RUSS AUGUST & KABAT
Marc A. Fenster, CA SBN 181067
mfenster@raklaw.com
Reza Mirzaie, CA SBN 246953
rmirzaie@raklaw.com
Philip X. Wang, CA SBN 262239
pwang@raklaw.com
Kent N. Shum, CA SBN 259189
kshum@raklaw.com
Christian Conkle, CA SBN 306374
cconkle@raklaw.com
Minna Y. Chan, CA SBN 305941
mchan@raklaw.com
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025
Tele: 310/826-7474
Fax: 310/826-6991

Attorneys for Plaintiff
XR Communications, LLC
dba Vivato Technologies

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

XR COMMUNICATIONS, LLC, dba VIVATO TECHNOLOGIES,

Plaintiff,

v.

ARRIS GROUP, INC.; ARRIS INTERNATIONAL PLC; and RUCKUS NETWORKS, AN ARRIS COMPANY,

Defendants.

Case No. 8:18-cv-192

COMPLAINT FOR PATENT INFRINGEMENT

I. JURISDICTION

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

II. THE PARTIES

2. Plaintiff XR Communications LLC d/b/a Vivato Technologies ("Vivato" or "Plaintiff") is a limited liability company organized and existing under the laws of Delaware with its principal place of business at 444 S. Cedros Ave., Solana Beach, CA 92075.

3. Arris Group, Inc. is a corporation organized and existing under the laws of Delaware with its principal place of business at 3871 Lakefield Dr., Suwanee, GA, 30024. Arris Group, Inc. has an office in this District, located at 1560 B South Baker Avenue, Ontario, CA 91761.

4. Arris International Plc is a company organized under the laws of England and Wales with its principal place of business at 3871 Lakefield Drive, Suwanee, GA, 30024. Arris International Plc has an office in this District, located at 1560 B South Baker Avenue, Ontario, CA 91761.

5. Upon information and belief, Ruckus Networks, an Arris Company is a company with its principal place of business at 350 West Java Drive., Sunnyvale, CA 94089.

6. Upon information and belief, Ruckus Networks is the alter ego of Arris Group, Inc. and/or Arris International Plc and does not operate as a separate entity, does not observe any corporate formalities, and is instead only a business unit of Arris Group, Inc. and/or Arris International Plc. For example, upon information and belief:

- Ruckus Networks fails to observe corporate formalities with Arris Group, Inc. and/or Arris International Plc including adequate capitalization;

- Ruckus Networks is a business unit of Arris Group, Inc. and/or Arris International Plc or is wholly-owned by Arris Group, Inc. and/or Arris International Plc;
- Arris Group, Inc. and/or Arris International Plc substantially dominates Ruckus Networks's management;
- Ruckus Networks does not have regular board meetings;
- Ruckus Networks has no functioning corporate directors;
- Ruckus Networks has no board of directors;
- Ruckus Networks has no employees; and
- Ruckus Networks products are developed, managed, and sold only by individuals who are employed by Arris Group, Inc. and/or Arris International Plc and whose salaries are paid by Arris Group, Inc. and/or Arris International Plc only.

7. Without a determination of alter ego, Vivato will suffer an inequitable result. For example, injustice would result if Ruckus Networks, Arris Group, Inc. or Arris International Plc were permitted to evade liability for infringement by adhering to the fiction of separate corporate existences.

8. Ruckus Wireless, Inc. ("Ruckus Wireless") is a corporation organized and existing under the laws of Delaware with its principal place of business at 350 West Java Drive., Sunnyvale, CA 94089. Ruckus has a registered agent for service of process at C T Corporation System, 818 W 7th St. Ste. 930, Los Angeles, CA 90017.

9. Ruckus Wireless was formerly a wholly-owned subsidiary, and alter ego, of Brocade Communication Systems, Inc. In December of 2017, in a multi-party merger/acquisition transaction, Ruckus Wireless was acquired by Arris International. As of the original filing of this Complaint on February 2, 2018, there was a pending action between Vivato and Ruckus Wireless before the U.S. District Court for the Central District of California, Case No. 2:17-cv-02961-AG-JCG. In

that action, counsel for Ruckus Wireless represented to the Court in a hearing on January 22, 2018, that Ruckus Wireless "probably doesn't exist any more," and "the company that exists is Ruckus Networks and Arris company." Counsel for Ruckus Wireless also represented to counsel for Vivato in an email sent February 1, 2018, that counsel for Ruckus Wireless believed that "Ruckus Wireless, Inc., a wholly owned subsidiary of Brocade, no longer exists." Counsel for Ruckus Wireless refused to allow Arris Group, Arris International, or Ruckus Networks to be added to Case No. 2:17-cv-02961-AG-JCG by amendment. Based on these representations from counsel for Ruckus Wireless, Vivato is informed and believes and thereupon alleges that, at least as of February 2, 2018, Ruckus Networks, Arris Group, and Arris International are the parties responsible for the infringing acts alleged below.

10. This Court has personal jurisdiction over Ruckus Networks, Arris Group, Inc. and Arris International Plc (collectively, "Defendants") because Defendants have committed acts within the this District giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Defendants would not offend traditional notions of fair play and substantial justice. Defendants, directly and through subsidiaries or intermediaries, has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the asserted patents.

11. Venue is proper in this federal district pursuant to 28 U.S.C. § 1400(b) because at the time of this action's filing, Defendants have committed acts of infringement in this District and have a regular and established place of business in this District. Defendants sell and offer to sell its infringing devices, including the ZoneFlex R710, to customers in this District directly, as well as through resellers and distributors. For example, Defendants sell the ZoneFlex R710 to customers located in this District through the website Amazon.com. Further, Defendants have a physical office in this District located in Ontario, as indicated above. Upon

information and belief, Defendants have numerous agents or employees that reside in this District, regularly work in this District including at the Ontario office, and conduct business in this District.

III. BACKGROUND OF THE TECHNOLOGY

12. Vivato was founded in 2000 as a $80+million venture-backed company with several key innovators in the wireless communication field including Siavash Alamouti, Ken Biba, William Crilly, James Brennan, Edward Casas, and Vahid Tarokh among many others. Wi-Fi/802.11 has become the ubiquitous wireless connection to the Internet and is now integrated into hundreds of millions of mobile devices globally. Vivato was founded to leverage its talent to generate intellectual property and deliver Wi-Fi/802.11 wireless connectivity solutions to service the growing demand for bandwidth.

13. Over the years, Vivato has developed proven technology, with over 400 deployments globally, including private, public and government, and has become a recognized provider of extended range Wi-Fi network infrastructure solutions. Vivato's wireless base stations integrate beamforming phased array antenna design with packet steering technology to deliver high-bandwidth extended range connections to serve multiple users and multiple devices.

14. Vivato's patent portfolio includes over 17 issued patents and pending patent applications. The patents-in-suit are directed to specific aspects of wireless communication including adaptively steered antenna technology and beam switching technology.

