, when both HARQ-ACK and SR are transmitted in the same sub-frame, a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH format 1a/1b resource for a negative SR transmission and transmit the HARQ-ACK on its assigned SR PUCCH resource for a positive SR transmission.

For FDD with PUCCH format 1b with channel selection, when both HARQ-ACK and SR are transmitted in the same sub-frame a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH resource with channel selection as defined in subclause 10.1.2.2.1 for a negative SR transmission and transmit one HARQ-ACK bit per serving cell on its assigned SR PUCCH resource for a positive SR transmission according to the following:

- if only one transport block or a PDCCH indicating downlink SPS release is detected on a serving cell, the HARQ-ACK bit for the serving cell is the HARQ-ACK bit corresponding to the transport block or the PDCCH indicating downlink SPS release;
- if two transport blocks are received on a serving cell, the HARQ-ACK bit for the serving cell is generated by spatially bundling the HARQ-ACK bits corresponding to the transport blocks;
- if neither PDSCH transmission for which HARQ-ACK response shall be provided nor PDCCH indicating downlink SPS release is detected for a serving cell, the HARQ-ACK bit for the serving cell is set to NACK;

and the HARQ-ACK bits for the primary cell and the secondary cell are mapped to $b(0)$ and $b(1)$, respectively, where $b(0)$ and $b(1)$ are specified in subclause 5.4.1 in [3]..

10.1.5 Scheduling Request (SR) procedure

A UE is configured by higher layers to transmit the scheduling request (SR) on one antenna port or two antenna ports. The scheduling request shall be transmitted on the PUCCH resource(s) $n_{\text{PUCCH}}^{(1,\tilde{p})} = n_{\text{PUCCH,SRI}}^{(1,\tilde{p})}$ for $\tilde{p}$ mapped to antenna port p as defined in [3], where $n_{\text{PUCCH,SRI}}^{(1,\tilde{p})}$ is configured by higher layers unless the SR coincides in time with the transmission of HARQ-ACK using PUCCH Format 3 in which case the SR is multiplexed with HARQ-ACK according to subclause 5.2.3.1 of [4]. The SR configuration for SR transmission periodicity $SR_{\text{PERIODICITY}}$ and SR subframe offset $N_{\text{OFFSET,SR}}$ is defined in Table 10.1.5-1 by the parameter *sr-ConfigIndex* I_{SR} given by higher layers.

See Exhibit M (3GPP TS 36.213) at 70, 120, §§ 7.3, 10.1.5.

96. The Accused Instrumentalities meet the fourth element of Claim 14, which recites "wherein: the response signal denotes an outcome of the decoding of the downlink data, or denotes a Discontinuous Transmission (DTX) representing that the outcome is not transmitted." *See, e.g.,*:

10.1.2.2.1 PUCCH format 1b with channel selection HARQ-ACK procedure

For FDD with two configured serving cells and PUCCH format 1b with channel selection, the UE shall transmit $b(0)b(1)$ on PUCCH resource $n^{(1)}_{\text{PUCCH}}$ selected from A PUCCH resources, $n^{(1)}_{\text{PUCCH},j}$ where $0 \le j \le A-1$ and $A \in \{2,3,4\}$, according to Table 10.1.2.2.1-3, Table 10.1.2.2.1-4, Table 10.1.2.2.1-5 in subframe n using PUCCH format 1b. HARQ-ACK(j) denotes the ACK/NACK/DTX response for a transport block or SPS release PDCCH associated with serving cell c, where the transport block and serving cell for HARQ-ACK(j) and A PUCCH resources are given by Table 10.1.2.2.1-1.

See Exhibit M (3GPP TS 36.213) at 102, § 10.1.2.2.1.

5.3 DL-SCH data transfer

5.3.2.2 HARQ process

The UE then shall:

- if this is a new transmission:
  - attempt to decode the received data.
- else if this is a retransmission:
  - if the data for this TB has not yet been successfully decoded:
    - combine the received data with the data currently in the soft buffer for this TB and attempt to decode the combined data.
- if the data which the UE attempted to decode was successfully decoded for this TB; or
- if the data for this TB was successfully decoded before:
  - if the HARQ process is equal to the broadcast process:
    - deliver the decoded MAC PDU to upper layers.
  - else if this is the first successful decoding of the data for this TB:
    - deliver the decoded MAC PDU to the disassembly and demultiplexing entity.
  - generate a positive acknowledgement (ACK) of the data in this TB.
- else:
  - replace the data in the soft buffer for this TB with the data which the UE attempted to decode.
  - generate a negative acknowledgement (NACK) of the data in this TB.

See Exhibit O (3GPP TS 36.321) at 20, § 5.3.2.2.

97. The Accused Instrumentalities meet the fifth element of Claim 14, which recites "when a plurality of downlink component carriers are configured, response signals for a plurality of downlink data in the downlink component carriers are transmitted." *See, e.g.*,:

10.1.2.2.1 PUCCH format 1b with channel selection HARQ-ACK procedure

For FDD with two configured serving cells and PUCCH format 1b with channel selection, the UE shall transmit $b(0)b(1)$ on PUCCH resource $n^{(1)}_{PUCCH}$ selected from A PUCCH resources, $n^{(1)}_{PUCCH,j}$ where $0 \le j \le A-1$ and $A \in \{2,3,4\}$, according to Table 10.1.2.2.1-3, Table 10.1.2.2.1-4, Table 10.1.2.2.1-5 in subframe n using PUCCH format 1b. HARQ-ACK(j) denotes the ACK/NACK/DTX response for a transport block or SPS release PDCCH associated with serving cell c, where the transport block and serving cell for HARQ-ACK(j) and A PUCCH resources are given by Table 10.1.2.2.1-1.

Table 10.1.2.2.1-1: Mapping of Transport Block and Serving Cell to HARQ-ACK(*j*) for PUCCH format 1b HARQ-ACK channel selection

A	*HARQ-ACK(j)*			
	HARQ-ACK(0)	HARQ-ACK(1)	HARQ-ACK(2)	HARQ-ACK(3)
2	TB1 Primary cell	TB1 Secondary cell	NA	NA
3	TB1 Serving cell1	TB2 Serving cell1	TB1 Serving cell2	NA
4	TB1 Primary cell	TB2 Primary cell	TB1 Secondary cell	TB2 Secondary cell

Table 10.1.2.2.1-3: Transmission of Format 1b HARQ-ACK channel selection for $A=2$

HARQ-ACK(0)	HARQ-ACK(1)	$n^{(1)}_{PUCCH}$	$b(0)b(1)$
ACK	ACK	$n^{(1)}_{PUCCH,1}$	1,1
ACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,1
NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	0,0
NACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0,0
DTX	NACK/DTX	No Transmission	

See Exhibit M (3GPP TS 36.213) at 102–03, § 10.1.2.2.1.

98. The Accused Instrumentalities meet the sixth element of Claim 14, which recites "when the response signals are transmitted, the response signals are transmitted using a phase point and one of the uplink control channel resources for the response signals depending on an outcome of the decoding of each of the plurality of downlink data." *See, e.g.*,:

7.1.2 QPSK

In case of QPSK modulation, pairs of bits, $b(i), b(i+1)$, are mapped to complex-valued modulation symbols $x=I+jQ$ according to Table 7.1.2-1.

Table 7.1.2-1: QPSK modulation mapping.

$b(i), b(i+1)$	I	Q
00	$1/\sqrt{2}$	$1/\sqrt{2}$
01	$1/\sqrt{2}$	$-1/\sqrt{2}$
10	$-1/\sqrt{2}$	$1/\sqrt{2}$
11	$-1/\sqrt{2}$	$-1/\sqrt{2}$

See Exhibit K (3GPP TS 36.211) at 95, § 7.1.2.

7.3 UE procedure for reporting HARQ-ACK

For FDD with PUCCH format 1a/1b transmission, when both HARQ-ACK and SR are transmitted in the same sub-frame, a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH format 1a/1b resource for a negative SR transmission and transmit the HARQ-ACK on its assigned SR PUCCH resource for a positive SR transmission.

For FDD with PUCCH format 1b with channel selection, when both HARQ-ACK and SR are transmitted in the same sub-frame a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH resource with channel selection as defined in subclause 10.1.2.2.1 for a negative SR transmission and transmit one HARQ-ACK bit per serving cell on its assigned SR PUCCH resource for a positive SR transmission according to the following:

- if only one transport block or a PDCCH indicating downlink SPS release is detected on a serving cell, the HARQ-ACK bit for the serving cell is the HARQ-ACK bit corresponding to the transport block or the PDCCH indicating downlink SPS release;
- if two transport blocks are received on a serving cell, the HARQ-ACK bit for the serving cell is generated by spatially bundling the HARQ-ACK bits corresponding to the transport blocks;
- if neither PDSCH transmission for which HARQ-ACK response shall be provided nor PDCCH indicating downlink SPS release is detected for a serving cell, the HARQ-ACK bit for the serving cell is set to NACK;

and the HARQ-ACK bits for the primary cell and the secondary cell are mapped to $b(0)$ and $b(1)$, respectively, where $b(0)$ and $b(1)$ are specified in subclause 5.4.1 in [3]..

