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 19 XR COMMUNICATIONS, LLC,  
 20 dba VIVATO TECHNOLOGIES

21 **UNITED STATES DISTRICT COURT**  
 22 **CENTRAL DISTRICT OF CALIFORNIA**

23 XR COMMUNICATIONS, LLC, dba  
 24 VIVATO TECHNOLOGIES,

25 *Plaintiff,*

26 *v.*

27 CISCO SYSTEMS, INC.,

28 *Defendant.*

Case No. 2:17-cv-2951-AG(JCGx)

**AMENDED COMPLAINT FOR  
 PATENT INFRINGEMENT**

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1     **I.     JURISDICTION AND VENUE**

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

5     **II.    THE PARTIES**

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

10            3.     Cisco Systems, Inc. (“Cisco” or “Defendant”) is a corporation  
11 organized and existing under the laws of California with its principal place of  
12 business at 170 West Tasman Dr., San Jose, CA 95134. Cisco has a registered  
13 agent for service of process at Corporation Service Company, 2710 Gateway Oaks  
14 Dr., Ste. 150N, Sacramento, CA 95833.

15            4.     This Court has personal jurisdiction over Cisco because Cisco is  
16 incorporated under the laws of California and has its principal place of business in  
17 California.

18            5.     Venue is proper in this federal district pursuant to 28 U.S.C.  
19 §§ 1391(b)-(d) and 1400(b) in that Cisco is subject to jurisdiction in this District,  
20 resides in this District, has done business in this District, has regular and  
21 established places of business in this District, has committed acts of infringement  
22 in this District, and continues to commit acts of infringement in this District,  
23 entitling Plaintiff to relief.

24     **III.  BACKGROUND OF THE TECHNOLOGY**

25            6.     Vivato was founded in 2000 as a \$80+million venture-backed  
26 company with several key innovators in the wireless communication field  
27 including Siavash Alamouti, Ken Biba, William Crilly, James Brennan, Edward  
28 Casas, and Vahid Tarokh among many others. Wi-Fi/802.11 has become the

1 ubiquitous wireless connection to the Internet and is now integrated into hundreds  
2 of millions of mobile devices globally. Vivato was founded to leverage its talent to  
3 generate intellectual property and deliver Wi-Fi/802.11 wireless connectivity  
4 solutions to service the growing demand for bandwidth.

5 7. Over the years, Vivato has developed proven technology, with over  
6 400 deployments globally, including private, public and government, and has  
7 become a recognized provider of extended range Wi-Fi network infrastructure  
8 solutions. Vivato's wireless base stations integrate beamforming phased array  
9 antenna design with packet steering technology to deliver high-bandwidth  
10 extended range connections to serve multiple users and multiple devices.

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

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

17 9. On June 13, 2006, United States Patent No. 7,062,296 ("the '296  
18 Patent") was duly and legally issued for inventions entitled "Forced Beam  
19 Switching in Wireless Communication Systems Having Smart Antennas." Vivato  
20 owns the '296 Patent and holds the right to sue and recover damages for  
21 infringement thereof. A copy of the '296 Patent is attached hereto as Exhibit A.

22 10. Defendant has directly infringed and continues to directly infringe  
23 numerous claims of the '296 Patent, including at least claim 33, by manufacturing,  
24 using, selling, offering to sell, and/or importing into the United States WiFi access  
25 points and routers supporting MU-MIMO, including without limitation access  
26 points and routers utilizing the IEEE 802.11ac-2013 standard (e.g. Defendant's  
27 Aironet 1562I, Aironet 1562E, Aironet 1562D, Aironet 1810, Aironet 1810W,  
28 Aironet 1815I, Aironet 1830I, Aironet 1850I, Aironet 1850E, Aironet 3800I,

RUSS, AUGUST & KABAT

1 Aironet 3800E, Aironet 3800P, Aironet 2800I, Aironet 2800E, MR30H, MR33,  
2 MR42, MR52, MR53, MR74, MR84, Aironet 1852E, Aironet 1852I, Aironet  
3 1832I, Aironet 1810W, Aironet 2802I, Aironet 2802E, Aironet 3802I, Aironet  
4 3802E) (collectively the “Accused Products”). Defendant is liable for infringement  
5 of the ’296 Patent pursuant to 35 U.S.C. § 271(a).

6 11. Each of the Accused Products comprises an apparatus for use in a  
7 wireless communication system. For example, the Cisco Aironet 3800E is an  
8 apparatus for use in a wireless communication system.

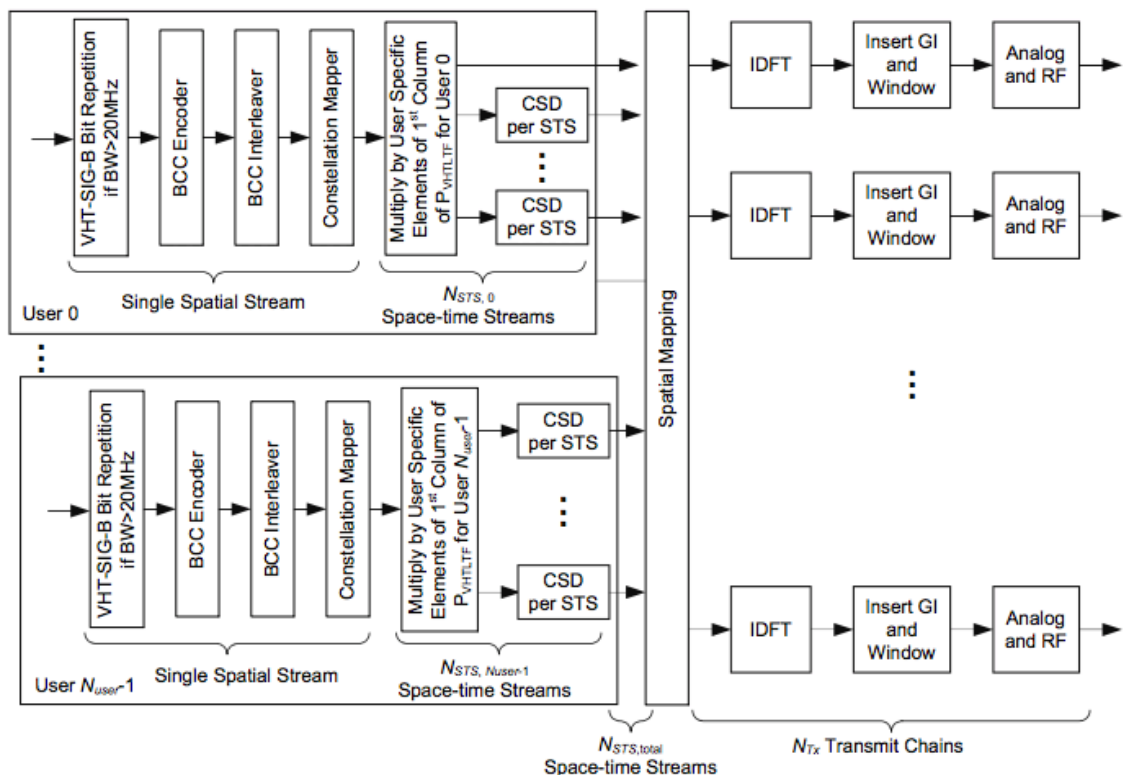
9 12. Each of the Accused Products comprises at least one smart antenna.  
10 For example, the Cisco Aironet 3800E has at least one smart antenna.