IV. COUNT ONE: INFRINGEMENT OF UNITED STATES PATENT NO. 7,062,296

15. On June 13, 2006, United States Patent No. 7,062,296 ("the '296 Patent") was duly and legally issued for inventions entitled "Forced Beam Switching in Wireless Communication Systems Having Smart Antennas." Vivato owns the

'296 Patent and holds the right to sue and recover damages for infringement thereof. A copy of the '296 Patent is attached hereto as Exhibit A.

16. Defendants have directly infringed and continues to directly infringe numerous claims of the '296 Patent, including at least claim 33, by manufacturing, using, selling, offering to sell, and/or importing into the United States Wi-Fi access points and routers supporting MU-MIMO, including without limitation access points and routers utilizing the IEEE 802.11ac-2013 standard (e.g. Defendants' ZoneFlex R710, ZoneFlex R610, ZoneFlex R510, ZoneFlex H510, ZoneFlex T310, ZoneFlex T710, ZoneFlex T610, and ZoneFlex C110) (collectively the "Accused Products"). Defendants are liable for infringement of the '296 Patent pursuant to 35 U.S.C. § 271(a).

17. Each of the Accused Products comprises an apparatus for use in a wireless communication system. For example, the ZoneFlex R710 is an apparatus for use in a wireless communication system.

18. Each of the Accused Products comprises at least one smart antenna. For example, the ZoneFlex R710 has at least one smart antenna.

19. Each of the Accused Products comprises at least one transceiver operatively coupled to said smart antenna and configured to send and receive electromagnetic signals using said smart antenna. For example, the ZoneFlex R710 has a Qualcomm QCA9994 Wi-Fi radio coupled to the smart antenna to send and receive signals. *See, e.g.*, IEEE 802.11ac-2013 ("802.11ac Standard") Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h), 22.3.4.8(p), 22.3.4.9.1(q), 22.3.4.9.2(q), 22.3.4.10.4(e) ("Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit."); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

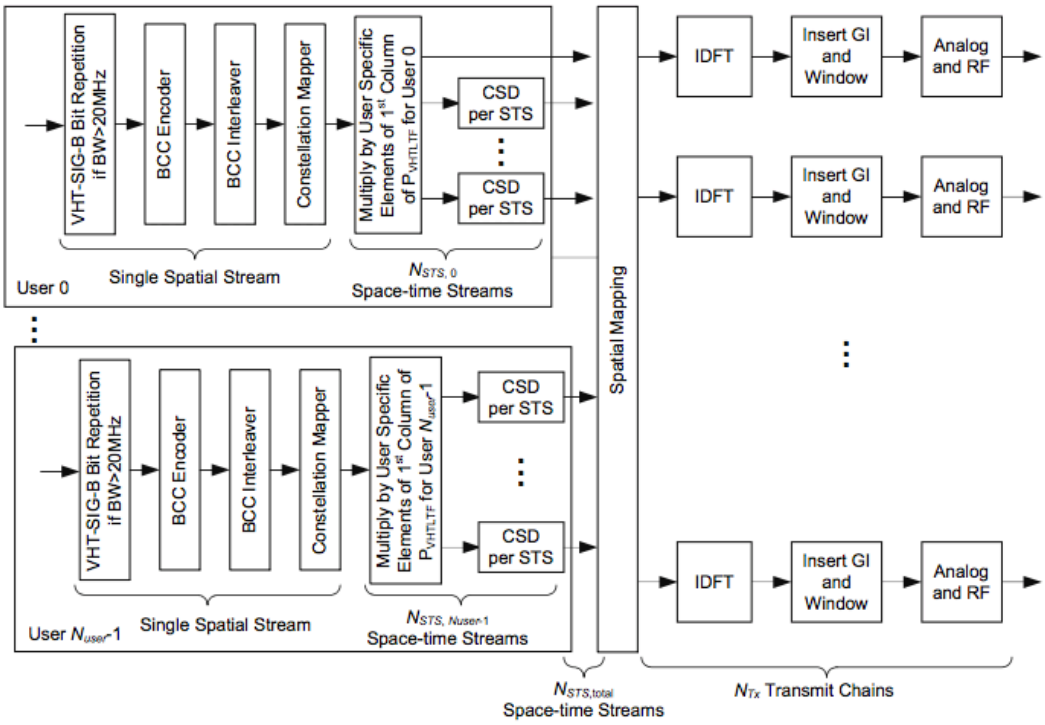

Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

20. Each of the Accused Products comprises logic operatively coupled to said transceiver and configured to selectively allow a second device to operatively associate with a beam downlink transmittable to said second device using said smart antenna. For example, the ZoneFlex R710 allows a client device to operatively associate with a beam downlink transmittable to that client device using the smart antenna. *See, e.g.*, 802.11ac Standard Clause 8.5.23.3 ("The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs. The Action field of a Group ID Management frame contains the information shown in Table 8-281aj"); *id.* Clause 8.4.1.51 ("The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a member

of the group — Set to 1 if STA is a member of the group The Membership Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU transmissions) are reserved."); *id.* Clause 8.4.1.52 ("The User Position Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-80g. * * * If the Membership Status subfield for a particular group ID is 1, then the corresponding User Position subfield is encoded as shown in Table 8-53l."); *id.* Table 8-53*l*:

Table 8-53l—Encoding of User Position subfield

User Position subfield value	User position
00	0
01	1
10	2
11	3

Id. Clause 22.3.8.3.3 ("The VHT-SIG-A field carries information required to interpret VHT PPDUs. The structure of the VHT-SIG-A field for the first part (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown in Figure 22-19."); *id.* Figure 22-18:

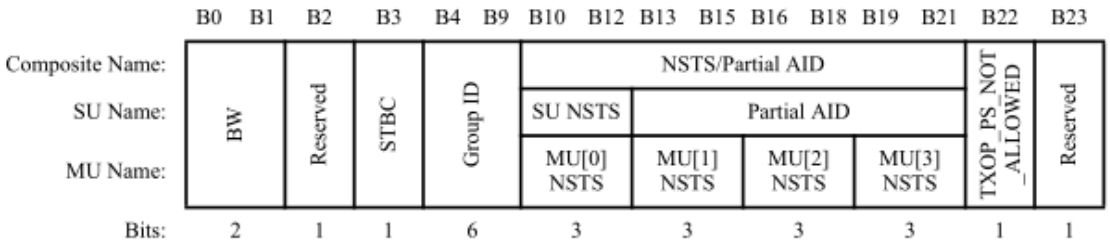

Figure 22-18—VHT-SIG-A1 structure

Id. Clause 22.3.11.4:

> When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value *k* and where MembershipStatusInGroupID[*k*] is equal to 1, then the number of space-time streams for that STA is indicated in the MU[UserPositionInGroupID[*k*]] NSTS field in VHT-SIG-A. The space-time streams of different users are ordered in accordance to user position values, i.e., the space-time streams for the user in user position 0 come first, followed by the space-time streams for the user in position 1, followed by the space-time streams for the user in position 2, and followed by the space-time streams for the user in position 3.
>
> A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, the STA may use the channel state information for all space-time streams to reduce the effect of interfering space-time streams.