10.1.2.2.1 PUCCH format 1b with channel selection HARQ-ACK procedure

For FDD with two configured serving cells and PUCCH format 1b with channel selection, the UE shall transmit $b(0)b(1)$ on PUCCH resource $n^{(1)}_{\text{PUCCH}}$ selected from A PUCCH resources, $n^{(1)}_{\text{PUCCH},j}$ where $0 \le j \le A-1$ and $A \in \{2,3,4\}$, according to Table 10.1.2.2.1-3, Table 10.1.2.2.1-4, Table 10.1.2.2.1-5 in subframe n using PUCCH format 1b. HARQ-ACK(j) denotes the ACK/NACK/DTX response for a transport block or SPS release PDCCH associated with serving cell c, where the transport block and serving cell for HARQ-ACK(j) and A PUCCH resources are given by Table 10.1.2.2.1-1.

Table 10.1.2.2.1-3: Transmission of Format 1b HARQ-ACK channel selection for $A = 2$

HARQ-ACK(0)	HARQ-ACK(1)	$n^{(1)}_{\text{PUCCH}}$	$b(0)b(1)$
ACK	ACK	$n^{(1)}_{\text{PUCCH},1}$	1,1
ACK	NACK/DTX	$n^{(1)}_{\text{PUCCH},0}$	1,1
NACK/DTX	ACK	$n^{(1)}_{\text{PUCCH},1}$	0,0
NACK	NACK/DTX	$n^{(1)}_{\text{PUCCH},0}$	0,0
DTX	NACK/DTX	No Transmission	

See Exhibit M (3GPP TS 36.213) at 70, 102–03, §§ 7.3, 10.1.2.2.1.

99. The Accused Instrumentalities meet the last element of Claim 14, which recites "when both the response signals and the SR are transmitted in a same sub-frame, the response signals are transmitted using the phase point and an uplink control channel resource for the SR depending on an outcome of the decoding of each of the plurality of downlink data." *See, e.g.,*:

7.1.2 QPSK

In case of QPSK modulation, pairs of bits, $b(i), b(i+1)$, are mapped to complex-valued modulation symbols $x=I+jQ$ according to Table 7.1.2-1.

Table 7.1.2-1: QPSK modulation mapping.

$b(i), b(i+1)$	I	Q
00	$1/\sqrt{2}$	$1/\sqrt{2}$
01	$1/\sqrt{2}$	$-1/\sqrt{2}$
10	$-1/\sqrt{2}$	$1/\sqrt{2}$
11	$-1/\sqrt{2}$	$-1/\sqrt{2}$

See Exhibit K (3GPP TS 36.211) at 95, § 7.1.2.

5.2.3.1 Channel coding for UCI HARQ-ACK

The HARQ-ACK bits are received from higher layers for each subframe of each cell. Each positive acknowledgement (ACK) is encoded as a binary '1' and each negative acknowledgement (NACK) is encoded as a binary '0'. For the case where PUCCH format 3 [2] is configured by higher layers and is used for transmission of the HARQ-ACK feedback information, the HARQ-ACK feedback consists of the concatenation of HARQ-ACK bits for each of the serving cells.

TS 36.212 § 5.2.3.1, Ex. M at 41.

7.3 UE procedure for reporting HARQ-ACK

For FDD with PUCCH format 1a/1b transmission, when both HARQ-ACK and SR are transmitted in the same sub-frame, a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH format 1a/1b resource for a negative SR transmission and transmit the HARQ-ACK on its assigned SR PUCCH resource for a positive SR transmission.

For FDD with PUCCH format 1b with channel selection, when both HARQ-ACK and SR are transmitted in the same sub-frame a UE shall transmit the HARQ-ACK on its assigned HARQ-ACK PUCCH resource with channel selection as defined in subclause 10.1.2.2.1 for a negative SR transmission and transmit one HARQ-ACK bit per serving cell on its assigned SR PUCCH resource for a positive SR transmission according to the following:

- if only one transport block or a PDCCH indicating downlink SPS release is detected on a serving cell, the HARQ-ACK bit for the serving cell is the HARQ-ACK bit corresponding to the transport block or the PDCCH indicating downlink SPS release;
- if two transport blocks are received on a serving cell, the HARQ-ACK bit for the serving cell is generated by spatially bundling the HARQ-ACK bits corresponding to the transport blocks;
- if neither PDSCH transmission for which HARQ-ACK response shall be provided nor PDCCH indicating downlink SPS release is detected for a serving cell, the HARQ-ACK bit for the serving cell is set to NACK;

and the HARQ-ACK bits for the primary cell and the secondary cell are mapped to $b(0)$ and $b(1)$ respectively, where $b(0)$ and $b(1)$ are specified in subclause 5.4.1 in [3]..

10.1.5 Scheduling Request (SR) procedure

A UE is configured by higher layers to transmit the scheduling request (SR) on one antenna port or two antenna ports. The scheduling request shall be transmitted on the PUCCH resource(s) $n_{\text{PUCCH}}^{(1,\tilde{p})} = n_{\text{PUCCH,SRI}}^{(1,\tilde{p})}$ for $\tilde{p}$ mapped to antenna port p as defined in [3], where $n_{\text{PUCCH,SRI}}^{(1,\tilde{p})}$ is configured by higher layers unless the SR coincides in time with the transmission of HARQ-ACK using PUCCH Format 3 in which case the SR is multiplexed with HARQ-ACK according to subclause 5.2.3.1 of [4]. The SR configuration for SR transmission periodicity $SR_{\text{PERIODICITY}}$ and SR subframe offset $N_{\text{OFFSET,SR}}$ is defined in Table 10.1.5-1 by the parameter *sr-ConfigIndex* I_{SR} given by higher layers.

See Exhibit L (3GPP TS 36.212) at 70, 120, §§ 7.3, 10.1.5.

100. HTC directly infringes Claim 14 of the '602 Patent. The Accused Instrumentalities, by complying with TS 36.211, TS 36.212, TS 36.213, TS 36.300, and TS

36.321, meet every element of Claim 14. Claim 14 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 14 without any initiation or involvement by the end user. *See SiRF Tech.*, 601 F.3d at 1329–31. The Accused Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 14 because the Accused Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

101. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

102. HTC also indirectly infringes Claim 14 of the '602 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 14 of the '602 Patent, in violation of 35 U.S.C. § 271(b).

103. HTC induced these third parties' direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 14 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction

manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

104. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’602 Patent and the fact that the ’602 Patent would be essential to the use of the applicable LTE standards. HTC was also aware as early as July 10, 2019 of SPT’s specific infringement theories as to the ’602 Patent when SPT presented HTC with specific claim charts, and in any event, by no later than the filing or service of the Original Complaint (Dkt. No. 1) on September 1, 2020. HTC also had actual notice of the ’602 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

105. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 14 of the ’602 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’602 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’602 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

106. For the same reasons, HTC's infringement of the '602 Patent has been willful. Despite its knowledge or willful blindness to the '602 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT's good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT's rights.

107. SPT has been and continues to be damaged by HTC's infringement of the '602 Patent.

108. HTC's infringement of the '602 Patent is exceptional, and SPT is entitled to recover reasonable attorneys' fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

COUNT THREE: INFRINGEMENT OF THE '535 PATENT

109. SPT incorporates by reference the preceding paragraphs as if fully set forth herein.

110. U.S. Patent No. 9,055,535 ("the '535 Patent"), entitled "Wireless Communication Device and Method for Controlling Transmission Power," was legally and duly issued on June 9, 2015. *See* Exhibit C (the '535 Patent).

111. The '535 Patent is valid and enforceable. *See generally* Exhibit C (the '535 Patent).

112. The patent discloses that, on the LTE-Advanced network,

> [A] base station must know the status of the propagation path between each antenna of a terminal and each antenna of the base station. Hence, the terminal must transmit an SRS to the base station from each antenna.
>
> . . .

> Meanwhile, when the reception SINR (signal to interference and noise ratio) of an SRS transmitted from a terminal to a base station (reception level of SRS at the base station) decreases to a certain level, the measurement accuracy of the channel quality (e.g. SINR measurement value) using SRSs between the base station and the terminal (SINR measurement accuracy) is significantly deteriorated due to an influence of interference and noise.
>
> . . .
>
> If the SINR measurement accuracy is deteriorated, the base station cannot perform precise scheduling of a PUSCH (such as frequency resource assignment and MCS selection), impairing the system performance.