11 13. Each of the Accused Products comprises at least one transceiver  
12 operatively coupled to said smart antenna and configured to send and receive  
13 electromagnetic signals using said smart antenna. For example, the Cisco Aironet  
14 3800E has a Cisco WiFi radio coupled to the smart antenna to send and receive  
15 signals. *See, e.g.*, IEEE 802.11ac-2013 (“802.11ac Standard”) Clauses 22.3.4.5(j),  
16 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)  
17 (“Analog and RF: Up-convert the resulting complex baseband waveform  
18 associated with each transmit chain to an RF signal according to the center  
19 frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.*  
20 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**

14. 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 Cisco Aironet 3800E 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

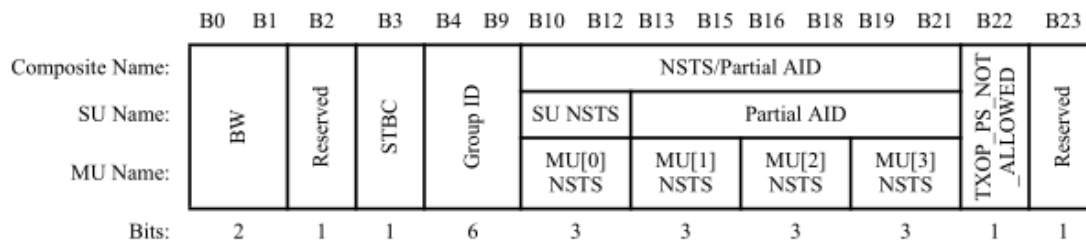
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1 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if  
 2 the STA is not a member of the group — Set to 1 if STA is a member of the group  
 3 The Membership Status subfields for group ID 0 (transmissions to AP) and group  
 4 ID 63 (downlink SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User  
 5 Position Array field is used in the Group ID Management frame (see 8.5.23.3). The  
 6 length of the field is 16 octets. A 16 octet User Position Array field (indexed by the  
 7 Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs,  
 8 as shown in Figure 8-80g. \* \* \* If the Membership Status subfield for a particular  
 9 group ID is 1, then the corresponding User Position subfield is encoded as shown  
 10 in Table 8-53l.”); *id.* Table 8-53l:

11 **Table 8-53l—Encoding of User Position subfield**

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

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



25 **Figure 22-18—VHT-SIG-A1 structure**

26 *Id.* Clause 22.3.11.4:

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1 When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value  $k$  and where  
2 MembershipStatusInGroupID[ $k$ ] is equal to 1, then the number of space-time streams for that STA is  
3 indicated in the MU[UserPositionInGroupID[ $k$ ]] NSTS field in VHT-SIG-A. The space-time streams of  
4 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.

5 A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-  
6 LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended  
7 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.

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



1 the VHT beamformer.”); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
 2 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)  
 3 (“Spatial mapping: Apply the  $Q$  matrix as described in 22.3.10.11.1.”); *id.* Clauses  
 4 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

5 15. Each of the Accused Products comprises logic configured to  
 6 determine information from at least one uplink transmission receivable from said  
 7 second device through said smart antenna. For example, the Cisco Aironet 3800E  
 8 determines information from a VHT Compressed Beamforming frame received  
 9 from a client device through its smart antenna. *See, e.g.*, 802.11ac Standard  
 10 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  
 11 20.3.12.3.6.

12 16. Each of the Accused Products comprises logic configured to  
 13 determine if said associated second device should operatively associate with a  
 14 different beam downlink transmittable using said smart antenna based on said  
 15 determined information. For example, the Cisco Aironet 3800E determines, based  
 16 on the information received in a VHT Compressed Beamforming frame, if the  
 17 client device should operatively associate with a different beam downlink  
 18 transmittable using the smart antenna. *See, e.g.*, 802.11ac Standard Clauses  
 19 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:

20 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 21 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 22 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed in  
 23 the form of angles using the method described in 20.3.12.3.6. The angles,  $\phi(k,u)$  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.

24 The beamformee shall generate the beamforming feedback matrices with the number of rows ( $N_r$ ) equal to  
 25 the  $N_{STS}$  of the NDP.

26 After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 27 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 28 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 is implementation specific.



1           17. Each of the Accused Products comprises logic configured to allow  
2 said second device to operatively associate with said different beam if said  
3 associated second device should operatively associate with a different beam and  
4 selectively identify that said second device is not allowed to operatively associate  
5 with said beam. For example, the Cisco Aironet 3800E allows a client device to  
6 operatively associate with a beam that is different from the beam with which the  
7 client was associated previously, and to identify that the client device is not  
8 allowed to operatively associate with the prior beam. *See, e.g.*, 802.11ac Standard  
9 Clause 10.40 (“An AP determines the possible combinations of STAs that can be  
10 addressed by a VHT MU PPDU by assigning STAs to groups and to specific user  
11 positions within those groups. Assignments or changes of user positions  
12 corresponding to one or more Group IDs shall be performed using a Group ID  
13 Management frame defined in 8.5.23.3...A VHT MU PPDU shall be transmitted to  
14 a STA based on the content of the Group ID Management frame most recently  
15 transmitted to the STA and for which an acknowledgement was received.”); *id.*  
16 Clause 8.5.23.3 (“The Group ID Management frame is an Action frame of category  
17 VHT. It is transmitted by the AP to assign or change the user position of a STA for  
18 one or more group IDs. The Action field of a Group ID Management frame  
19 contains the information shown in Table 8-281aj”); *id.* Clause 8.4.1.51 (“The  
20 Membership Status Array field is used in the Group ID Management frame (see  
21 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array  
22 field (indexed by the group ID) consists of a 1-bit Membership Status subfield for  
23 each of the 64 group IDs, as shown in Figure 8-80f. \* \* \* Within the 8 octet  
24 Membership Status Array field, the 1-bit Membership Status subfield for each  
25 group ID is set as follows: — Set to 0 if the STA is not a member of the group —  
26 Set to 1 if STA is a member of the group The Membership Status subfields for  
27 group ID 0 (transmissions to AP) and group ID 63 (downlink SU transmissions)  
28 are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field is used in the