Id. Clause 9.31.5.1 ("Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer and a STA for which reception is optimized is called a VHT beamformee. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix."); *id.* Clause 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer.");

id. Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(*l*), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) ("Spatial mapping: Apply the *Q* matrix as described in 22.3.10.11.1."); *id.* Clauses 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

21. Each of the Accused Products comprises logic configured to determine information from at least one uplink transmission receivable from said second device through said smart antenna. For example, the ZoneFlex R710 determines information from a VHT Compressed Beamforming frame received from a client device through its smart antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

22. Each of the Accused Products comprises logic configured to determine if said associated second device should operatively associate with a different beam downlink transmittable using said smart antenna based on said determined information. For example, the ZoneFlex R710 determines, based on the information received in a VHT Compressed Beamforming frame, if the client device should operatively associate with a different beam downlink transmittable using the smart antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.2:

> Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer. The beamforming feedback matrix, $V_{k,u}$, found by the beamformee u for subcarrier k shall be compressed in the form of angles using the method described in 20.3.12.3.6. The angles, $\phi(k,\upsilon)$ and $\psi(k,u)$, are quantized according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22 beamforming feedback format defined.
>
> The beamformee shall generate the beamforming feedback matrices with the number of rows (Nr) equal to the N_{STS} of the NDP.
>
> After receiving the angle information, $\phi(k,u)$ and $\psi(k,u)$, the beamformer reconstructs $V_{k,u}$ using Equation (20-79). For SU-MIMO beamforming, the beamformer can use this $V_{k,0}$ matrix to determine the steering matrix Q_k. For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix $Q_k = [Q_{k,0}, Q_{k,1}, \ldots, Q_{k,N_{user}-1}]$ using $V_{k,u}$ and $SNR_{k,u}$ $(0 \le u \le N_{user} - 1)$ in order to suppress crosstalk between participating beamformees. The method used by the beamformer to calculate the steering matrix Q_k is implementation specific.

23. Each of the Accused Products comprises logic configured to allow said second device to operatively associate with said different beam if said associated second device should operatively associate with a different beam and selectively identify that said second device is not allowed to operatively associate with said beam. For example, the ZoneFlex R710 allows a client device to operatively associate with a beam that is different from the beam with which the client was associated previously, and to identify that the client device is not allowed to operatively associate with the prior beam. *See, e.g.*, 802.11ac Standard Clause 10.40 ("An AP determines the possible combinations of STAs that can be addressed by a VHT MU PPDU by assigning STAs to groups and to specific user positions within those groups. Assignments or changes of user positions corresponding to one or more Group IDs shall be performed using a Group ID Management frame defined in 8.5.23.3…A VHT MU PPDU shall be transmitted to a STA based on the content of the Group ID Management frame most recently transmitted to the STA and for which an acknowledgement was received."); *id*. Clause 8.5.23.3 ("The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs. The Action field of a Group ID Management frame contains the information shown in Table 8-281aj"); *id.* Clause 8.4.1.51 ("The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a member of the group The Membership Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU transmissions) are reserved."); *id.* Clause 8.4.1.52 ("The User Position Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is

16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-80g. * * * If the Membership Status subfield for a particular group ID is 1, then the corresponding User Position subfield is encoded as shown in Table 8-53l."); *id.* Table 8-53*l*:

Table 8-53l—Encoding of User Position subfield

User Position subfield value	User position
00	0
01	1
10	2
11	3

Id. Clause 22.3.8.3.3 ("The VHT-SIG-A field carries information required to interpret VHT PPDUs. The structure of the VHT-SIG-A field for the first part (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown in Figure 22-19."); *id.* Figure 22-18:

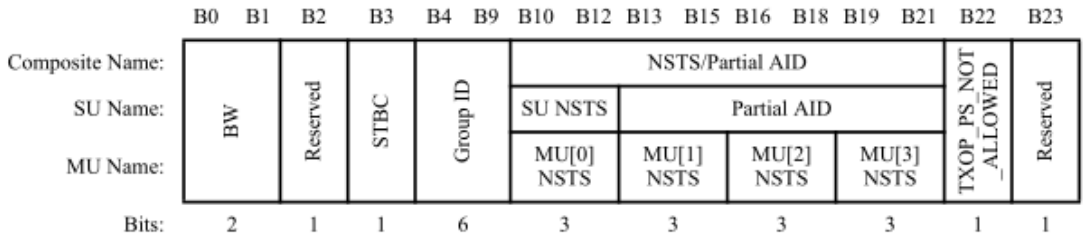

Figure 22-18—VHT-SIG-A1 structure

Id. Clause 22.3.11.4:

> When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value *k* and where MembershipStatusInGroupID[*k*] is equal to 1, then the number of space-time streams for that STA is indicated in the MU[UserPositionInGroupID[*k*]] NSTS field in VHT-SIG-A. The space-time streams of different users are ordered in accordance to user position values, i.e., the space-time streams for the user in user position 0 come first, followed by the space-time streams for the user in position 1, followed by the space-time streams for the user in position 2, and followed by the space-time streams for the user in position 3.
>
> A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, the STA may use the channel state information for all space-time streams to reduce the effect of interfering space-time streams.

Id. Clause 9.31.5.1 ("Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer and a STA for which reception is optimized is called a VHT beamformee. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix."); *id.* Clause 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer."); *id*. Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(*l*), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) ("Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1."); *id.* Clauses 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

24. Defendants have been and are now indirectly infringing at least one claim of the '296 Patent in accordance with 35 U.S.C. § 271(b) in this district and elsewhere in the United States. More specifically, Defendants have been and are now

actively inducing direct infringement by other persons (e.g., Defendants' customers who use, sell, or offer for sale the Accused Products).

25. By at least the filing and service of the original Complaint on April 19, 2017, and May 3, 2017, respectively, Defendants had knowledge of the '296 Patent, and that its actions resulted in a direct infringement of the '296 Patent. Defendants also knew or were willfully blind that its actions would induce direct infringement by others and intended that its actions would induce direct infringement by others.

26. Defendants actively induced, and continue to induce, such infringement by, among other things, providing user manuals and other instruction material for its Accused Products that induce their customers to use the Accused Products in their normal and customary way to infringe the '296 Patent. For example, Defendants' websites provided, and continue to provide, instructions for using the Accused Products on wireless communication systems, and to utilize their beamforming and MU-MIMO functionalities. Defendants sold, and continue to sell, for example, on Amazon.com, the Accused Products to customers despite their knowledge of the '296 Patent. Defendants manufactured and imported into the United States, and continues to do so, the Accused Products for sale and distribution to their customers, despite its knowledge of the '296 Patent. Through their continued manufacture, importation, and sales of its Accused Products, Defendants specifically intended for their customers to infringe claims of the '296 Patent. Further, Defendants were aware that these normal and customary activities would infringe the '296 Patent. Defendants performed, and continues to perform, acts that constitute induced infringement, and that would induce actual infringement, with knowledge of the '296 Patent and with the knowledge or willful blindness that the induced acts would constitute direct infringement.

27. Accordingly, a reasonable inference is that Defendants specifically intended for others, such as their customers, to directly infringe one or more claims of the '296 Patent in the United States because Defendants had knowledge of the

'296 Patent and actively induced others (e.g., their customers) to directly infringe the '296 Patent by using, selling, or offering to sell the Accused Products and the MU-MIMO functionality within the Accused Products.