Id. at 1:56–59, 2:16–23, 36–39. The patent goes on to describe a current method that successfully "prevent[s] deterioration of the SINR measurement accuracy of SRS[.]" *Id.* at 2:53–67. Using this method, however, increases power consumption of the terminal. *Id.* at 3:1–5. The claimed inventions include a method that decreases the power consumed at the terminal while still preventing deterioration of the SINR measurement accuracy at the base station, thereby improving network performance. *Id.* at 3:48–51.

113. The '535 Patent is directed to patentable subject matter. *See generally* the Exhibit C (the '535 Patent); Exhibit I (3GPP TR 25.814); Exhibit M (3GPP TS 36.213).

114. The '535 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the '535 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for

example, by both preventing deterioration of SINR measurements and also reducing power consumption at the terminal. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

115. Claim 7 of the ’535 Patent is reproduced below:

> 7. A method of controlling transmission power of a reference signal, the method comprising:
>
> generating a first Sounding Reference Signal (SRS) with a first transmission time interval and a second SRS with a second transmission time interval, the second transmission time interval being different from the first transmission time interval, both of the first SRS and the second SRS being reference signals for channel-quality estimation;
>
> setting a first offset value to control transmission power used to transmit the first SRS and to set a second offset value to control transmission power used to transmit the second SRS, the second offset value being different from the first offset value; and
>
> transmitting the first SRS with the transmission power controlled based on the first offset value and transmitting the second SRS with the transmission power controlled based on the second offset value.

116. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 7 that recites “A method of controlling transmission power of a reference signal, the method comprising.” *See, e.g.*, Exhibit M (3GPP TS 36.213) at § 5.1.3 (describing the setting of UE Transmit power for the Sounding Reference Symbol).

117. The Accused Instrumentalities meet the first element of Claim 7, which recites “generating a first Sounding Reference Signal (SRS) with a first transmission time interval and a second SRS with a second transmission time interval, the second transmission time interval

being different from the first transmission time interval, both of the first SRS and the second SRS being reference signals for channel-quality estimation." *See, e.g.*,:

9.1.1.2.2 Uplink reference-signal structure

As indicated in Section 9.1.1, uplink reference signals are transmitted within the two short blocks, which are time-multiplexed with long blocks. Uplink reference signals are received and used at the Node B for the following two purposes:

- Uplink channel estimation for uplink coherent demodulation/detection
- Possible uplink channel-quality estimation for uplink frequency- and/or time-domain channel-dependent scheduling

Reference-signal for uplink channel-quality estimation (channel sounding):

- Reference signal may occupy at least partly different spectrum than data transmission. This allows for channel-quality estimation also for other frequencies than that used for data transmission and, as a consequence, allows for uplink channel-dependent scheduling.
- For multiplexing reference-signals from different UEs within the same Node B, distributed FDM and/or CDM is used.
- Multiplexing of reference signals for the case of a UE with multiple antennas or multiple UEs in MU-MIMO is to be studied further.
- When reference-signal for uplink channel-quality estimation is transmitted with data symbols within the same sub-frame, a part of this reference-signal can also be used for channel estimation for demodulation/detection of the data symbols.

See Exhibit I (3GPP TR 25.814) at 75, 77, § 9.1.1.2.2.

8.2 UE sounding procedure

A UE shall transmit Sounding Reference Symbol (SRS) on per serving cell SRS resources based on two trigger types:

- trigger type 0: higher layer signalling

- trigger type 1: DCI formats 0/4/1A for FDD and TDD and DCI formats 2B/2C for TDD.

In case both trigger type 0 and trigger type 1 SRS transmissions would occur in the same subframe in the same serving cell, the UE shall only transmit the trigger type 1 SRS transmission.

A UE may be configured with SRS parameters for trigger type 0 and trigger type 1 on each serving cell. The following SRS parameters are serving cell specific and semi-statically configurable by higher layers for trigger type 0 and for trigger type 1.

- Transmission comb $\bar{k}_{TC}$, as defined in subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1
- Starting physical resource block assignment n_{RRC}, as defined in subclause 5.5.3.2 of [3] for trigger type 0 and each configuration of trigger type 1
- *duration*: single or indefinite (until disabled), as defined in [11] for trigger type 0
- *srs-ConfigIndex* I_{SRS} for SRS periodicity T_{SRS} and SRS subframe offset T_{offset}, as defined in Table 8.2-1 and Table 8.2-2 for trigger type 0 and SRS periodicity $T_{SRS,1}$ and SRS subframe offset $T_{offset,1}$, as defined in Table 8.2-4 and Table 8.2-5 trigger type 1

See Exhibit M (3GPP TS 36.213) at 81, § 8.2.

118. The Accused Instrumentalities meet the second element of Claim 7, which recites "setting a first offset value to control transmission power used to transmit the first SRS and to set a second offset value to control transmission power used to transmit the second SRS, the second offset value being different from the first offset value." *See, e.g.,*:

5.1.3 Sounding Reference Symbol

5.1.3.1 UE behaviour

The setting of the UE Transmit power P_{SRS} for the Sounding Reference Symbol transmitted on subframe i for serving cell c is defined by

$$P_{SRS,c}(i) = \min\left\{ P_{CMAX,c}(i),\ P_{SRS\_OFFSET,c}(m) + 10\log_{10}(M_{SRS,c}) + P_{O\_PUSCH,c}(j) + \alpha_c(j) \cdot PL_c + f_c(i) \right\} \quad [dBm]$$

where

- $P_{CMAX,c}(i)$ is the configured UE transmit power defined in [6] in subframe i for serving cell c.
- $P_{SRS\_OFFSET,c}(m)$ is a 4-bit parameter semi-statically configured by higher layers for $m=0$ and $m=1$ for serving cell c. For SRS transmission given trigger type 0 then $m=0$ and for SRS transmission given trigger type 1 then $m=1$. For $K_S = 1.25$, $P_{SRS\_OFFSET,c}(m)$ has 1dB step size in the range [-3, 12] dB. For $K_S = 0$, $P_{SRS\_OFFSET,c}(m)$ has 1.5 dB step size in the range [-10.5, 12] dB.
- $M_{SRS,c}$ is the bandwidth of the SRS transmission in subframe i for serving cell c expressed in number of resource blocks.
- $f_c(i)$ is the current PUSCH power control adjustment state for serving cell c, see subclause 5.1.1.1.
- $P_{O\_PUSCH,c}(j)$ and $\alpha_c(j)$ are parameters as defined in subclause 5.1.1.1, where $j = 1$.

See Exhibit M (3GPP TS 36.213) at 18–19, § 5.1.3.

119. The Accused Instrumentalities meet the final element of Claim 7, which recites "transmitting the first SRS with the transmission power controlled based on the first offset value and transmitting the second SRS with the transmission power controlled based on the second offset value." *See, e.g.*,:

5.1.3 Sounding Reference Symbol

5.1.3.1 UE behaviour

The setting of the UE Transmit power P_{SRS} for the Sounding Reference Symbol transmitted on subframe i for serving cell c is defined by

$$P_{SRS,c}(i) = \min\{P_{CMAX,c}(i),\ P_{SRS\_OFFSET,c}(m) + 10\log_{10}(M_{SRS,c}) + P_{O\_PUSCH,c}(j) + \alpha_c(j)\cdot PL_c + f_c(i)\}\ \text{[dBm]}$$

where

- $P_{CMAX,c}(i)$ is the configured UE transmit power defined in [6] in subframe i for serving cell c.

- $P_{SRS\_OFFSET,c}(m)$ is a 4-bit parameter semi-statically configured by higher layers for $m=0$ and $m=1$ for serving cell c. For SRS transmission given trigger type 0 then $m=0$ and for SRS transmission given trigger type 1 then $m=1$. For $K_S = 1.25$, $P_{SRS\_OFFSET,c}(m)$ has 1dB step size in the range [-3, 12] dB. For $K_S = 0$, $P_{SRS\_OFFSET,c}(m)$ has 1.5 dB step size in the range [-10.5, 12] dB.
- $M_{SRS,c}$ is the bandwidth of the SRS transmission in subframe i for serving cell c expressed in number of resource blocks.
- $f_c(i)$ is the current PUSCH power control adjustment state for serving cell c, see subclause 5.1.1.1.
- $P_{O\_PUSCH,c}(j)$ and $\alpha_c(j)$ are parameters as defined in subclause 5.1.1.1, where $j = 1$.

8.2 UE sounding procedure

A UE shall transmit Sounding Reference Symbol (SRS) on per serving cell SRS resources based on two trigger types:

- trigger type 0: higher layer signalling

- trigger type 1: DCI formats 0/4/1A for FDD and TDD and DCI formats 2B/2C for TDD.