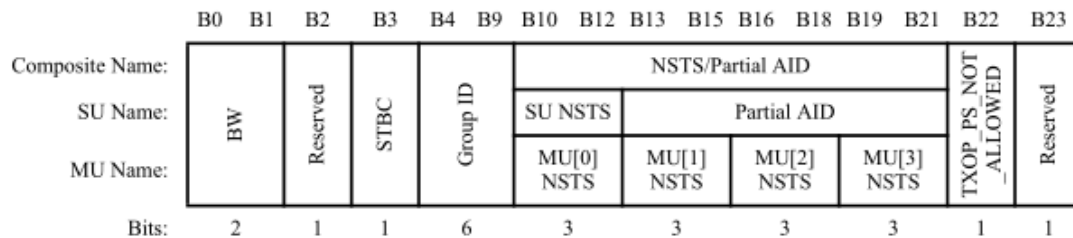
RUSS, AUGUST & KABAT

1 Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A  
 2 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit  
 3 User Position subfield for each of the 64 group IDs, as shown in Figure 8-  
 4 80g. \* \* \* If the Membership Status subfield for a particular group ID is 1, then the  
 5 corresponding User Position subfield is encoded as shown in Table 8-531.”); *id.*  
 6 Table 8-531:

7 **Table 8-531—Encoding of User Position subfield**

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

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



21 **Figure 22-18—VHT-SIG-A1 structure**

22 *Id.* Clause 22.3.11.4:

23 When a STA receives a VHT MU PDU where the Group ID field in VHT-SIG-A has the value  $k$  and where  
 24 MembershipStatusInGroupID[ $k$ ] is equal to 1, then the number of space-time streams for that STA is  
 25 indicated in the MU[UserPositionInGroupID[ $k$ ]] NSTS field in VHT-SIG-A. The space-time streams of  
 26 different users are ordered in accordance to user position values, i.e., the space-time streams for the user in  
 27 user position 0 come first, followed by the space-time streams for the user in position 1, followed by the  
 28 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 PDU 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.

1 *Id.* Clause 9.31.5.1 (“Transmit beamforming and DL-MU-MIMO require  
2 knowledge of the channel state to compute a steering matrix that is applied to the  
3 transmitted signal to optimize reception at one or more receivers. The STA  
4 transmitting using the steering matrix is called the VHT beamformer and a STA for  
5 which reception is optimized is called a VHT beamformee. An explicit feedback  
6 mechanism is used where the VHT beamformee directly measures the channel  
7 from the training symbols transmitted by the VHT beamformer and sends back a  
8 transformed estimate of the channel state to the VHT beamformer. The VHT  
9 beamformer then uses this estimate, perhaps combining estimates from multiple  
10 VHT beamformees, to derive the steering matrix.”); *id.* Clause 9.31.5.2 (“A VHT  
11 beamformer shall initiate a sounding feedback sequence by transmitting a VHT  
12 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT  
13 beamformer shall include in the VHT NDP Announcement frame one STA Info  
14 field for each VHT beamformee that is expected to prepare VHT Compressed  
15 Beamforming feedback and shall identify the VHT beamformee by including the  
16 VHT beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP  
17 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP  
18 VHT beamformee that receives a VHT NDP Announcement frame... shall  
19 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a  
20 Beamforming Report Poll with RA matching its MAC address and a non-  
21 bandwidth signaling TA obtained from the TA field matching the MAC address of  
22 the VHT beamformer.”); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
23 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)  
24 (“Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses  
25 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

26 18. Defendant has been and is now indirectly infringing at least one claim  
27 of the ’296 Patent in accordance with 35 U.S.C. § 271(b) in this district and  
28 elsewhere in the United States. More specifically, Defendant has been and is now

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

3 19. By at least the filing and service of the original Complaint on April  
4 19, 2017, and May 3, 2017, respectively, Defendant had knowledge of the '296  
5 Patent, and that its actions resulted in a direct infringement of the '296 Patent.  
6 Defendant also knew or was willfully blind that its actions would induce direct  
7 infringement by others and intended that its actions would induce direct  
8 infringement by others.

9 20. Defendant actively induced, and continues to induce, such  
10 infringement by, among other things, providing user manuals and other instruction  
11 material for its Accused Products that induce its customers to use the Accused  
12 Products in their normal and customary way to infringe the '296 Patent. For  
13 example, Defendant's website provided, and continues to provide, instructions for  
14 using the Accused Products on wireless communication systems, and to utilize  
15 their beamforming and MU-MIMO functionalities. Defendant sold, and continues  
16 to sell, the Accused Products to customers despite its knowledge of the '296  
17 Patent. Defendant manufactured and imported into the United States, and continues  
18 to do so, the Accused Products for sale and distribution to its customers, despite its  
19 knowledge of the '296 Patent. Through its continued manufacture, importation,  
20 and sales of its Accused Products, Defendant specifically intended for its  
21 customers to infringe claims of the '296 Patent. Further, Defendant was aware that  
22 these normal and customary activities would infringe the '296 Patent. Defendant  
23 performed, and continues to perform, acts that constitute induced infringement, and  
24 that would induce actual infringement, with knowledge of the '296 Patent and with  
25 the knowledge or willful blindness that the induced acts would constitute direct  
26 infringement.

27 21. Accordingly, a reasonable inference is that Defendant specifically  
28 intended for others, such as its customers, to directly infringe one or more claims

RUSS, AUGUST & KABAT

1 of the '296 Patent in the United States because Defendant had knowledge of the  
2 '296 Patent and actively induced others (e.g., its customers) to directly infringe the  
3 '296 Patent by using, selling, or offering to sell the Accused Products and the MU-  
4 MIMO functionality within the Accused Products.

5 22. Defendant also infringes other claims of the '296 Patent, directly and  
6 through inducing infringement, for similar reasons as explained above with respect  
7 to Claim 33.

8 23. The '296 Patent is valid and enforceable.

9 Defendant's infringement of the '296 Patent has damaged Vivato, and  
10 Defendant is liable to Vivato in an amount to be determined at trial that  
11 compensates Vivato for the infringement, which by law can be no less than a  
12 reasonable royalty.

13 24. As a result of Defendant's infringement of the '296 Patent, Vivato has  
14 suffered irreparable harm and will continue to suffer loss and injury.

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

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

22 26. Defendant has directly infringed and continues to directly infringe  
23 numerous claims of the '728 Patent, including at least claim 16, by manufacturing,  
24 using, selling, offering to sell, and/or importing into the United States the Accused  
25 Products. Defendant is liable for infringement of the '728 Patent pursuant to 35  
26 U.S.C. § 271(a).

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RUSS, AUGUST & KABAT

1 27. Each of the Accused Products comprises a wireless communication  
 2 system. For example, the Cisco Aironet 3800E is a wireless access point for use in  
 3 a Wi-Fi network.

4 28. Each of the Accused Products comprises a phased array antenna  
 5 configured to transmit beam downlinks. *See, e.g.:* 802.11ac Standard Clause  
 6 8.4.2.58.6, Table 8-128.