28. Defendants also infringe other claims of the '296 Patent, directly and through inducing infringement, for similar reasons as explained above with respect to Claim 33.

29. The '296 Patent is valid and enforceable.

30. Defendants' infringement of the '296 Patent has damaged Vivato, and Defendants are liable to Vivato in an amount to be determined at trial that compensates Vivato for the infringement, which by law can be no less than a reasonable royalty.

31. As a result of Defendants' infringement of the '296 Patent, Vivato has suffered irreparable harm and will continue to suffer loss and injury.

V. COUNT TWO: INFRINGEMENT OF UNITED STATES PATENT NO. 7,729,728

32. On June 1, 2010, United States Patent No. 7,729,728 ("the '728 Patent") was duly and legally issued for inventions entitled "Forced Beam Switching in Wireless Communication Systems Having Smart Antennas." Vivato owns the '728 Patent and holds the right to sue and recover damages for infringement thereof. A copy of the '728 Patent is attached hereto as Exhibit B.

33. Defendants have directly infringed and continue to directly infringe numerous claims of the '728 Patent, including at least claim 16, by manufacturing, using, selling, offering to sell, and/or importing into the United States the Accused Products. Defendants are liable for infringement of the '728 Patent pursuant to 35 U.S.C. § 271(a).

34. Each of the Accused Products comprises a wireless communication system. For example, the ZoneFlex R710 is a wireless access point for use in a Wi-Fi network.

35. Each of the Accused Products comprises a phased array antenna configured to transmit beam downlinks. *See, e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table 8-128.

36. Each of the Accused Products comprises a transceiver operatively coupled to the phased array antenna and configured to send and receive electromagnetic signals via the phased array antenna. For example, the ZoneFlex R710 has a Qualcomm QCA9994 Wi-Fi radio that is configured to send and receive electromagnetic signals via the phased array antenna. *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h), 22.3.4.8(p), 22.3.4.9.1(q), 22.3.4.9.2(q), 22.3.4.10.4(e) ("Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit."); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

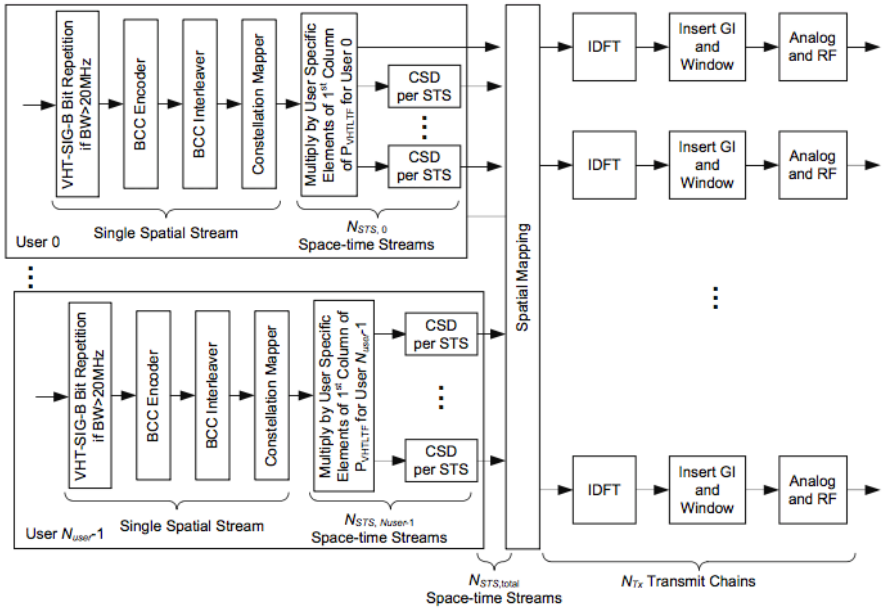

Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

37. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver. For example, the ZoneFlex R710 comprises an access point that includes a phased antenna array and a Qualcomm QCA9994 Wi-Fi radio.

38. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to selectively allow a receiving device to operatively associate with a beam downlink transmitted to the receiving device via the phased array antenna. *See, e.g.*, 802.11ac Standard Clause 8.5.23.3 ("The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs. The Action field of a Group ID Management frame contains the information shown in Table 8-281aj"); *id.* Clause 8.4.1.51 ("The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a member of the group The Membership Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU transmissions) are reserved."); *id.* Clause 8.4.1.52 ("The User Position Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-80g. * * * If the Membership Status subfield for a particular group ID is 1, then the corresponding User Position subfield is encoded as shown in Table 8-53l."); *id.* Table 8-53*l*:

Table 8-53l—Encoding of User Position subfield

User Position subfield value	User position
00	0
01	1
10	2
11	3

Id. Clause 22.3.8.3.3 ("The VHT-SIG-A field carries information required to interpret VHT PPDUs. The structure of the VHT-SIG-A field for the first part (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown in Figure 22-19."); *id.* Figure 22-18:

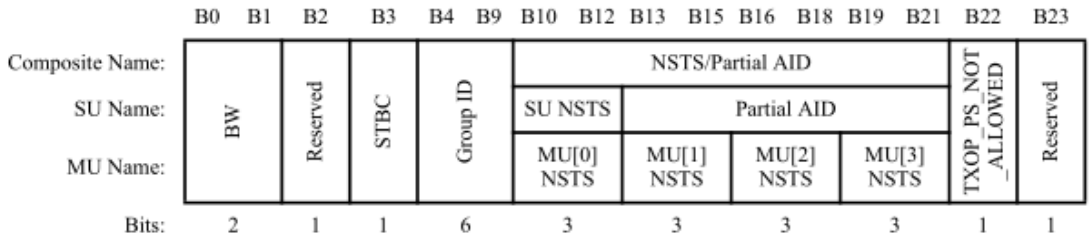

Figure 22-18—VHT-SIG-A1 structure

Id. Clause 22.3.11.4:

> When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value *k* and where MembershipStatusInGroupID[*k*] is equal to 1, then the number of space-time streams for that STA is indicated in the MU[UserPositionInGroupID[*k*]] NSTS field in VHT-SIG-A. The space-time streams of different users are ordered in accordance to user position values, i.e., the space-time streams for the user in user position 0 come first, followed by the space-time streams for the user in position 1, followed by the space-time streams for the user in position 2, and followed by the space-time streams for the user in position 3.
>
> A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, the STA may use the channel state information for all space-time streams to reduce the effect of interfering space-time streams.