See Exhibit M (3GPP TS 36.213) at 18–19, 81, §§ 5.1.3, 8.2.

120. HTC directly infringes Claim 7 of the '535 Patent. The Accused Instrumentalities, by complying with TR 25.814 and TS 36.213, meet every element of Claim 7. Claim 7 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 7 without any initiation or involvement by the end user. *See SiRF Tech.*, 601 F.3d at 1329–31. The Accused

Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 7 because the Accused Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

121. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

122. HTC also indirectly infringes Claim 7 of the ’535 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 7 of the ’535 Patent, in violation of 35 U.S.C. § 271(b).

123. HTC induced these third parties’ direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 7 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused

Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

124. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’535 Patent and the fact that the ’535 Patent would be essential to the use of the applicable LTE standards. HTC was also aware as early as March 10, 2020 of SPT’s specific infringement theories as to the ’535 Patent when SPT presented HTC with specific claim charts, and in any event, by no later than the filing or service of the Original Complaint (Dkt. No. 1) on September 1, 2020. HTC also had actual notice of the ’535 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

125. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 7 of the ’535 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’535 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’535 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

126. For the same reasons, HTC’s infringement of the ’535 Patent has been willful. Despite its knowledge or willful blindness to the ’535 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT’s good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT’s rights.

127. SPT has been and continues to be damaged by HTC's infringement of the '535 Patent.

128. HTC's infringement of the '535 Patent is exceptional, and SPT is entitled to recover reasonable attorneys' fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

COUNT FOUR: INFRINGEMENT OF THE '320 PATENT

129. SPT incorporates by reference the preceding paragraphs as if fully set forth herein.

130. U.S. Patent No. 9,532,320 ("the '320 Patent"), entitled "Power-Limit Reporting in a Communication System Using Carrier Aggregation," was duly and legally issued on December 27, 2016. *See* Exhibit D (the '320 Patent).

131. The '320 Patent is valid and enforceable. *See generally* Exhibit D (the '320 Patent).

132. The '320 Patent discloses transmissions sent across the LTE-Advanced network:

> To request resources, the user equipment transmits a resource request message to the eNodeB. This resources request message could for example contain information on the buffer status, the power status of the user equipment and some Quality of Services (QoS) related information. This information, which will be referred to as scheduling information, allows for eNodeB to make an appropriate resource allocation.

Id. at 6:20–27. The patent goes on to discuss the purposes of power control in the LTE-Advanced network:

> Uplink transmitter power control in a mobile communication system serves the purpose of balancing the need for sufficient transmitter energy per bit to achieve the required QoS against the need to minimize interference to other users of the system and to maximize the battery life of the user equipment.

Id. 8:9–14. Within this context, the ’320 Patent claims a method for power reporting of a user equipment to the eNodeB.

133. The ’320 Patent is directed to patentable subject matter. *See generally* Exhibit D (the ’320 Patent); Exhibit J (3GPP TS 36.101); Exhibit O (3GPP TS 36.321).

134. The ’320 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the ’320 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for example, by reporting to the base station (or eNodeB) the LTE device’s (or UE) power usage to assist the eNodeB with scheduling transmission resources. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

135. Claim 1 of the ’320 Patent is reproduced below:

> 1. A method for informing an eNodeB of a transmit power status of a user equipment (UE) in a wireless communication system using component carrier aggregation, in which two or more component carriers (CCs) are aggregated, wherein the method comprises the following steps performed by the UE:
>
> generating a power status report that includes:
>
> (i) a CC specific maximum transmission power, $P_{CMAX,c}$, for each configured and activated uplink CC, wherein $P_{CMAX,c}$ shall be set within following bounds:

$$P_{CMAX\_L,c} <= P_{CMAX,c} <= P_{CMAX\_H,c}$$

> where $P_{CMAX\_L,c}$ is a lower bound and $P_{CMAX\_H,c}$ is a higher bound of a CC specific maximum transmission power, and
>
> (ii) a power headroom report indicative of a difference between the CC specific maximum transmission power, $P_{CMAX,c}$, and an estimate UE transmit power, per each configured and activated uplink CC,
>
> wherein the CC specific maximum transmission power, $P_{CMAX,c}$, for each configured and activated CC is included in the power status report when a resource is assigned for the configured and activated uplink CC for the UE, and

transmitting the power status report to the eNodeB.

136. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 1, which recites "A method for informing an eNodeB of a transmit power status of a user equipment (UE) in a wireless communication system using component carrier aggregation, in which two or more component carriers (CCs) are aggregated, wherein the method comprises the following steps performed by the UE." *See, e.g.*,:

5.5A Operating bands for CA

E-UTRA carrier aggregation is designed to operate in the operating bands defined in Tables 5.5A-1 and 5.5A-2.

6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell *c* and its total configured maximum output power P_{CMAX}.

See Exhibit J (3GPP TS 36.101) at 20, 44, §§ 5.5A, 6.2.5A.

137. The Accused Instrumentalities meet the first element of Claim 1, which recites "generating a power status report that includes." *See, e.g.*,:

5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving eNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH transmission on PCell.

The reporting period, delay and mapping of Power Headroom are defined in subclause 9.1.8 of [9]. RRC controls Power Headroom reporting by configuring the two timers *periodicPHR-Timer* and *prohibitPHR-Timer*, and by signalling *dl-PathlossChange* which sets the change in measured downlink pathloss and the required power backoff due to power management (as allowed by P-MPR$_c$ [10]) to trigger a PHR [8].

6.1.3.6a Extended Power Headroom MAC Control Element

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m					

Figure 6.1.3.6a-2: Extended Power Headroom MAC Control Element

See Exhibit O (3GPP TS 36.321) at 28, 41, §§ 5.4.6, 6.1.3.6a.

138. The Accused Instrumentalities meet the second element of Claim 1, which recites "(i) a CC specific maximum transmission power, $P_{CMAX,c}$, for each configured and activated uplink CC, wherein $P_{CMAX,c}$ shall be set within following bounds: $P_{CMAX\_L,c}$ <= $P_{CMAX,c}$ <= $P_{CMAX\_H,c}$, where $P_{CMAX\_L,c}$ is a lower bound and $P_{CMAX\_H,c}$ is a higher bound of a CC specific maximum transmission power." *See, e.g.*,:

6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell c. The configured maximum output power $P_{CMAX,c}$ is set within the following bounds:

$$P_{CMAX\_L,c} \leq P_{CMAX,c} \leq P_{CMAX\_H,c}$$

with

$$P_{CMAX\_L,c} = MIN \{P_{EMAX,c} - \Delta T_{C,c}, P_{PowerClass} - MAX(MPR_c + A\text{-}MPR_c + \Delta T_{IB,c} + \Delta T_{C,c}, P\text{-}MPR_c)\}$$

$$P_{CMAX\_H,c} = MIN \{P_{EMAX,c}, P_{PowerClass}\}$$

6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell c and its total configured maximum output power P_{CMAX}.

The configured maximum output power $P_{CMAX,c}$ on serving cell c shall be set as specified in subclause 6.2.5.

See Exhibit J (3GPP TS 36.101) at 42, 44, §§ 6.2.5, 6.2.5A.

6.1.3.6a Extended Power Headroom MAC Control Element

Table 6.1.3.6a-1: Nominal UE transmit power level for Extended PHR

$P_{CMAX,c}$	Nominal UE transmit power level
0	PCMAX_C_00
1	PCMAX_C_01
2	PCMAX_C_02
…	…
61	PCMAX_C_61
62	PCMAX_C_62
63	PCMAX_C_63

See Exhibit O (3GPP TS 36.321) at 41, § 6.1.3.6a.

6.1.3.6a Extended Power Headroom MAC Control Element

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m					

Figure 6.1.3.6a-2: Extended Power Headroom MAC Control Element

See Exhibit O (3GPP TS 36.321) at 41, § 6.1.3.6a.

139. The Accused Instrumentalities meet the third element of Claim 1, which recites "(ii) a power headroom report indicative of a difference between the CC specific maximum transmission power, PCMAX,c, and an estimate UE transmit power, per each configured and activated uplink CC." *See, e.g.*,:

5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving eNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH transmission on PCell.

The reporting period, delay and mapping of Power Headroom are defined in subclause 9.1.8 of [9]. RRC controls Power Headroom reporting by configuring the two timers *periodicPHR-Timer* and *prohibitPHR-Timer*, and by signalling *dl-PathlossChange* which sets the change in measured downlink pathloss and the required power backoff due to power management (as allowed by $P\text{-}MPR_c$ [10]) to trigger a PHR [8].

See Exhibit O (3GPP TS 36.321) at 28, § 5.4.6.