7 29. Each of the Accused Products comprises a transceiver operatively  
 8 coupled to the phased array antenna and configured to send and receive  
 9 electromagnetic signals via the phased array antenna. For example, the Cisco  
 10 Aironet 3800E has a Cisco WiFi radio that is configured to send and receive  
 11 electromagnetic signals via the phased array antenna. *See, e.g.,* 802.11ac Standard  
 12 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),  
 13 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex  
 14 baseband waveform associated with each transmit chain to an RF signal according  
 15 to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,  
 16 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

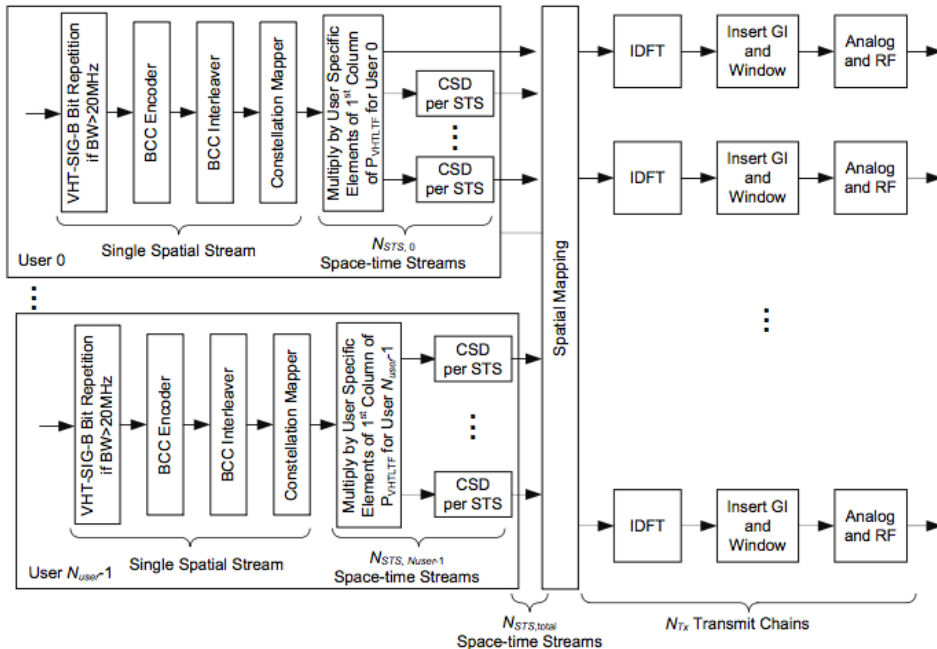


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU



1           30. Each of the Accused Products comprises an access point that includes  
2 the phased array antenna and the transceiver. For example, the Cisco Aironet  
3 3800E comprises an access point that includes a phased antenna array and a Cisco  
4 WiFi radio.

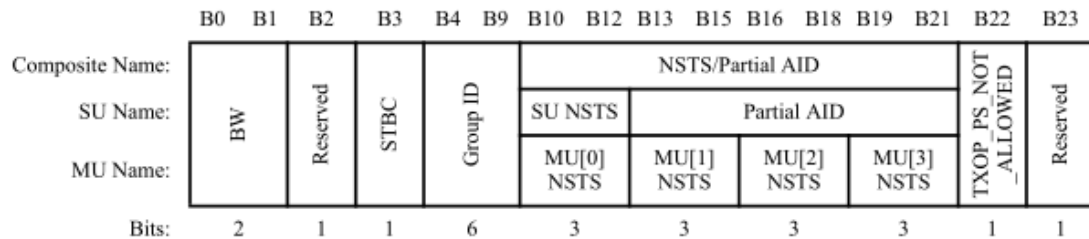
5           31. Each of the Accused Products comprises an access point that includes  
6 the phased array antenna and the transceiver that is configured to selectively allow  
7 a receiving device to operatively associate with a beam downlink transmitted to the  
8 receiving device via the phased array antenna. *See, e.g.*, 802.11ac Standard Clause  
9 8.5.23.3 (“The Group ID Management frame is an Action frame of category VHT.  
10 It is transmitted by the AP to assign or change the user position of a STA for one  
11 or more group IDs. The Action field of a Group ID Management frame contains  
12 the information shown in Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership  
13 Status Array field is used in the Group ID Management frame (see 8.5.23.3). The  
14 length of the field is 8 octets. An 8 octet Membership Status Array field (indexed  
15 by the group ID) consists of a 1-bit Membership Status subfield for each of the 64  
16 group IDs, as shown in Figure 8-80f. \* \* \* Within the 8 octet Membership Status  
17 Array field, the 1-bit Membership Status subfield for each group ID is set as  
18 follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a  
19 member of the group The Membership Status subfields for group ID 0  
20 (transmissions to AP) and group ID 63 (downlink SU transmissions) are  
21 reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field is used in the  
22 Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A  
23 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit  
24 User Position subfield for each of the 64 group IDs, as shown in Figure 8-  
25 80g. \* \* \* If the Membership Status subfield for a particular group ID is 1, then the  
26 corresponding User Position subfield is encoded as shown in Table 8-53l.”); *id.*  
27 Table 8-53l:

28 ///

**Table 8-53I—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 PPDU. 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  $\text{MembershipStatusInGroupID}[k]$  is equal to 1, then the number of space-time streams for that STA is indicated in the  $\text{MU}[\text{UserPositionInGroupID}[k]]$  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

1 mechanism is used where the VHT beamformee directly measures the channel  
2 from the training symbols transmitted by the VHT beamformer and sends back a  
3 transformed estimate of the channel state to the VHT beamformer. The VHT  
4 beamformer then uses this estimate, perhaps combining estimates from multiple  
5 VHT beamformees, to derive the steering matrix.”); *id.* Clause 9.31.5.2 (“A VHT  
6 beamformer shall initiate a sounding feedback sequence by transmitting a VHT  
7 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT  
8 beamformer shall include in the VHT NDP Announcement frame one STA Info  
9 field for each VHT beamformee that is expected to prepare VHT Compressed  
10 Beamforming feedback and shall identify the VHT beamformee by including the  
11 VHT beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP  
12 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP  
13 VHT beamformee that receives a VHT NDP Announcement frame... shall  
14 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a  
15 Beamforming Report Poll with RA matching its MAC address and a non-  
16 bandwidth signaling TA obtained from the TA field matching the MAC address of  
17 the VHT beamformer.”); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
18 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)  
19 (“Spatial mapping: Apply the  $Q$  matrix as described in 22.3.10.11.1.”); *id.* Clauses  
20 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

21 32. Each of the Accused Products comprises an access point that includes  
22 the phased array antenna and the transceiver that is configured to receive an uplink  
23 transmission from the receiving device through the phased array antenna. For  
24 example, the Cisco Aironet 3800E is configured to receive a VHT Compressed  
25 Beamforming Feedback frame from a “receiving device” such as a connected  
26 laptop or smartphone through its phased-array antenna. *See, e.g.*, 802.11ac  
27 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-  
28 2012 Clause 20.3.12.3.6.