Id. Clause 9.31.5.1 ("Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer and a STA for which reception is optimized is called a VHT beamformee. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix."); *id.* Clause 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP

Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer."); *id*. Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(*l*), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) ("Spatial mapping: Apply the *Q* matrix as described in 22.3.10.11.1."); *id.* Clauses 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

39. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to receive an uplink transmission from the receiving device through the phased array antenna. For example, the ZoneFlex R710 is configured to receive a VHT Compressed Beamforming Feedback frame from a "receiving device" such as a connected laptop or smartphone through its phased-array antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

40. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to determine from the uplink transmission if the receiving device should operatively associate with a different beam downlink transmission. For example, the ZoneFlex R710 is configured to determine from information contained in the VHT Compressed Beamforming Feedback frame if the receiving device that sent the VHT Compressed

Beamforming Feedback frame should operatively associate with a different beam downlink transmission. *See, e.g.*, 802.11ac Standard Clauses 3.2, 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.2:

> Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer. The beamforming feedback matrix, $V_{k,u}$, found by the beamformee u for subcarrier k shall be compressed in the form of angles using the method described in 20.3.12.3.6. The angles, $\phi(k,\upsilon)$ and $\psi(k,u)$, are quantized according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22 beamforming feedback format defined.
>
> The beamformee shall generate the beamforming feedback matrices with the number of rows (Nr) equal to the N_{STS} of the NDP.
>
> After receiving the angle information, $\phi(k,u)$ and $\psi(k,u)$, the beamformer reconstructs $V_{k,u}$ using Equation (20-79). For SU-MIMO beamforming, the beamformer can use this $V_{k,0}$ matrix to determine the steering matrix Q_k. For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix $Q_k = [Q_{k,0}, Q_{k,1}, \ldots, Q_{k,N_{user}-1}]$ using $V_{k,u}$ and $SNR_{k,u}$ $(0 \le u \le N_{user} - 1)$ in order to suppress crosstalk between participating beamformees. The method used by the beamformer to calculate the steering matrix Q_k is implementation specific.

41. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to at least one of: (i) allow the receiving device to operatively associate with the different beam downlink if determined that the receiving device should operatively associate with the different beam downlink; (ii) force the receiving device to operatively associate with the different beam downlink if determined that the receiving device should be operatively associated with the different beam downlink. For example, the ZoneFlex R710 is configured to transmit a Group ID Management frame or VHT MU PPDU VHT-SIG-A or combination thereof to allow the receiving device to operatively associate with the different beam downlink if determined that the receiving device should operatively associate with the different beam downlink; (ii) force the receiving device to operatively associate with the different beam downlink if determined that the receiving device should be operatively associated with the different beam downlink. *See, e.g.*, 802.11ac Standard Clause 10.40 ("An AP determines the possible combinations of STAs that can be addressed by a VHT MU PPDU by assigning STAs to groups and to specific user positions within those

groups. Assignments or changes of user positions corresponding to one or more Group IDs shall be performed using a Group ID Management frame defined in 8.5.23.3…A VHT MU PPDU shall be transmitted to a STA based on the content of the Group ID Management frame most recently transmitted to the STA and for which an acknowledgement was received."); *id.* Clause 8.5.23.3 ("The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs. The Action field of a Group ID Management frame contains the information shown in Table 8-281aj"); *id.* Clause 8.4.1.51 ("The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a member of the group The Membership Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU transmissions) are reserved."); *id.* Clause 8.4.1.52 ("The User Position Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-80g. * * * If the Membership Status subfield for a particular group ID is 1, then the corresponding User Position subfield is encoded as shown in Table 8-53l."); *id.* Table 8-53*l*:

Table 8-53l—Encoding of User Position subfield

User Position subfield value	User position
00	0
01	1
10	2
11	3

Id. Clause 22.3.8.3.3 ("The VHT-SIG-A field carries information required to interpret VHT PPDUs. The structure of the VHT-SIG-A field for the first part (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown in Figure 22-19."); *id.* Figure 22-18:

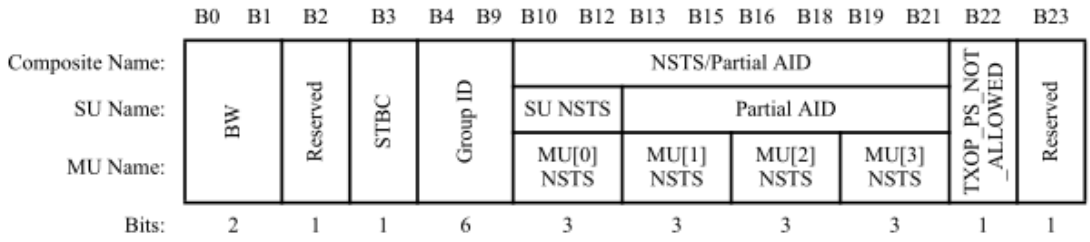

Figure 22-18—VHT-SIG-A1 structure

Id. Clause 22.3.11.4:

> When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value *k* and where MembershipStatusInGroupID[*k*] is equal to 1, then the number of space-time streams for that STA is indicated in the MU[UserPositionInGroupID[*k*]] NSTS field in VHT-SIG-A. The space-time streams of different users are ordered in accordance to user position values, i.e., the space-time streams for the user in user position 0 come first, followed by the space-time streams for the user in position 1, followed by the space-time streams for the user in position 2, and followed by the space-time streams for the user in position 3.
>
> A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, the STA may use the channel state information for all space-time streams to reduce the effect of interfering space-time streams.

Id. Clause 9.31.5.1 ("Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer and a STA for which reception is optimized is called a VHT beamformee. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix."); *id.* Clause 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP

Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer."); *id*. Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(*l*), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) ("Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1."); *id.* Clauses 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

42. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to actively probe the receiving device by generating a signal to initiate that the phased array antenna transmit at least one downlink transmittable message over the beam downlinks, and gather signal parameter information from uplink transmittable messages received from the receiving device through the phased array antenna. For example, the ZoneFlex R710 is configured to actively probe the receiving device by generating a signal to initiate that the phased array antenna transmit a signal, e.g. a VHT null data packet announcement frame over the beam downlinks, and to gather signal parameter information from uplink transmittable messages received from the receiving device through the phased array antenna, e.g. one or more VHT Compressed Beamforming Feedback frames. *See, e.g.,* 802.11ac Standard Clause 9.31.5, 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a

SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer."); *id.* Clause 8.4.1.24; IEEE 802.11-2012 Clause 20.3.12.3.6; 802.11ac Standard Clause 8.5.23.2 (defining format and subfields within the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-(h)) ("Each SNR value per tone in stream *i* (before being averaged) corresponds to the SNR associated with the column *i* of the beamforming feedback matrix *V* determined at the beamformee"); *id.* Clause 8.4.1.49 (including Table 8-53i – MU Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.8.3.5; *id.* Clause 22.3.11.2.

43. Defendants have been and is now indirectly infringing at least one claim of the '728 Patent in accordance with 35 U.S.C. § 271(b) in this district and elsewhere in the United States. More specifically, Defendants have been and are now actively inducing direct infringement by other persons (e.g., Defendants' customers who use, sell, or offer for sale the Accused Products).

44. By at least the filing and service of the original Complaint on April 19, 2017, and May 3, 2017, respectively, Defendants had knowledge of the '728 Patent, and that its actions resulted in a direct infringement of the '728 Patent. Defendants also knew or were willfully blind that its actions would induce direct infringement by others and intended that its actions would induce direct infringement by others.