140. The Accused Instrumentalities meet the fourth element of Claim 1, which recites "wherein the CC specific maximum transmission power, PCMAX,c, for each configured and

activated CC is included in the power status report when a resource is assigned for the configured and activated uplink CC for the UE." *See, e.g.*,:

5.4.6 Power Headroom Reporting

If the UE has UL resources allocated for new transmission for this TTI:

- if it is the first UL resource allocated for a new transmission since the last MAC reset, start *periodicPHR-Timer*;
- if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled, and;
- if the allocated UL resources can accommodate a PHR MAC control element plus its subheader if *extendedPHR* is not configured, or the Extended PHR MAC control element plus its subheader if *extendedPHR* is configured, as a result of logical channel prioritization:
  - if *extendedPHR* is configured:
    - for each activated Serving Cell with configured uplink:
      - obtain the value of the Type 1 power headroom;
      - if the UE has UL resources allocated for transmission on this Serving Cell for this TTI:
        - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
    - if *simultaneousPUCCH-PUSCH* is configured:
      - obtain the value of the Type 2 power headroom for the PCell;
      - if the UE has a PUCCH transmission in this TTI:
        - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
    - instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element as defined in subclause 6.1.3.6a based on the values reported by the physical layer;

See Exhibit O (3GPP TS 36.321) at 28–29, § 5.4.6.

141. The Accused Instrumentalities meet the final element of Claim 1, which recites "transmitting the power status report to the eNodeB." *See, e.g.*,:

5.4.6 Power Headroom Reporting

If the UE has UL resources allocated for new transmission for this TTI:

- if it is the first UL resource allocated for a new transmission since the last MAC reset, start *periodicPHR-Timer*;
- if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled, and;
- if the allocated UL resources can accommodate a PHR MAC control element plus its subheader if *extendedPHR* is not configured, or the Extended PHR MAC control element plus its subheader if *extendedPHR* is configured, as a result of logical channel prioritization:
  - if *extendedPHR* is configured:
    - for each activated Serving Cell with configured uplink:
      - obtain the value of the Type 1 power headroom;
      - if the UE has UL resources allocated for transmission on this Serving Cell for this TTI:
        - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
    - if *simultaneousPUCCH-PUSCH* is configured:
      - obtain the value of the Type 2 power headroom for the PCell;
      - if the UE has a PUCCH transmission in this TTI:
        - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
    - instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element as defined in subclause 6.1.3.6a based on the values reported by the physical layer;

See Exhibit O (3GPP TS 36.321) at 28–29, § 5.4.6.

142. HTC directly infringes Claim 1 of the ’320 Patent. The Accused Instrumentalities, by complying with TR 36.101 and TS 36.321, meet every element of Claim 1. Claim 1 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 1 without any initiation or involvement by the end user. *See SiRF Tech.*, 601 F.3d at 1329–31. The Accused Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 1 because the Accused Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The

software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

143. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

144. HTC also indirectly infringes Claim 1 of the ’320 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 1 of the ’320 Patent, in violation of 35 U.S.C. § 271(b).

145. HTC induced these third parties’ direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 1 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

146. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’320 Patent and the fact that the ’320 Patent would be essential to the use of the applicable LTE standards. HTC was also aware as early as March 10, 2020 of SPT’s specific infringement theories as to the ’320 Patent when SPT presented HTC with specific claim charts, and in any event, by no later than the filing or service of the Original Complaint (Dkt. No. 1) on September 1, 2020. HTC also had actual notice of the ’320 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

147. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 1 of the ’320 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’320 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’320 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

148. For the same reasons, HTC’s infringement of the ’320 Patent has been willful. Despite its knowledge or willful blindness to the ’320 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT’s good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT’s rights.

149. SPT has been and continues to be damaged by HTC’s infringement of the ’320 Patent.

150. HTC's infringement of the '320 Patent is exceptional, and SPT is entitled to recover reasonable attorneys' fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

COUNT FIVE: INFRINGEMENT OF THE '594 PATENT

151. SPT incorporates by reference the preceding paragraphs as if fully set forth herein.

152. U.S. Patent No. 9,392,594 ("the '594 Patent"), entitled "Resource Assignment for Single and Multiple Cluster Transmission," was duly and legally issued on July 12, 2016. *See* Exhibit R (the '594 Patent).

153. The '594 Patent is valid and enforceable. *See generally* Exhibit R (the '594 Patent).

154. The '594 Patent discloses the signaling of resource allocation information to a terminal of a mobile communication system for assigning resources to the terminal:

> In mobile communication systems, a base station assigns downlink resources to a terminal, which the base station can use for downlink transmissions to said terminal, and/or assigns uplink resources to a terminal, which said terminal can use for uplink transmissions. The downlink and/or uplink resource allocation (or assignment) is signaled from the base station (or another related network device) to the terminal.

Id. at 1:28–34. The patent goes on to point out that situations may occur in which the number of available bits for signaling the resource allocation information is insufficient:

> The present invention has recognized that for most cases (i.e. for most values of the uplink system bandwidth define by the specification 3GPP TS 36.213), the number of available bits in the DCI and required bits to denote all allowed RBG allocation combinations supported by the system are matching. However, for some cases an insufficient number of bits is available in the DCI.

Id. 10:53–59. Within this context, the '594 Patent claims a method for denoting the resource allocation information even where the number of available bits is insufficient.

155. The '594 Patent is directed to patentable subject matter. *See generally* Exhibit R (the '594 Patent); Exhibit L (3GPP TS 36.212); Exhibit M (3GPP TS 36.213).

156. The '594 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the '594 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for example, by using particular methods to denote resource allocation information even where the number of available bits is insufficient. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

157. Claim 9 of the '594 Patent is reproduced below:

9. A receiving method comprising:

receiving downlink control information which includes a resource allocation field for signaling resource allocation information that indicates resources assigned to a terminal apparatus,

wherein when a plurality of clusters are allocated to the terminal apparatus and a number of available bits in the resource allocation field is smaller than a number of bits necessary to indicate the allocated plurality of clusters, a portion of the bits necessary to indicate the allocated plurality of clusters are received using the available bits in the resource allocation field, and remaining bit(s) of the bits necessary to indicate the allocated plurality of clusters are assumed to be a defined value, and

when the number of available bits in the resource allocation field is equal to or larger than the number of bits necessary to indicate the allocated plurality of clusters, the bits necessary to indicate the allocated plurality of clusters are received by using the available bits in the resource allocation field; and

determining the resource allocation information based at least on the available bits in the resource allocation field included in the received downlink control information.

158. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 9, which recites "A receiving method." *See, e.g.*, Exhibit N (3GPP TS 36.300) at § 5.5 (describing UE receiving information on one or multiple Component Carriers (CCs)).

159. The Accused Instrumentalities meet the first element of Claim 9, which recites "receiving downlink control information which includes a resource allocation field for signaling resource allocation information that indicates resources assigned to a terminal apparatus." *See, e.g.*,:

5.3.3	Downlink control information

5.3.3.1.1 Format 0

DCI format 0 is used for the scheduling of PUSCH in one UL cell.

The following information is transmitted by means of the DCI format 0:

- Carrier indicator – 0 or 3 bits. This field is present according to the definitions in [3].
- Flag for format0/format1A differentiation – 1 bit, where value 0 indicates format 0 and value 1 indicates format 1A
- Frequency hopping flag – 1 bit as defined in section 8.4 of [3]. This field is used as the MSB of the corresponding resource allocation field for resource allocation type 1.
- Resource block assignment and hopping resource allocation – $\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$ bits
  - For PUSCH hopping (resource allocation type 0 only):
    - N_{UL_hop} MSB bits are used to obtain the value of $\tilde{n}_{PRB}(i)$ as indicated in section 8.4 of [3]
    - $\left(\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil - N_{UL\_hop}\right)$ bits provide the resource allocation of the first slot in the UL subframe
  - For non-hopping PUSCH with resource allocation type 0:
    - $\left(\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil\right)$ bits provide the resource allocation in the UL subframe as defined in section 8.1.1 of [3]
  - For non-hopping PUSCH with resource allocation type 1:
    - The concatenation of the frequency hopping flag field and the resource block assignment and hopping resource allocation field provides the resource allocation field in the UL subframe as defined in section 8.1.2 of [3]

See Exhibit L (3GPP TS 36.212) at 58-59, § 5.3.3.1.1.

8.1.2 Uplink Resource allocation type 1

The resource allocation information for uplink resource allocation type 1 indicates to a scheduled UE two sets of resource blocks with each set including one or more consecutive resource block groups of size P as given in table 7.1.6.1-1 assuming N_{RB}^{UL} as the system bandwidth. A combinatorial index r consists of $\left\lceil \log_2\left(\binom{\lceil N_{RB}^{UL}/P+1 \rceil}{4}\right)\right\rceil$ bits.