1           33. Each of the Accused Products comprises an access point that includes  
 2 the phased array antenna and the transceiver that is configured to determine from  
 3 the uplink transmission if the receiving device should operatively associate with a  
 4 different beam downlink transmission. For example, the Cisco Aironet 3800E is  
 5 configured to determine from information contained in the VHT Compressed  
 6 Beamforming Feedback frame if the receiving device that sent the VHT  
 7 Compressed Beamforming Feedback frame should operatively associate with a  
 8 different beam downlink transmission. *See, e.g.*, 802.11ac Standard Clauses 3.2,  
 9 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:

10           Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 11 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 12 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed in  
 13 the form of angles using the method described in 20.3.12.3.6. The angles,  $\phi(k,u)$  and  $\psi(k,u)$ , are quantized  
 14 according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the  
 15 indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-  
 16 MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22  
 17 beamforming feedback format defined.

18           The beamformee shall generate the beamforming feedback matrices with the number of rows ( $N_r$ ) equal to  
 19 the  $N_{STS}$  of the NDP.

20           After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 21 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 22 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 23  $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 24 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 25 is implementation specific.

26           34. Each of the Accused Products comprises an access point that includes  
 27 the phased array antenna and the transceiver that is configured to at least one of:  
 28 (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 Cisco  
 Aironet 3800E 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

1 receiving device should operatively associate with the different beam downlink;  
2 (ii) force the receiving device to operatively associate with the different beam  
3 downlink if determined that the receiving device should be operatively associated  
4 with the different beam downlink. *See, e.g.*, 802.11ac Standard Clause 10.40 (“An  
5 AP determines the possible combinations of STAs that can be addressed by a VHT  
6 MU PPDU by assigning STAs to groups and to specific user positions within those  
7 groups. Assignments or changes of user positions corresponding to one or more  
8 Group IDs shall be performed using a Group ID Management frame defined in  
9 8.5.23.3...A VHT MU PPDU shall be transmitted to a STA based on the content of  
10 the Group ID Management frame most recently transmitted to the STA and for  
11 which an acknowledgement was received.”); *id.* Clause 8.5.23.3 (“The Group ID  
12 Management frame is an Action frame of category VHT. It is transmitted by the  
13 AP to assign or change the user position of a STA for one or more group IDs. The  
14 Action field of a Group ID Management frame contains the information shown in  
15 Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used  
16 in the Group ID Management frame (see 8.5.23.3). The length of the field is 8  
17 octets. An 8 octet Membership Status Array field (indexed by the group ID)  
18 consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as  
19 shown in Figure 8-80f. \* \* \* Within the 8 octet Membership Status Array field, the  
20 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if  
21 the STA is not a member of the group — Set to 1 if STA is a member of the group  
22 The Membership Status subfields for group ID 0 (transmissions to AP) and group  
23 ID 63 (downlink SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User  
24 Position Array field is used in the Group ID Management frame (see 8.5.23.3). The  
25 length of the field is 16 octets. A 16 octet User Position Array field (indexed by the  
26 Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs,  
27 as shown in Figure 8-80g. \* \* \* If the Membership Status subfield for a particular  
28 group ID is 1, then the corresponding User Position subfield is encoded as shown



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1 in Table 8-531.”); *id.* Table 8-531:

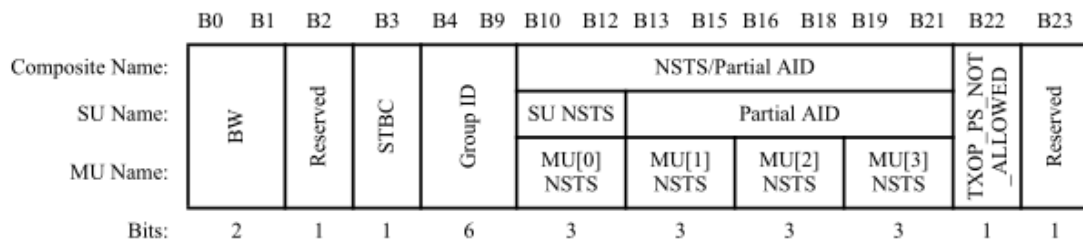
2 **Table 8-531—Encoding of User Position subfield**

3

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

4  
5  
6  
7

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



**Figure 22-18—VHT-SIG-A1 structure**

17 *Id.* Clause 22.3.11.4:

18 When a STA receives a VHT MU PPDU where the Group ID field in VHT-SIG-A has the value  $k$  and where  
19 MembershipStatusInGroupID[ $k$ ] is equal to 1, then the number of space-time streams for that STA is  
20 indicated in the MU[UserPositionInGroupID[ $k$ ]] NSTS field in VHT-SIG-A. The space-time streams of  
21 different users are ordered in accordance to user position values, i.e., the space-time streams for the user in  
22 user position 0 come first, followed by the space-time streams for the user in position 1, followed by the  
23 space-time streams for the user in position 2, and followed by the space-time streams for the user in  
24 position 3.

25 A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-  
26 LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended  
27 for the STA and can also be used to measure the channel for the interfering space-time streams. To  
28 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.

25 *Id.* Clause 9.31.5.1 (“Transmit beamforming and DL-MU-MIMO require  
26 knowledge of the channel state to compute a steering matrix that is applied to the  
27 transmitted signal to optimize reception at one or more receivers. The STA  
28 transmitting using the steering matrix is called the VHT beamformer and a STA for



1 which reception is optimized is called a VHT beamformee. An explicit feedback  
2 mechanism is used where the VHT beamformee directly measures the channel  
3 from the training symbols transmitted by the VHT beamformer and sends back a  
4 transformed estimate of the channel state to the VHT beamformer. The VHT  
5 beamformer then uses this estimate, perhaps combining estimates from multiple  
6 VHT beamformees, to derive the steering matrix.”); *id.* Clause 9.31.5.2 (“A VHT  
7 beamformer shall initiate a sounding feedback sequence by transmitting a VHT  
8 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT  
9 beamformer shall include in the VHT NDP Announcement frame one STA Info  
10 field for each VHT beamformee that is expected to prepare VHT Compressed  
11 Beamforming feedback and shall identify the VHT beamformee by including the  
12 VHT beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP  
13 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP  
14 VHT beamformee that receives a VHT NDP Announcement frame... shall  
15 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a  
16 Beamforming Report Poll with RA matching its MAC address and a non-  
17 bandwidth signaling TA obtained from the TA field matching the MAC address of  
18 the VHT beamformer.”); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
19 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)  
20 (“Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses  
21 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

22 35. Each of the Accused Products comprises an access point that includes  
23 the phased array antenna and the transceiver that is configured to actively probe the  
24 receiving device by generating a signal to initiate that the phased array antenna  
25 transmit at least one downlink transmittable message over the beam downlinks,  
26 and gather signal parameter information from uplink transmittable messages  
27 received from the receiving device through the phased array antenna. For example,  
28 the Cisco Aironet 3800E is configured to actively probe the receiving device by