45. Defendants actively induced, and continue to induce, such infringement by, among other things, providing user manuals and other instruction material for its Accused Products that induce their customers to use the Accused Products in their normal and customary way to infringe the '728 Patent. For example, Defendants' websites provided, and continues to provide, instructions for using the Accused Products on wireless communication systems, and to utilize their beamforming and MU-MIMO functionalities. Defendants sold, and continue to sell, for example, on Amazon.com, the Accused Products to customers despite its knowledge of the '728 Patent. Defendants manufactured and imported into the United States, and continue to do so, the Accused Products for sale and distribution to their customers, despite its knowledge of the '728 Patent. Through their continued manufacture, importation, and sales of its Accused Products, Defendants specifically intended for their customers to infringe claims of the '728 Patent. Further, Defendants were aware that these normal and customary activities would infringe the '728 Patent. Defendants performed, and continue to perform, the acts that constitute induced infringement, and that would induce actual infringement, with knowledge of the '728 Patent and with the knowledge or willful blindness that the induced acts would constitute direct infringement.

46. Accordingly, a reasonable inference is that Defendants specifically intended for others, such as their customers, to directly infringe one or more claims of the '728 Patent in the United States because Defendants had knowledge of the '728 Patent and actively induced others (e.g., their customers) to directly infringe the '728 Patent by using, selling, or offering to sell the Accused Products and the MU-MIMO functionality within the Accused Products.

47. Defendants also infringe other claims of the '728 Patent, directly and through inducing infringement, for similar reasons as explained above with respect to Claim 16.

48. The '728 Patent is valid and enforceable.

49. Defendants' infringement of the '728 Patent has damaged Vivato, and Defendants are liable to Vivato in an amount to be determined at trial that compensates Vivato for the infringement, which by law can be no less than a reasonable royalty.

50. As a result of Defendants' infringement of the '728 Patent, Vivato has suffered irreparable harm and will continue to suffer loss and injury.

VI. COUNT THREE: INFRINGEMENT OF UNITED STATES PATENT NO. 6,611,231

51. On August 26, 2003, United States Patent No. 6,611,231 ("the '231 Patent") was duly and legally issued for inventions entitled "Wireless Packet Switched Communication Systems and Networks Using Adaptively Steered Antenna Arrays." Vivato owns the '231 Patent and holds the right to sue and recover damages for infringement thereof. A copy of the '231 Patent is attached hereto as Exhibit C.

52. Defendants have directly infringed and continue to directly infringe numerous claims of the '231 Patent, including at least claim 1, by manufacturing, using, selling, offering to sell, and/or importing into the United States the Accused Products. Defendants are liable for infringement of the '231 Patent pursuant to 35 U.S.C. § 271(a).

53. Each of the Accused Products comprises an apparatus for use in a wireless routing network. For example, the ZoneFlex R710 is an apparatus for use in a wireless routing network.

54. Each of the Accused Products comprises an adaptive antenna. For example, the ZoneFlex R710 has at least one adaptive antenna. *See, e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table 8-128:

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/ / /

8.4.2.58.6 Transmit Beamforming Capabilities

Change the following rows in Table 8-128:

Table 8-128—Subfields of the Transmit Beamforming Capabilities field

Subfield	Definition	Encoding
CSI Number of Beamformer Antennas Supported	Indicates the maximum number of beamformer antennas the HT beamformee can support when CSI feedback is required	Set to 0 for single Tx antenna sounding Set to 1 for 2 Tx antenna sounding Set to 2 for 3 Tx antenna sounding Set to 3 for 4 Tx antenna sounding
Noncompressed Steering Number of Beamformer Antennas Supported	Indicates the maximum number of beamformer antennas the HT beamformee can support when noncompressed beamforming feedback matrix is required	Set to 0 for single Tx antenna sounding Set to 1 for 2 Tx antenna sounding Set to 2 for 3 Tx antenna sounding Set to 3 for 4 Tx antenna sounding
Compressed Steering Number of Beamformer Antennas Supported	Indicates the maximum number of beamformer antennas the HT beamformee can support when compressed beamforming feedback matrix is required	Set to 0 for single Tx antenna sounding Set to 1 for 2 Tx antenna sounding Set to 2 for 3 Tx antenna sounding Set to 3 for 4 Tx antenna sounding
CSI Max Number of Rows Beamformer Supported	Indicates the maximum number of rows of CSI explicit feedback from the HT beamformee or calibration responder or transmit ASEL responder that an HT beamformer or calibration initiator or transmit ASEL initiator can support when CSI feedback is required.	Set to 0 for a single row of CSI Set to 1 for 2 rows of CSI Set to 2 for 3 rows of CSI Set to 3 for 4 rows of CSI

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55. Each of the Accused Products comprises at least one transmitter operatively coupled to said adaptive antenna and at least one receiver operatively coupled to said adaptive antenna. For example, the ZoneFlex R710 has a Qualcomm QCA9994 Wi-Fi radio operatively coupled to the adaptive antenna. *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h), 22.3.4.8(p), 22.3.4.9.1(q), 22.3.4.9.2(q), 22.3.4.10.4(e) ("Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit."); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

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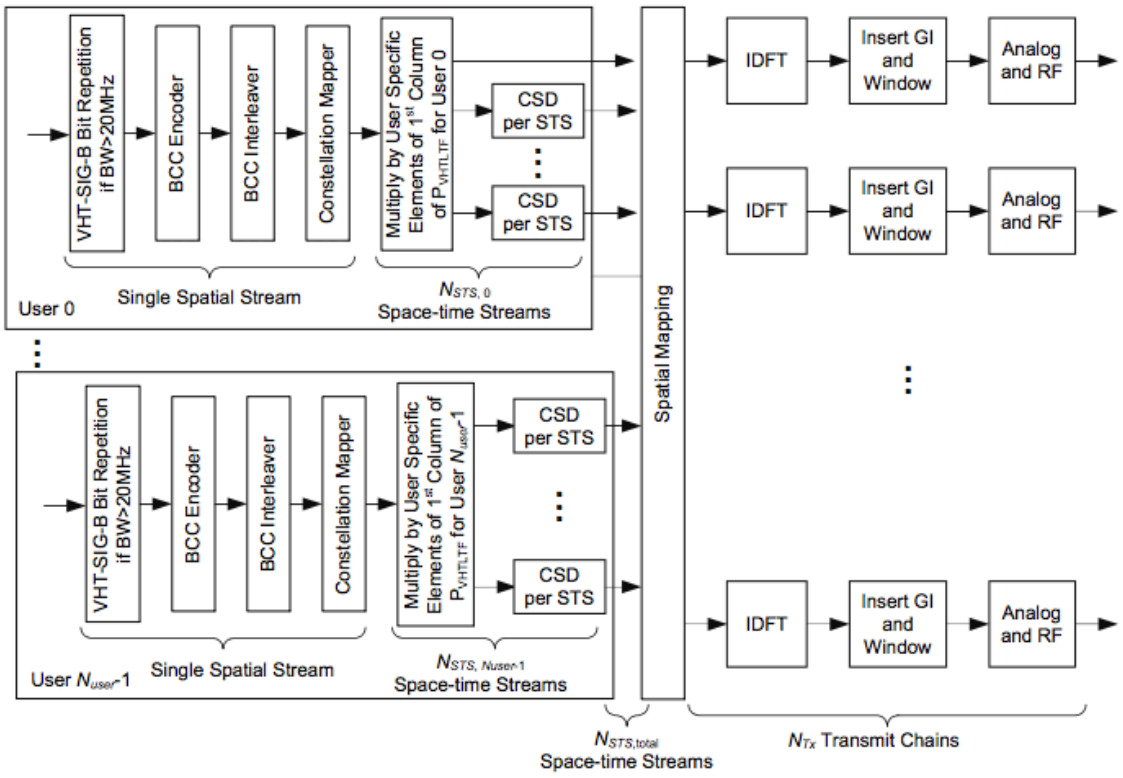

Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

56. Each of the Accused Products comprises a control logic operatively coupled to said transmitter and configured to cause said at least one transmitter to output at least one transmission signal to said adaptive antenna to transmit corresponding outgoing multi-beam electromagnetic signals exhibiting a plurality of selectively placed transmission peaks and transmission nulls within a far field region of a coverage area based on routing information. For example, the ZoneFlex R710 is configured to output at least one transmission signal to said adaptive antenna. For a further example, the ZoneFlex R710 is configured to cause said at least one transmitter to output at least one transmission signal to said adaptive antenna to transmit corresponding outgoing multi-beam electromagnetic signals exhibiting a plurality of selectively placed transmission peaks and transmission nulls within a far field region of a coverage area based on routing information. *See, e.g.*, 802.11ac Standard Clause 9.31.5.1 ("Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the

transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer and a STA for which reception is optimized is called a VHT beamformee. An explicit feedback mechanism is used where the VHT beamformee directly measures the channel from the training symbols transmitted by the VHT beamformer and sends back a transformed estimate of the channel state to the VHT beamformer. The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive the steering matrix."); *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(*l*), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) ("Spatial mapping: Apply the *Q* matrix as described in 22.3.10.11.1."); *id.* Clause 22.3.10.11.1; IEEE 802.11-2012 Standard Clause 20.3.12.3.6; 802.11ac Standard Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.1:

> The DL-MU-MIMO steering matrix $Q_k = [Q_{k,0}, Q_{k,1}, \ldots, Q_{k,N_{user}-1}]$ can be determined by the beamformer using the beamforming feedback matrices for subcarrier k from beamformee u, $V_{k,u,}$ and SNR information for subcarrier k from beamformee u, $SNR_{k,u}$, where $u = 0, 1, \ldots, N_{user} - 1$. The steering matrix that is computed (or updated) using new beamforming feedback matrices and new SNR information from some or all of participating beamformees might replace the existing steering matrix Q_k for the next DL-MU-MIMO data transmission. The beamformee group for the MU transmission is signaled using the Group ID field in VHT-SIG-A (see 22.3.8.3.3 and 22.3.11.4).

Id. Clause 22.3.11.2:

> Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer. The beamforming feedback matrix, $V_{k,u}$, found by the beamformee u for subcarrier k shall be compressed in the form of angles using the method described in 20.3.12.3.6. The angles, $\phi(k,\upsilon)$ and $\psi(k,u)$, are quantized according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22 beamforming feedback format defined.
>
> The beamformee shall generate the beamforming feedback matrices with the number of rows (Nr) equal to the N_{STS} of the NDP.
>
> After receiving the angle information, $\phi(k,u)$ and $\psi(k,u)$, the beamformer reconstructs $V_{k,u}$ using Equation (20-79). For SU-MIMO beamforming, the beamformer can use this $V_{k,0}$ matrix to determine the steering matrix Q_k. For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix $Q_k = [Q_{k,0}, Q_{k,1}, \ldots, Q_{k,N_{user}-1}]$ using $V_{k,u}$ and $SNR_{k,u}$ $(0 \le u \le N_{user} - 1)$ in order to suppress crosstalk between participating beamformees. The method used by the beamformer to calculate the steering matrix Q_k is implementation specific.

57. Each of the Accused Products comprises search receiver logic operatively coupled to said control logic and said at least one receiver and configured to update said routing information based at least in part on cross-correlated signal information that is received by said receiver using said adaptive antenna. For example, the ZoneFlex R710 updates the routing information based at least in part on cross-correlated signal information received in a VHT Compressed Beamforming frame. *See, e.g.*, 802.11ac Standard Clause 9.31.5.2 ("A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame one STA Info field for each VHT beamformee that is expected to prepare VHT Compressed Beamforming feedback and shall identify the VHT beamformee by including the VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a VHT NDP Announcement frame… shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA matching its MAC address and a non-bandwidth signaling TA obtained from the TA field matching the MAC address of the VHT beamformer."); *id*. Clause 8.5.23.2 (defining format and subfields within the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-(h)) ("Each SNR value per tone in stream *i* (before being averaged) corresponds to the SNR associated with the column *i* of the beamforming feedback matrix *V* determined at the beamformee"); *id.* Clause 8.4.1.49 (including Table 8-53i – MU Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.8.3.5; *id.* Clause 22.3.11.2:

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> Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer. The beamforming feedback matrix, $V_{k,u}$, found by the beamformee u for subcarrier k shall be compressed in the form of angles using the method described in 20.3.12.3.6. The angles, $\phi(k,\upsilon)$ and $\psi(k,u)$, are quantized according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22 beamforming feedback format defined.
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> The beamformee shall generate the beamforming feedback matrices with the number of rows (Nr) equal to the N_{STS} of the NDP.
>
> After receiving the angle information, $\phi(k,u)$ and $\psi(k,u)$, the beamformer reconstructs $V_{k,u}$ using Equation (20-79). For SU-MIMO beamforming, the beamformer can use this $V_{k,0}$ matrix to determine the steering matrix Q_k. For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix $Q_k = [Q_{k,0}, Q_{k,1}, \ldots, Q_{k,N_{user}-1}]$ using $V_{k,u}$ and $SNR_{k,u}$ $(0 \le u \le N_{user} - 1)$ in order to suppress crosstalk between participating beamformees. The method used by the beamformer to calculate the steering matrix Q_k is implementation specific.

58. Defendants have been and are now indirectly infringing at least one claim of the '231 Patent in accordance with 35 U.S.C. § 271(b) in this district and elsewhere in the United States. More specifically, Defendants have been and are now actively inducing direct infringement by other persons (e.g., Defendants' customers who use, sell, or offer for sale the Accused Products).

59. By at least the citation during the prosecution of U.S. Patent No. 7,877,113 and the filing and service of the original Complaint on April 19, 2017, and May 3, 2017, respectively, Defendants had knowledge of the '231 Patent, and that their actions resulted in a direct infringement of the '231 Patent. Defendants also knew or were willfully blind that its actions would induce direct infringement by others and intended that their actions would induce direct infringement by others.