The bits from the resource allocation field in the scheduling grant represent r unless the number of bits in the resource allocation field in the scheduling grant is

- smaller than required to fully represent r, in which case the bits in the resource allocation field in the scheduling grant occupy the LSBs of r and the value of the remaining bits of r shall be assumed to be 0; or
- larger than required to fully represent r, in which case r occupies the LSBs of the resource allocation field in the scheduling grant.

The combinatorial index r corresponds to a starting and ending RBG index of resource block set 1, s_0 and $s_1 - 1$, and resource block set 2, s_2 and $s_3 - 1$ respectively, where r is given by equation $r = \sum_{i=0}^{M-1} \left\langle {N - s_i \atop M - i} \right\rangle$ defined in subclause 7.2.1 with M=4 and $N = \lceil N_{RB}^{UL}/P \rceil + 1$. Subclause 7.2.1 also defines ordering properties and range of values that s_i (RBG indices) map to. Only a single RBG is allocated for a set at the starting RBG index if the corresponding ending RBG index equals the starting RBG index.

See Exhibit M (3GPP TS 36.213) at 81-82, § 8.1.2.

160. The Accused Instrumentalities meet the second element of Claim 9, which recites "wherein when a plurality of clusters are allocated to the terminal apparatus and a number of

available bits in the resource allocation field is smaller than a number of bits necessary to indicate the allocated plurality of clusters, a portion of the bits necessary to indicate the allocated plurality of clusters are received using the available bits in the resource allocation field, and remaining bit(s) of the bits necessary to indicate the allocated plurality of clusters are assumed to be a defined value." *See, e.g.,*:

> 8.1.2 Uplink Resource allocation type 1
>
> The resource allocation information for uplink resource allocation type 1 indicates to a scheduled UE two sets of resource blocks with each set including one or more consecutive resource block groups of size *P* as given in table 7.1.6.1-1 assuming $N_{\mathrm{RB}}^{\mathrm{UL}}$ as the system bandwidth. A combinatorial index *r* consists of $\left\lceil \log_2\left(\binom{\lceil N_{RB}^{UL}/P+1\rceil}{4}\right)\right\rceil$ bits.
>
> The bits from the resource allocation field in the scheduling grant represent *r* unless the number of bits in the resource allocation field in the scheduling grant is
>
> - smaller than required to fully represent *r*, in which case the bits in the resource allocation field in the scheduling grant occupy the LSBs of *r* and the value of the remaining bits of *r* shall be assumed to be 0; or
> - larger than required to fully represent *r*, in which case *r* occupies the LSBs of the resource allocation field in the scheduling grant.
>
> The combinatorial index *r* corresponds to a starting and ending RBG index of resource block set 1, s_0 and $s_1 - 1$, and resource block set 2, s_2 and $s_3 - 1$ respectively, where *r* is given by equation $r = \sum_{i=0}^{M-1} \left\langle {N - s_i \atop M - i} \right\rangle$ defined in subclause 7.2.1 with *M*=4 and $N = \lceil N_{\mathrm{RB}}^{\mathrm{UL}}/P \rceil + 1$. Subclause 7.2.1 also defines ordering properties and range of values that s_i
>
> (RBG indices) map to. Only a single RBG is allocated for a set at the starting RBG index if the corresponding ending RBG index equals the starting RBG index.

See Exhibit M (3GPP TS 36.213) at 81-82, § 8.1.2.

161. The Accused Instrumentalities meet the third element of Claim 9, which recites "when the number of available bits in the resource allocation field is equal to or larger than the number of bits necessary to indicate the allocated plurality of clusters, the bits necessary to indicate the allocated plurality of clusters are received by using the available bits in the resource allocation field." *See, e.g.,*:

8.1.2 Uplink Resource allocation type 1

The resource allocation information for uplink resource allocation type 1 indicates to a scheduled UE two sets of resource blocks with each set including one or more consecutive resource block groups of size P as given in table 7.1.6.1-1 assuming N_{RB}^{UL} as the system bandwidth. A combinatorial index r consists of $\left\lceil \log_2\left(\binom{\lceil N_{RB}^{UL}/P+1\rceil}{4}\right)\right\rceil$ bits.

The bits from the resource allocation field in the scheduling grant represent r unless the number of bits in the resource allocation field in the scheduling grant is

- smaller than required to fully represent r, in which case the bits in the resource allocation field in the scheduling grant occupy the LSBs of r and the value of the remaining bits of r shall be assumed to be 0; or
- larger than required to fully represent r, in which case r occupies the LSBs of the resource allocation field in th scheduling grant.

The combinatorial index r corresponds to a starting and ending RBG index of resource block set 1, s_0 and $s_1 - 1$, and resource block set 2, s_2 and $s_3 - 1$ respectively, where r is given by equation $r = \sum_{i=0}^{M-1} \left\langle \begin{matrix} N - s_i \\ M - i \end{matrix} \right\rangle$ defined in subclause 7.2.1 with M=4 and $N = \lceil N_{RB}^{UL}/P \rceil + 1$. Subclause 7.2.1 also defines ordering properties and range of values that s_i (RBG indices) map to. Only a single RBG is allocated for a set at the starting RBG index if the corresponding ending RBG index equals the starting RBG index.

See Exhibit M (3GPP TS 36.213) at 81-82, § 8.1.2.

162. The Accused Instrumentalities meet the final element of Claim 9, which recites "determining the resource allocation information based at least on the available bits in the resource allocation field included in the received downlink control information." *See, e.g.*,:

5.3.3 Downlink control information

5.3.3.1.1 Format 0

DCI format 0 is used for the scheduling of PUSCH in one UL cell.

The following information is transmitted by means of the DCI format 0:

- Carrier indicator – 0 or 3 bits. This field is present according to the definitions in [3].
- Flag for format0/format1A differentiation – 1 bit, where value 0 indicates format 0 and value 1 indicates format 1A
- Frequency hopping flag – 1 bit as defined in section 8.4 of [3]. This field is used as the MSB of the corresponding resource allocation field for resource allocation type 1.
- Resource block assignment and hopping resource allocation – $\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$ bits
  - For PUSCH hopping (resource allocation type 0 only):
    - N_{UL_hop} MSB bits are used to obtain the value of $\tilde{n}_{PRB}(i)$ as indicated in section 8.4 of [3]
    - $\left(\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil - N_{UL\_hop} \right)$ bits provide the resource allocation of the first slot in the UL subframe
  - For non-hopping PUSCH with resource allocation type 0:
    - $\left(\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil \right)$ bits provide the resource allocation in the UL subframe as defined in section 8.1.1 of [3]
  - For non-hopping PUSCH with resource allocation type 1:
    - The concatenation of the frequency hopping flag field and the resource block assignment and hopping resource allocation field provides the resource allocation field in the UL subframe as defined in section 8.1.2 of [3]

See Exhibit L (3GPP TS 36.212) at 58-59, § 5.3.3.1.1.

163. HTC directly infringes Claim 9 of the '594 Patent. The Accused Instrumentalities, by complying with TS 36.212 and TS 36.213, meet every element of Claim 9. Claim 9 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 9 without any initiation or involvement by the end user. *See SiRF Tech.*, 601 F.3d at 1329–31. The Accused Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 9 because the Accused Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

164. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

165. HTC also indirectly infringes Claim 9 of the ’594 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 9 of the ’594 Patent, in violation of 35 U.S.C. § 271(b).

166. HTC induced these third parties’ direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 9 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

167. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’594 Patent and the fact that the ’594 Patent would be essential to the use of the applicable LTE standards. HTC was also aware as early as July 10, 2019 of SPT’s specific

infringement theories as to the ’594 Patent when SPT presented HTC with specific claim charts, and in any event, by no later than the filing or service of this Complaint. HTC also had actual notice of the ’594 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

168. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 9 of the ’594 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’594 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’594 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

169. For the same reasons, HTC’s infringement of the ’594 Patent has been willful. Despite its knowledge or willful blindness to the ’594 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT’s good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT’s rights.

170. SPT has been and continues to be damaged by HTC’s infringement of the ’594 Patent.

171. HTC’s infringement of the ’594 Patent is exceptional, and SPT is entitled to recover reasonable attorneys’ fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

COUNT SIX: INFRINGEMENT OF THE ’032 PATENT

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

173. U.S. Patent No. 9,814,032 (“the ’032 Patent”), entitled “Wireless Communication Apparatus and Channel Allocation Method,” was legally and duly issued on November 7, 2017. *See* Exhibit S (the ’032 Patent).