1 generating a signal to initiate that the phased array antenna transmit a signal, e.g. a  
2 VHT null data packet announcement frame over the beam downlinks, and to gather  
3 signal parameter information from uplink transmittable messages received from the  
4 receiving device through the phased array antenna, e.g. one or more VHT  
5 Compressed Beamforming Feedback frames. *See, e.g.*, 802.11ac Standard Clause  
6 9.31.5, 9.31.5.2 (“A VHT beamformer shall initiate a sounding feedback sequence  
7 by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a  
8 SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame  
9 one STA Info field for each VHT beamformee that is expected to prepare VHT  
10 Compressed Beamforming feedback and shall identify the VHT beamformee by  
11 including the VHT beamformee’s AID in the AID subfield of the STA Info field.  
12 The VHT NDP Announcement frame shall include at least one STA Info field.”);  
13 *id.* (“A non-AP VHT beamformee that receives a VHT NDP Announcement  
14 frame... shall transmit its VHT Compressed Beamforming feedback a SIFS after  
15 receiving a Beamforming Report Poll with RA matching its MAC address and a  
16 non-bandwidth signaling TA obtained from the TA field matching the MAC  
17 address of the VHT beamformer.”); *id.* Clause 8.4.1.24; IEEE 802.11-2012 Clause  
18 20.3.12.3.6; 802.11ac Standard Clause 8.5.23.2 (defining format and subfields  
19 within the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including  
20 Tables 8-53(d)-(h)) (“Each SNR value per tone in stream  $i$  (before being averaged)  
21 corresponds to the SNR associated with the column  $i$  of the beamforming feedback  
22 matrix  $V$  determined at the beamformee”); *id.* Clause 8.4.1.49 (including Table 8-  
23 53i – MU Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24,  
24 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.8.3.5; *id.* Clause 22.3.11.2.

25 36. Defendant has been and is now indirectly infringing at least one claim  
26 of the ’728 Patent in accordance with 35 U.S.C. § 271(b) in this district and  
27 elsewhere in the United States. More specifically, Defendant has been and is now  
28 actively inducing direct infringement by other persons (e.g., Defendant’s

1 customers who use, sell or offer for sale the Accused Products).

2 37. By at least the filing and service of the original Complaint on April  
3 19, 2017, and May 3, 2017, respectively, Defendant had knowledge of the '728  
4 Patent, and that its actions resulted in a direct infringement of the '728 Patent.  
5 Defendant also knew or was willfully blind that its actions would induce direct  
6 infringement by others and intended that its actions would induce direct  
7 infringement by others.

8 38. Defendant actively induced, and continues to induce, such  
9 infringement by, among other things, providing user manuals and other instruction  
10 material for its Accused Products that induce its customers to use the Accused  
11 Products in their normal and customary way to infringe the '728 Patent. For  
12 example, Defendant's website provided, and continues to provide, instructions for  
13 using the Accused Products on wireless communication systems, and to utilize  
14 their beamforming and MU-MIMO functionalities. Defendant sold, and continues  
15 to sell, the Accused Products to customers despite its knowledge of the '728  
16 Patent. Defendant manufactured and imported into the United States, and continues  
17 to do so, the Accused Products for sale and distribution to its customers, despite its  
18 knowledge of the '728 Patent. Through its continued manufacture, importation,  
19 and sales of its Accused Products, Defendant specifically intended for its  
20 customers to infringe claims of the '728 Patent. Further, Defendant was aware that  
21 these normal and customary activities would infringe the '728 Patent. Defendant  
22 performed, and continues to perform, acts that constitute induced infringement, and  
23 that would induce actual infringement, with knowledge of the '728 Patent and with  
24 the knowledge or willful blindness that the induced acts would constitute direct  
25 infringement.

26 39. Accordingly, a reasonable inference is that Defendant specifically  
27 intended for others, such as its customers, to directly infringe one or more claims  
28 of the '728 Patent in the United States because Defendant had knowledge of the

1 '728 Patent and actively induced others (e.g., its customers) to directly infringe the  
2 '728 Patent by using, selling, or offering to sell the Accused Products and the MU-  
3 MIMO functionality within the Accused Products.

4 40. Defendant also infringes other claims of the '728 Patent, directly and  
5 through inducing infringement, for similar reasons as explained above with respect  
6 to Claim 16.

7 41. The '728 Patent is valid and enforceable.

8 42. Defendant's infringement of the '728 Patent has damaged Vivato, and  
9 Defendant is liable to Vivato in an amount to be determined at trial that  
10 compensates Vivato for the infringement, which by law can be no less than a  
11 reasonable royalty.

12 43. As a result of Defendant's infringement of the '728 Patent, Vivato has  
13 suffered irreparable harm and will continue to suffer loss and injury.

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

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

22 44. Defendant has directly infringed and continues to directly infringe  
23 numerous claims of the '231 Patent, including at least claim 1, by manufacturing,  
24 using, selling, offering to sell, and/or importing into the United States the Accused  
25 Products. Defendant is liable for infringement of the '231 Patent pursuant to 35  
26 U.S.C. § 271(a).

27 45. Each of the Accused Products comprises an apparatus for use in a  
28 wireless routing network. For example, the Cisco Aironet 3800E is an apparatus

1 for use in a wireless routing network.

2 46. Each of the Accused Products comprises an adaptive antenna. For  
3 example, the Cisco Aironet 3800E has at least one adaptive antenna. *See, e.g.:*  
4 802.11ac Standard Clause 8.4.2.58.6, Table 8-128:

5 **8.4.2.58.6 Transmit Beamforming Capabilities**

6 *Change the following rows in Table 8-128:*

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

8 Subfield	Definition	Encoding
9 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
10 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
11 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
12 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