60. Defendants actively induced, and continue to induce, such infringement by, among other things, providing user manuals and other instruction material for their Accused Products that induce their customers to use the Accused Products in their normal and customary way to infringe the '231 Patent. For example, Defendants' websites provided, and continue to provide, instructions for using the Accused Products on wireless communication systems, and to utilize their beamforming and MU-MIMO functionalities. Defendants sold, and continue to sell, for example, on Amazon.com, the Accused Products to customers despite its

knowledge of the '231 Patent. Defendants manufactured and imported into the United States, and continue to do so, the Accused Products for sale and distribution to their customers, despite its knowledge of the '231 Patent. Through its continued manufacture, importation, and sales of its Accused Products, Defendants specifically intended for their customers to infringe claims of the '231 Patent. Further, Defendants were aware that these normal and customary activities would infringe the '231 Patent. Defendants performed, and continue to perform, acts that constitute induced infringement, and that would induce actual infringement, with knowledge of the '231 Patent and with the knowledge or willful blindness that the induced acts would constitute direct infringement.

61. Accordingly, a reasonable inference is that Defendants specifically intended for others, such as their customers, to directly infringe one or more claims of the '231 Patent in the United States because Defendants had knowledge of the '231 Patent and actively induced others (e.g., their customers) to directly infringe the '231 Patent by using, selling, or offering to sell the Accused Products and the MU-MIMO functionality within the Accused Products.

62. Defendants also infringe other claims of the '231 Patent, directly and through inducing infringement, for similar reasons as explained above with respect to Claim 1.

63. The '231 Patent is valid and enforceable.

64. Defendants' infringement of the '231 Patent has damaged Vivato, and Defendants are liable to Vivato in an amount to be determined at trial that compensates Vivato for the infringement, which by law can be no less than a reasonable royalty.

65. As a result of Defendants' infringement of the '231 Patent, Vivato has suffered irreparable harm and will continue to suffer loss and injury.

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VII. WILLFUL INFRINGEMENT

66. Defendants have knowledge of the patents-in-suit by at least the citation of the application that led to Vivato's '231 Patent during the prosecution of Defendants' U.S. Patent No. 7,877,113, "Transmission parameter control for an antenna apparatus with selectable elements." On October 17, 2008, Defendants cited to the U.S. Patent and Trademark Office, U.S. Application Publication No. 2002/0158801A1 to Crilly, which is the application that led to Vivato's '231 Patent. Vivato's '231 Patent, however, had already issued on August 26, 2003. Accordingly, a reasonable inference is that Defendants had knowledge of the '231 Patent, and its issued claims, by at least as early as October 17, 2008. Defendants also had knowledge of the '296 Patent because that patent was issued on June 13, 2006, before Defendants' citation of the '231 Patent, and was assigned to the same assignee (Vivato, Inc.) as the '231 Patent and covered the same beamforming and MU-MIMO technologies as the '231 Patent. Defendants also had knowledge of the '728 Patent because its patent application was published on October 26, 2006, before Defendants' citation of the '231 Patent, and was assigned to Vivato, Inc., and covered the same beamforming and MU-MIMO technologies as the '231 Patent. Because of this commonality between the '231 Patent and the '296 and '728 Patents, Defendants knew, or should have known, about Plaintiff's '296 and '728 Patents. Further, by at least the filing and service of the original Complaint on April 19, 2017, and May 3, 2017, respectively, Defendants had knowledge of the patents-in-suit.

67. Despite such knowledge, Defendants infringed and continues to infringe the patents-in-suit with full and complete knowledge of their applicability to Defendants' MU-MIMO products without taking a license and without a good faith belief that the patents-in-suit are invalid and not infringed. Defendants' infringement of the patents-in-suit occurred, and continues to occur, with knowledge of infringement and/or objective recklessness. Defendants' infringement was, and continues to be, willful and deliberate. For example, Defendants sold, and continues

to sell its Accused Products (e.g., its ZoneFlex R710 on Amazon.com, attached hereto as Exhibit M) to customers despite Defendants' knowledge of the patents-in-suit. Defendants also manufactured and imported into the United States, and continues to do so, the Accused Products for sale and distribution to their customers, despite its knowledge of the patents-in-suit.

68. Defendants also actively induced, and continues to induce, their customers to infringe the patents-in-suit by, among other things, providing user manuals and other instruction material for its Accused Products that induce their customers to use the Accused Products in their normal and customary way to infringe the patents-in-suit. For example, Defendants' websites provided, and continues to provide, instructions for using the Accused Products on wireless communication systems, and to utilize their beamforming and MU-MIMO functionalities. Through its continued manufacture, importation, and sales of its Accused Products, Defendants specifically intended, and continues to intend, for their customers to infringe claims of the patents-in-suit, despite Defendants' knowledge of the patents-in-suit.

69. Defendants' infringement of the patents-in-suit is egregious because despite its knowledge of the '231 Patent, Defendants deliberately copied the innovation claimed in the '231 Patent and implemented that patented innovation in its Accused Products. Further, despite Defendants' knowledge of the patents-in-suit, Defendants sold, offered for sale, manufactured, and imported, the Accused Products—and continues to do so—without investigating the scope of the '231 Patent (or the other patents-in-suit) and without forming a good-faith belief that its Accused Products do not infringe or that the patents-in-suit are invalid. Defendants have not taken any steps to remedy its infringement of the patents-in-suit (e.g., by removing the Accused Products from its sales channels); but instead, continues to sell its Accused Products to customers, such as its continued sale of its ZoneFlex R710 on Amazon.com. Defendants' behavior is egregious because it engaged in

misconduct beyond that of typical infringement. For example, in a typical infringement, an infringer would investigate the scope of the asserted patents and develop a good-faith belief that it does not infringe the asserted patents or that the asserted patents are invalid before selling (or continuing to sell) its accused products. An infringer would also remove its accused products from its sales channels and discontinue further sales.

70. Thus, Defendants' infringement of the patents-in-suit is willful and deliberate, entitling Vivato to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

PRAYER FOR RELIEF

WHEREFORE, Vivato prays for the following relief:

(a) A judgment in favor of Vivato that Defendants have infringed and is infringing U.S. Patent Nos. 7,062,296, 7,729,728, and 6,611,231;

(b) An award of damages to Vivato arising out of Defendants' infringement of U.S. Patent Nos. 7,062,296, 7,729,728, and 6,611,231, including enhanced damages pursuant to 35 U.S.C. § 284, together with prejudgment and post-judgment interest, jointly and severally, in an amount according to proof;

(c) An award of an ongoing royalty for Defendants' post-judgment infringement, jointly and severally, in an amount according to proof;

(d) Declaring that Defendants' infringement is willful and that this is an exceptional case under 35 U.S.C. § 285 and awarding attorneys' fees and costs in this action.

(e) Granting Vivato its costs and further relief as the Court may deem just and proper.

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DEMAND FOR JURY TRIAL

Vivato demands a trial by jury of any and all issues triable of right before a jury.

Respectfully submitted,

Dated: February 2, 2018

RUSS AUGUST & KABAT

By: */s/ Reza Mirzaie*
Reza Mirzaie
Marc A. Fenster
Philip X. Wang
Kent N. Shum
Christian Conkle
Minna Y. Chan

Attorneys for Plaintiff
XR COMMUNICATIONS, LLC,
dba VIVATO TECHNOLOGIES