174. The ’032 Patent is valid and enforceable. *See generally* Exhibit S (the ’032 Patent).

175. The inventions claimed in the ’032 Patent include a “channel assignment method for improving the use efficiency of frequency in a case where communication bandwidths are asymmetric between uplink and downlink.” *Id.* at 4:7–11. The patent further discusses the need for LTE-Advanced base stations to support LTE devices (or “terminals”) that can use one or multiple component bands:

> An LTE+ base station supports an LTE+ system support terminal (hereinafter LTE+ terminal”). LTE+ terminals include a terminal that can perform communication using only one component band (hereinafter “type-1 LTE+ terminal”) and a terminal that can perform communication using a plurality of component bands (hereinafter “type-2 LTE+ terminal”). Also, the LTE+ base station needs to support not only the above LTE+ terminal but also a terminal that supports the LTE system and that can perform communication using only one component band (hereinafter “LTE terminal”). That is, the LTE+ system is designed to be able to assign a plurality of component bands to single communication, and follows the LTE system in which single communication is independently assigned to each component band.

Id. at 2:22–36.

176. The ’032 Patent is directed to patentable subject matter. *See generally* Exhibit S (the ’032 Patent); Exhibit K (3GPP TS 36.211); Exhibit L (3GPP TS 36.212); Exhibit M (3GPP TS 36.213); Exhibit N (3GPP TS 36.300); Exhibit T (3GPP TR 36.912).

177. The ’032 Patent is drawn to specific improvements relating to LTE networks, and thus, presents technical, computer-centric solutions to problems arising out of the operation and performance of computer and communications network, including, for example, problems related to network resource use and efficiency. The disclosed inventive concepts were not conventional, well-understood, or routine at the time of the invention of the ’032 Patent. The claimed methods and inventions improve the overall performance of the LTE network and the efficiency of communication between LTE devices and LTE base stations in light of the new capabilities (and performance demands) introduced in the LTE-Advanced network, including, for example, by using particular resource allocations where communication bandwidths are asymmetric between uplink and downlink. The aspects of the invention that contribute to these solutions are reflected in the elements of the claims.

178. Claim 8 of the ’032 Patent is reproduced below:

8. A communication method comprising:

receiving first downlink resource allocation information for a first downlink component carrier;

receiving second downlink resource allocation information for a second downlink component carrier, which is different from the first downlink component carrier;

receiving first downlink data on the first downlink component carrier in accordance with the first downlink resource allocation information;

receiving second downlink data on the second downlink component carrier in accordance with the second downlink resource allocation information;

receiving uplink resource allocation information for uplink component carriers on only one downlink component carrier out of the first downlink component carrier and the second downlink component carrier;

transmitting uplink data on the uplink component carriers in accordance with the uplink resource allocation information; and

receiving an Acknowledgement/Negative-acknowledgement (ACK/NACK) signal for the uplink data only on said one downlink component carrier on which the uplink resource allocation information is received.

179. To the extent the preamble is considered a limitation, the Accused Instrumentalities meet the preamble of Claim 8 that recites "A communication method comprising." *See*, *e.g.*, Exhibit N (3GPP TS 36.300) at § 5.5 (describing UE receiving information on one or multiple Component Carriers (CCs)).

180. The Accused Instrumentalities meet the first element of Claim 8, which recites "receiving first downlink resource allocation information for a first downlink component carrier." *See, e.g.*,:

6.8 Physical downlink control channel

6.8.1 PDCCH formats

The physical downlink control channel carries scheduling assignments and other control information. A physical control channel is transmitted on an aggregation of one or several consecutive control channel elements (CCEs), where a control channel element corresponds to 9 resource element groups. The number of resource-element groups not assigned to PCFICH or PHICH is N_{REG}. The CCEs available in the system are numbered from 0 to $N_{CCE}-1$, where $N_{CCE}=\lfloor N_{REG}/9 \rfloor$. The PDCCH supports multiple formats as listed in Table 6.8.1-1. A PDCCH consisting of n consecutive CCEs may only start on a CCE fulfilling $i \bmod n = 0$, where i is the CCE number.

See Exhibit K (3GPP TS 36.211) at 66, § 6.8.1.

5.3.3 Downlink control information

A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

See Exhibit L (3GPP TS 36.212) at 56, § 5.3.3.

5.5 Carrier Aggregation

In Carrier Aggregation (CA), two or more Component Carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz. A UE may simultaneously receive or transmit on one or multiple CCs depending on its capabilities:

- A Rel-10 UE with reception and/or transmission capabilities for CA can simultaneously receive and/or transmit on multiple CCs corresponding to multiple serving cells;
- A Rel-8/9 UE can receive on a single CC and transmit on a single CC corresponding to one serving cell only.

CA is supported for both contiguous and non-contiguous CCs with each CC limited to a maximum of 110 Resource Blocks in the frequency domain using the Rel-8/9 numerology.

It is possible to configure a UE to aggregate a different number of CCs originating from the same eNB and of possibly different bandwidths in the UL and the DL.

- The number of DL CCs that can be configured depends on the DL aggregation capability of the UE;
- The number of UL CCs that can be configured depends on the UL aggregation capability of the UE;
- It is not possible to configure a UE with more UL CCs than DL CCs;
- In typical TDD deployments, the number of CCs and the bandwidth of each CC in UL and DL is the same.

CCs originating from the same eNB need not to provide the same coverage.

CCs shall be LTE Rel-8/9 compatible. Nevertheless, existing mechanisms (e.g. barring) may be used to avoid Rel-8/9 UEs to camp on a CC.

The spacing between centre frequencies of contiguously aggregated CCs shall be a multiple of 300 kHz. This is in order to be compatible with the 100 kHz frequency raster of Rel-8/9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing. Depending on the aggregation scenario, the $n \times 300$ kHz spacing can be facilitated by insertion of a low number of unused subcarriers between contiguous CCs.

7.5 Carrier Aggregation

When CA is configured, the UE only has one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC).

Depending on UE capabilities, Secondary Cells (SCells) can be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC).

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 57, 92–93, §§ 5.5, 7.5, 11.1.

181. The Accused Instrumentalities meet the second element of Claim 8, which recites "receiving second downlink resource allocation information for a second downlink component carrier, which is different from the first downlink component carrier." *See, e.g.,*:

6.8 Physical downlink control channel

6.8.1 PDCCH formats

The physical downlink control channel carries scheduling assignments and other control information. A physical control channel is transmitted on an aggregation of one or several consecutive control channel elements (CCEs), where a control channel element corresponds to 9 resource element groups. The number of resource-element groups not assigned to PCFICH or PHICH is N_{REG}. The CCEs available in the system are numbered from 0 to $N_{CCE}-1$, where $N_{CCE}=\lfloor N_{REG}/9 \rfloor$. The PDCCH supports multiple formats as listed in Table 6.8.1-1. A PDCCH consisting of n consecutive CCEs may only start on a CCE fulfilling $i \bmod n = 0$, where i is the CCE number.

See Exhibit K (3GPP TS 36.211) at 66, § 6.8.1.

5.3.3 Downlink control information

A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

See Exhibit L (3GPP TS 36.212) at 56, § 5.3.3.

5.5 Carrier Aggregation

In Carrier Aggregation (CA), two or more Component Carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz. A UE may simultaneously receive or transmit on one or multiple CCs depending on its capabilities:

- A Rel-10 UE with reception and/or transmission capabilities for CA can simultaneously receive and/or transmit on multiple CCs corresponding to multiple serving cells;
- A Rel-8/9 UE can receive on a single CC and transmit on a single CC corresponding to one serving cell only.

CA is supported for both contiguous and non-contiguous CCs with each CC limited to a maximum of 110 Resource Blocks in the frequency domain using the Rel-8/9 numerology.

It is possible to configure a UE to aggregate a different number of CCs originating from the same eNB and of possibly different bandwidths in the UL and the DL.

- The number of DL CCs that can be configured depends on the DL aggregation capability of the UE;
- The number of UL CCs that can be configured depends on the UL aggregation capability of the UE;
- It is not possible to configure a UE with more UL CCs than DL CCs;
- In typical TDD deployments, the number of CCs and the bandwidth of each CC in UL and DL is the same.

CCs originating from the same eNB need not to provide the same coverage.

CCs shall be LTE Rel-8/9 compatible. Nevertheless, existing mechanisms (e.g. barring) may be used to avoid Rel-8/9 UEs to camp on a CC.

The spacing between centre frequencies of contiguously aggregated CCs shall be a multiple of 300 kHz. This is in order to be compatible with the 100 kHz frequency raster of Rel-8/9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing. Depending on the aggregation scenario, the $n \times 300$ kHz spacing can be facilitated by insertion of a low number of unused subcarriers between contiguous CCs.

7.5 Carrier Aggregation

When CA is configured, the UE only has one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC).

Depending on UE capabilities, Secondary Cells (SCells) can be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC).

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 57, 92–93, §§ 5.5, 7.5, 11.1.

182. The Accused Instrumentalities meet the third element of Claim 8, which recites "receiving first downlink data on the first downlink component carrier in accordance with the first downlink resource allocation information." *See, e.g.*,:

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 92–93, § 11.1.