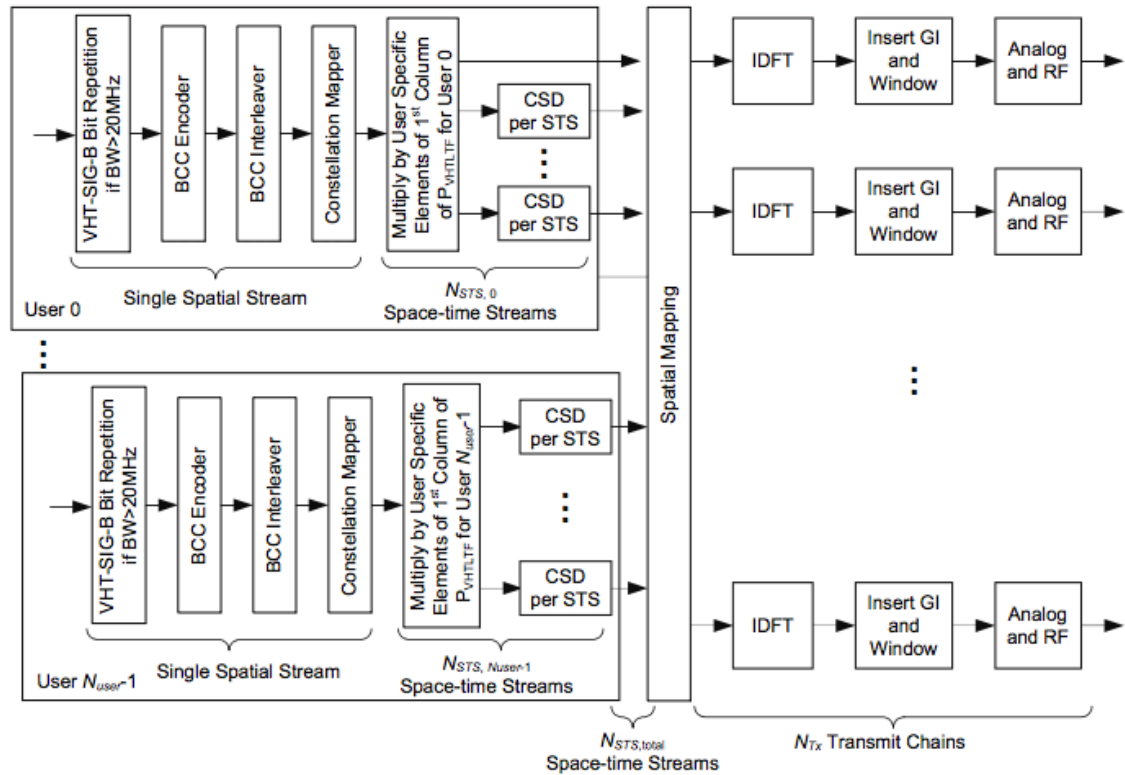
13 90

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14 47. Each of the Accused Products comprises at least one transmitter  
15 operatively coupled to said adaptive antenna and at least one receiver operatively  
16 coupled to said adaptive antenna. For example, the Cisco Aironet 3800E has a  
17 Cisco WiFi radio operatively coupled to the adaptive antenna. *See, e.g.,* 802.11ac  
18 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),  
19 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex  
20 baseband waveform associated with each transmit chain to an RF signal according  
21 to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,  
22 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**

48. 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 Cisco Aironet 3800E is configured to output at least one transmission signal to said adaptive antenna. For a further example, the Cisco Aironet 3800E 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



1 matrix that is applied to the transmitted signal to optimize reception at one or more  
 2 receivers. The STA transmitting using the steering matrix is called the VHT  
 3 beamformer and a STA for which reception is optimized is called a VHT  
 4 beamformee. An explicit feedback mechanism is used where the VHT beamformee  
 5 directly measures the channel from the training symbols transmitted by the VHT  
 6 beamformer and sends back a transformed estimate of the channel state to the VHT  
 7 beamformer. The VHT beamformer then uses this estimate, perhaps combining  
 8 estimates from multiple VHT beamformees, to derive the steering matrix.”); *id.*  
 9 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),  
 10 22.3.4.10.4(a) (“Spatial mapping: Apply the  $Q$  matrix as described in  
 11 22.3.10.11.1.”); *id.* Clause 22.3.10.11.1; IEEE 802.11-2012 Standard Clause  
 12 20.3.12.3.6; 802.11ac Standard Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause  
 13 22.3.11.1:

14 The DL-MU-MIMO steering matrix  $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  can be determined by the  
 15 beamformer using the beamforming feedback matrices for subcarrier  $k$  from beamformee  $u$ ,  $V_{k,u}$ , and SNR  
 16 information for subcarrier  $k$  from beamformee  $u$ ,  $SNR_{k,u}$ , where  $u = 0, 1, \dots, N_{user} - 1$ . The steering matrix  
 17 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).

18 *Id.* Clause 22.3.11.2:

19 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 20 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  
 21 the form of angles using the method described in 20.3.12.3.6. The angles,  $\phi(k,u)$  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  
 22 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.

23 The beamformee shall generate the beamforming feedback matrices with the number of rows ( $Nr$ ) equal to  
 the  $N_{STS}$  of the NDP.

24 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  
 25 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 26 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 is implementation specific.

27 49. Each of the Accused Products comprises search receiver logic  
 28 operatively coupled to said control logic and said at least one receiver and

1 configured to update said routing information based at least in part on cross-  
2 correlated signal information that is received by said receiver using said adaptive  
3 antenna. For example, the Cisco Aironet 3800E updates the routing information  
4 based at least in part on cross-correlated signal information received in a VHT  
5 Compressed Beamforming frame. *See, e.g.*, 802.11ac Standard Clause 9.31.5.2 (“A  
6 VHT beamformer shall initiate a sounding feedback sequence by transmitting a  
7 VHT NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT  
8 beamformer shall include in the VHT NDP Announcement frame one STA Info  
9 field for each VHT beamformee that is expected to prepare VHT Compressed  
10 Beamforming feedback and shall identify the VHT beamformee by including the  
11 VHT beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP  
12 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP  
13 VHT beamformee that receives a VHT NDP Announcement frame... shall  
14 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a  
15 Beamforming Report Poll with RA matching its MAC address and a non-  
16 bandwidth signaling TA obtained from the TA field matching the MAC address of  
17 the VHT beamformer.”); *id.* Clause 8.5.23.2 (defining format and subfields within  
18 the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including Tables  
19 8-53(d)-(h)) (“Each SNR value per tone in stream  $i$  (before being averaged)  
20 corresponds to the SNR associated with the column  $i$  of the beamforming feedback  
21 matrix  $V$  determined at the beamformee”); *id.* Clause 8.4.1.49 (including Table 8-  
22 53i – MU Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24,  
23 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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1 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 2 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 3 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed in  
 4 the form of angles using the method described in 20.3.12.3.6. The angles,  $\phi(k,u)$  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.

5 The beamformee shall generate the beamforming feedback matrices with the number of rows ( $Nr$ ) equal to  
 6 the  $N_{STS}$  of the NDP.

7 After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 8 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 9 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 is implementation specific.

10 50. Defendant has been and is now indirectly infringing at least one claim  
 11 of the '231 Patent in accordance with 35 U.S.C. § 271(b) in this district and  
 12 elsewhere in the United States. More specifically, Defendant has been and is now  
 13 actively inducing direct infringement by other persons (e.g., Defendant's  
 14 customers who use, sell or offer for sale the Accused Products).

15 51. Defendant had knowledge of Vivato's '231 Patent by at least the  
 16 citation of the '231 Patent during the prosecution of Defendant's U.S. Patent No.  
 17 8,666,319, "Mitigating effects of identified interference with adaptive CCA  
 18 threshold." On June 28, 2013, during prosecution of Defendant's U.S. Patent  
 19 No. 8,666,319, the USPTO examiner cited the '231 Patent. Accordingly, a  
 20 reasonable inference is that Defendant had knowledge of the '231 Patent, and its  
 21 issued claims, by at least as early as June 28, 2013. Further, by at least the filing  
 22 and service of the original Complaint on April 19, 2017, and May 3, 2017,  
 23 respectively, Defendant had knowledge of the '231 Patent.

24 52. Based on this knowledge of Vivato's '231 Patent, Defendant also  
 25 knew that its actions resulted in a direct infringement of the '231 Patent. Defendant  
 26 also knew or was willfully blind that its actions would induce direct infringement  
 27 by others and intended that its actions would induce direct infringement by others.