183. The Accused Instrumentalities meet the fourth element of Claim 8, which recites "receiving second downlink data on the second downlink component carrier in accordance with the second downlink resource allocation information." *See, e.g.*,:

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 92–93, § 11.1.

184. The Accused Instrumentalities meet the fifth element of Claim 8, which recites "receiving uplink resource allocation information for uplink component carriers on only one downlink component carrier out of the first downlink component carrier and the second downlink component carrier." *See, e.g.*,:

5.3.3 Downlink control information

A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

See Exhibit L (3GPP TS 36.212) at 56, § 5.3.3.

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on $SCell_n$ corresponds to downlink transmission on $SCell_n$;
- UL grant received on $SCell_n$ corresponds to uplink transmission on $SCell_n$. If $SCell_n$ is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 92–93, §§ 5.5, 11.1.

185. The Accused Instrumentalities meet the sixth element of Claim 8, which recites "transmitting uplink data on the uplink component carriers in accordance with the uplink resource allocation information." *See, e.g.,*:

11.1 Basic Scheduler Operation

When CA is configured, a UE may be scheduled over multiple serving cells simultaneously but at most one random access procedure shall be ongoing at any time. Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- Cross-carrier scheduling does not apply to PCell i.e. PCell is always scheduled via its PDCCH;
- When the PDCCH of an SCell is configured, cross-carrier scheduling does not apply to this SCell i.e. it is always scheduled via its PDCCH;
- When the PDCCH of an SCell is not configured, cross-carrier scheduling applies and this SCell is always scheduled via the PDCCH of one other serving cell.

A linking between UL and DL allows identifying the serving cell for which the DL assignment or UL grant applies when the CIF is not present:

- DL assignment received on PCell corresponds to downlink transmission on PCell;
- UL grant received on PCell corresponds to uplink transmission on PCell;
- DL assignment received on SCell_n corresponds to downlink transmission on SCell_n;
- UL grant received on SCell_n corresponds to uplink transmission on SCell_n. If SCell_n is not configured for uplink usage by the UE, the grant is ignored by the UE.

See Exhibit N (3GPP TS 36.300) at 47, 92–93, §§ 5.5, 11.1.

186. The Accused Instrumentalities meet the final element of Claim 8, which recites "receiving an Acknowledgement/Negative-acknowledgement (ACK/NACK) signal for the uplink data only on said one downlink component carrier on which the uplink resource allocation information is received." *See, e.g.,*:

6.9 Physical hybrid ARQ indicator channel

The PHICH carries the hybrid-ARQ ACK/NACK. Multiple PHICHs mapped to the same set of resource elements constitute a PHICH group, where PHICHs within the same PHICH group are separated through different orthogonal sequences. A PHICH resource is identified by the index pair $\left(n_{\mathrm{PHICH}}^{\mathrm{group}}, n_{\mathrm{PHICH}}^{\mathrm{seq}}\right)$, where $n_{\mathrm{PHICH}}^{\mathrm{group}}$ is the PHICH group number and $n_{\mathrm{PHICH}}^{\mathrm{seq}}$ is the orthogonal sequence index within the group.

See Exhibit K (3GPP TS 36.211) at 68, § 6.9.

9.1.2 PHICH Assignment Procedure

For PUSCH transmissions scheduled from serving cell c in subframe n, a UE shall determine the corresponding PHICH resource of serving cell c in subframe $n + k_{PHICH}$, where k_{PHICH} is always 4 for FDD and is given in table 9.1.2-1 for TDD. For subframe bundling operation, the corresponding PHICH resource is associated with the last subframe in the bundle.

See Exhibit M (3GPP TS 36.213) at 95, § 9.1.2.

5.1A.1 DL control signalling

- For signalling of downlink HARQ ACK/NACK indication, following principles are applied.
  - PHICH physical transmission aspects from Rel-8 (orthogonal code design, modulation, scrambling sequence, mapping to resource elements) are reused.
  - PHICH is transmitted only on the downlink component carrier that was used to transmit the UL grant
  - At least in case that the number of downlink component carriers are more than or equal to that of uplink component carriers and no carrier indicator field is used, the Rel-8 PHICH resource mapping rule is reused.

See Exhibit T (3GPP TR 36.912) at 9, § 5.1A.1.

187. HTC directly infringes Claim 8 of the ’032 Patent. The Accused Instrumentalities, by complying with TS 36.211, TS 36.212, TS 36.213, and TS 36.300, meet every element of Claim 8. Claim 8 does not contain any steps specifying performance of a step by a third party (e.g., such as powering on a device or connecting to an LTE network). The Accused Instrumentalities contain software and/or firmware enabled and ready to perform the method claimed in Claim 8 without any initiation or involvement by the end user. *See SiRF Tech.*, 601 F.3d at 1329–31. The Accused Instrumentalities are designed to automatically perform the steps of the claimed method in Claim 8 because the Accused Instrumentalities are programmed to carry out the methods compliant with the LTE-Advanced Standards when they are connected to an LTE network. *See id.* The software and/or firmware residing on the Accused Instrumentalities carries out each of these steps without user involvement. *See id.*

188. Based on information and belief, third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to make, use, offer for sale, sell, and/or import the Accused Instrumentalities, including, for example, by using the Accused Instrumentalities in an LTE network, as described in more detail above.

189. HTC also indirectly infringes Claim 8 of the ’032 Patent by inducing third parties, including customers, end users, mobile network operators, distributors, and/or retailers, to use, offer for sale, sell, or import the Accused Instrumentalities, and/or to use the Accused Instrumentalities perform the infringing steps of Claim 8 of the ’032 Patent, in violation of 35 U.S.C. § 271(b).

190. HTC induced these third parties’ direct infringement by advertising and/or selling the Accused Instrumentalities (which meet every element of Claim 8 by virtue of their compliance with the applicable standards, as set forth above), and by providing support for, and encouraging and instructing in the use of, those devices. For example, HTC provides instruction manuals, user guides, owner manuals, and other online resources that specifically teach customers and other end users to use the Accused Instrumentalities in an infringing manner. As another example, HTC actively induces the infringement of others through joint business planning, distribution and/or reseller agreements, the provision of advertisements, technical specifications, instructional and/or promotional materials provided in connection with Accused Products, including, for example, the associated user manuals and other materials that instruct and encourage the purchaser to use the products in a manner that HTC knows to infringe.

191. HTC did so despite having knowledge, as early as September 21, 2018, of the application for the ’032 Patent and the fact that the ’032 Patent would be essential to the use of the applicable LTE standards. HTC was also aware of SPT’s specific infringement theories as to

the ’032 Patent by no later than the filing or service of this Complaint. HTC also had actual notice of the ’032 Patent as early as February 24, 2019, at which time SPT identified all of the Asserted Patents to HTC in writing.

192. HTC specifically intended and continues to specifically intend for persons who acquire and use the Accused Instrumentalities to use them in a manner that infringes at least Claim 8 of the ’032 Patent. If HTC did not know that the actions it encouraged constituted infringement of the ’032 Patent, HTC was willfully blind as to its inducing infringement of others. HTC subjectively believed that there was a high probability that others would infringe the ’032 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Thus, HTC has known, was willfully blind to, or should have known that its actions have actively induced infringement.

193. For the same reasons, HTC’s infringement of the ’032 Patent has been willful. Despite its knowledge or willful blindness to the ’032 Patent and its direct or indirect infringement of one or more claims of that patent, HTC has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Furthermore, HTC has rejected or ignored SPT’s good faith offers to license the Asserted Patents at FRAND rates. This conduct has been egregious, wanton, willful, and in deliberate disregard of SPT’s rights.

194. SPT has been and continues to be damaged by HTC’s infringement of the ’032 Patent.

195. HTC’s infringement of the ’032 Patent is exceptional, and SPT is entitled to recover reasonable attorneys’ fees incurred in prosecuting this action in accordance with 35 U.S.C. § 285.

JURY DEMAND

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

PRAYER FOR RELIEF

WHEREFORE, Plaintiff Sun Patent Trust asks this Court for an order granting the following relief:

a. a judgment in favor of SPT that HTC has infringed, either literally and/or under the doctrine of equivalents, the ’870, ’602, ’535, ’320, ’594, and ’032 Patents;

b. a judgment and order finding that HTC’s infringement has been and is willful;

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

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

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

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

Dated: January 4, 2021

/s/ Bradley W. Caldwell

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CERTIFICATE OF SERVICE

The undersigned certifies that the foregoing document was filed electronically in compliance with Local Rule CV-5(a). As such, this document was served on all counsel who have consented to electronic service on this 4th day of January, 2021. Local Rule CV-5(a)(3)(A).

/s/ Hamad Hamad
Hamad Hamad