28 ///

1           53. Defendant actively induced, and continues to induce, such  
2 infringement by, among other things, providing user manuals and other instruction  
3 material for its Accused Products that induce its customers to use the Accused  
4 Products in their normal and customary way to infringe the '231 Patent. For  
5 example, Defendant's website provided, and continues to provide, instructions for  
6 using the Accused Products on wireless communication systems, and to utilize  
7 their beamforming and MU-MIMO functionalities. Defendant sold, and continues  
8 to sell, the Accused Products to customers despite its knowledge of the '231  
9 Patent. Defendant manufactured and imported into the United States, and continues  
10 to do so, the Accused Products for sale and distribution to its customers, despite its  
11 knowledge of the '231 Patent. Through its continued manufacture, importation,  
12 and sales of its Accused Products, Defendant specifically intended for its  
13 customers to infringe claims of the '231 Patent. Further, Defendant was aware that  
14 these normal and customary activities would infringe the '231 Patent. Defendant  
15 performed, and continues to perform, acts that constitute induced infringement, and  
16 that would induce actual infringement, with knowledge of the '231 Patent and with  
17 the knowledge or willful blindness that the induced acts would constitute direct  
18 infringement.

19           54. Accordingly, a reasonable inference is that Defendant specifically  
20 intended for others, such as its customers, to directly infringe one or more claims  
21 of the '231 Patent in the United States because Defendant had knowledge of the  
22 '231 Patent and actively induced others (e.g., its customers) to directly infringe the  
23 '231 Patent by using, selling, or offering to sell the Accused Products and the MU-  
24 MIMO functionality within the Accused Products.

25           55. Defendant also infringes other claims of the '231 Patent, directly and  
26 through inducing infringement, for similar reasons as explained above with respect  
27 to Claim 1.

28           56. The '231 Patent is valid and enforceable.

1           57. Defendant's infringement of the '231 Patent has damaged Vivato, and  
2 Defendant is liable to Vivato in an amount to be determined at trial that  
3 compensates Vivato for the infringement, which by law can be no less than a  
4 reasonable royalty.

5           58. As a result of Defendant's infringement of the '231 Patent, Vivato has  
6 suffered irreparable harm and will continue to suffer loss and injury.

## 7 **VII. WILLFUL INFRINGEMENT**

8           59. Defendant had knowledge of Vivato's '231 Patent by at least the  
9 citation of the '231 Patent during the prosecution of Defendant's U.S. Patent No.  
10 8,666,319, "Mitigating effects of identified interference with adaptive CCA  
11 threshold." On June 28, 2013, during prosecution of Defendant's U.S. Patent  
12 No. 8,666,319, the USPTO examiner cited the '231 Patent. Accordingly, a  
13 reasonable inference is that Defendant had knowledge of the '231 Patent, and its  
14 issued claims, by at least as early as June 28, 2013. Further, by at least the filing  
15 and service of the original Complaint on April 19, 2017, and May 3, 2017,  
16 respectively, Defendant had knowledge of the '231 Patent.

17           60. Despite such knowledge, Defendant infringed and continues to  
18 infringe the '231 Patent with full and complete knowledge of the '231 Patent's  
19 applicability to Defendant's MU-MIMO WiFi access point and router products  
20 without taking a license and without a good faith belief that the '231 Patent is  
21 invalid and not infringed. Defendant's infringement of the '231 Patent occurred,  
22 and continues to occur, with knowledge of infringement and objective  
23 recklessness. Defendant's infringement was, and continues to be, willful,  
24 deliberate, and flagrant. Upon information and belief, Defendant's employees,  
25 contractors, and agents responsible for the research, development, and  
26 manufacturing of its Accused Products collaborated with Defendant's employees,  
27 contractors, agents, and attorneys responsible for the procurement and management  
28 of Defendant's U.S. Patent No. 8,666,319. As a result of this collaboration,

1 Defendant deliberately and flagrantly copied and incorporated into its Accused  
2 Products the invention claimed in the '231 Patent. Defendant sold, and continues to  
3 sell its Accused Products (e.g., Cisco Aironet 3800E) to customers despite its  
4 knowledge of the '231 Patent. Defendant also manufactured and imported into the  
5 United States, and continues to do so, the Accused Products for sale and  
6 distribution to its customers, despite its knowledge of the '231 Patent.

7 61. Defendant's infringement of the '231 Patent is egregious because  
8 despite its knowledge of the '231 Patent, Defendant deliberately and flagrantly  
9 copied the invention claimed in the '231 Patent and implemented that patented  
10 invention in its Accused Products. Further, despite Defendant's knowledge of the  
11 '231 Patent, Defendant sold, offered for sale, manufactured, and imported, the  
12 Accused Products—and continues to do so—without investigating the scope of the  
13 '231 Patent and without forming a good-faith belief that its Accused Products do  
14 not infringe or that the '231 Patent is invalid. Defendant has not taken any steps to  
15 remedy its infringement of the '231 Patent (e.g., by removing the Accused  
16 Products from its sales channels). Instead, Defendant continues to sell its Accused  
17 Products to customers, such as its continued sale of its Cisco Aironet 3800E.  
18 Defendant's behavior is egregious because it engaged, and continues to engage, in  
19 misconduct beyond that of typical infringement. For example, in a typical  
20 infringement, an infringer would investigate the scope of the asserted patents and  
21 develop a good-faith belief that it does not infringe the asserted patents or that the  
22 asserted patents are invalid before selling (and continuing to sell) its accused  
23 products. An infringer would also remove its accused products from its sales  
24 channels and discontinue further sales.

25 62. Thus, Defendant's infringement of the '231 Patent is willful,  
26 deliberate, and flagrant, entitling Vivato to increased damages under 35 U.S.C.  
27 § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35  
28 U.S.C. § 285.



RUSS, AUGUST & KABAT

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**PRAYER FOR RELIEF**

WHEREFORE, Vivato prays for the following relief:

(a) A judgment in favor of Vivato that Defendant has 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 Defendant’s infringement of U.S. Patent Nos. 7,062,296, 7,729,728, and 6,611,231, together with prejudgment and post-judgment interest, in an amount according to proof;

(c) An award of an ongoing royalty for Defendant’s post-judgment infringement in an amount according to proof;

(d) Declaring that Defendant’s infringement of the ’231 Patent is willful and that this is an exceptional case under 35 U.S.C. § 285, and awarding enhanced damages pursuant to 35 U.S.C. § 284 and attorneys’ fees and costs in this action.

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

**DEMAND FOR JURY TRIAL**

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

DATED: July 14, 2017

Respectfully submitted,

**RUSS AUGUST & KABAT**

By: /s/ Reza Mirzaie  
Reza Mirzaie  
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Kent N. Shum  
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*Attorneys for Plaintiff*

XR COMMUNICATIONS, LLC,  
dba VIVATO TECHNOLOGIES

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