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 11 XR Communications, LLC, dba Vivato Technologies

12 **UNITED STATES DISTRICT COURT**  
 13 **SOUTHERN DISTRICT OF CALIFORNIA**

14  
 15 XR COMMUNICATIONS, LLC,  
 16 dba VIVATO TECHNOLOGIES,

17 *Plaintiff,*

18 v.

19 XIRRUS, INC.,  
 20

21 *Defendant.*  
 22

Case No. '17CV0675 BAS KSC

**COMPLAINT FOR PATENT  
 INFRINGEMENT**

**JURY TRIAL DEMANDED**

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1 Plaintiff XR Communications, LLC, dba Vivato Technologies (“Vivato”)  
2 alleges as follows:

3 **I. JURISDICTION AND VENUE**

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

7 **II. THE PARTIES**

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

12 Xirrus, Inc. (“Xirrus” or “Defendant”) is a corporation organized and  
13 existing under the laws of California with its principal place of business at 2101  
14 Corporate Center Drive, Thousand Oaks, CA 91320. Xirrus has a registered agent  
15 for service of process as Robert Day, 6580 Page Mill Road, Palo Alto CA 94304.

16 This Court has personal jurisdiction over Defendant because Defendant is  
17 incorporated in the State of California and has its principal place of business in  
18 California.

19 Venue is proper in this federal district pursuant to 28 U.S.C. §§ 1391(b)-(d)  
20 and 1400(b) in that Defendant has done business in this District, has committed  
21 acts of infringement in this District, and continues to commit acts of infringement  
22 in this District, including by selling or offering for sale products in this District,  
23 entitling Plaintiffs to relief.

24 **III. BACKGROUND OF THE TECHNOLOGY**

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

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

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

11 Vivato's patent portfolio includes over 17 issued patents and pending patent  
12 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 U.S. PATENT NO. 7,062,296**

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

21 Defendant has directly infringed and continues to directly infringe numerous  
22 claims of the '296 Patent, including at least claim 33, by manufacturing, using,  
23 selling, offering to sell, and/or importing into the United States WiFi access points  
24 and routers supporting MU-MIMO, including without limitation access points and  
25 routers utilizing the IEEE 802.11ac-2013 standard (e.g. Defendant's XD2 11ac  
26 Wave 2 AP (XD2-240), XD4 11ac Wave 1 / 2 AP (XD4-240), XA4 11ac Wave 2  
27 AP (XA4-240), XR-2000 11ac Wave 1 / 2 AP series, XR-2436-WAVE2, XR-4000  
28 11ac Wave 1 / 2 AP and XR-4836-WAVE2) (collectively the "Accused

1 Products”). Defendant is liable for infringement of the ’296 Patent pursuant to 35  
2 U.S.C. § 271(a).

3 Each of the Accused Products comprises an apparatus for use in a wireless  
4 communication system. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240)  
5 is an apparatus for use in a wireless communication system.

6 Each of the Accused Products comprises at least one smart antenna. For  
7 example, the Xirrus XD2 11ac Wave2 AP (XD2-240) has at least one smart  
8 antenna.

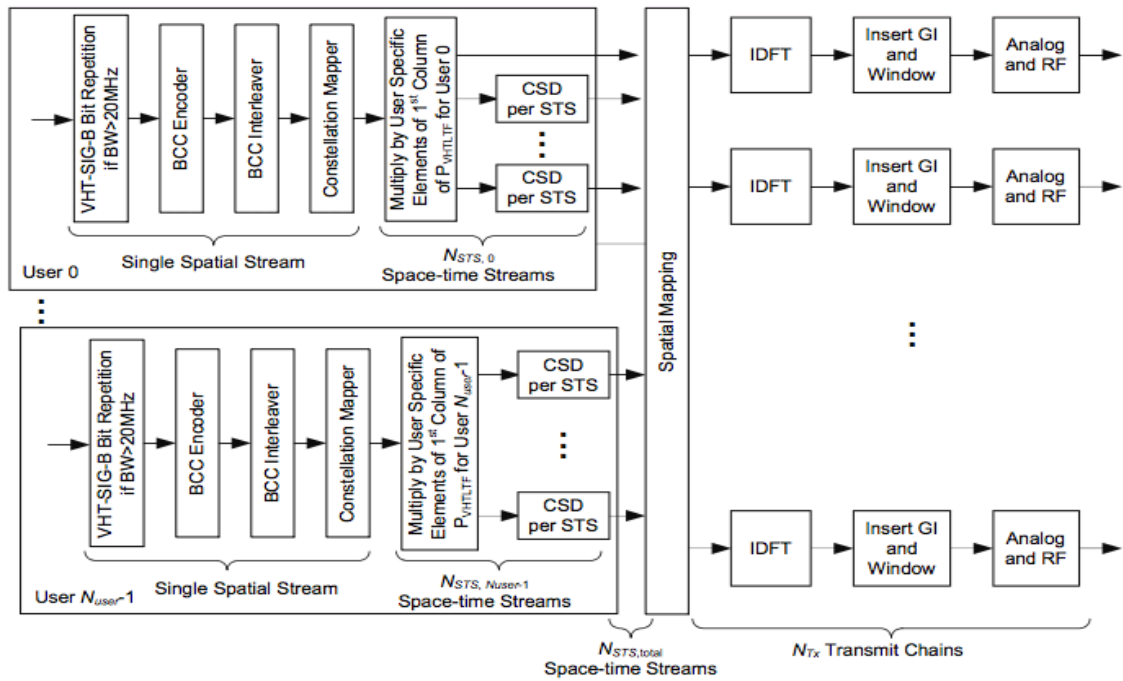
9 Each of the Accused Products comprises at least one transceiver operatively  
10 coupled to said smart antenna and configured to send and receive electromagnetic  
11 signals using said smart antenna. For example, the Xirrus XD2 11ac Wave2 AP  
12 (XD2-240) has a Broadcom BCM43465 Enterprise Wave 2 4x4 11ac Dual-band  
13 Radio coupled to the smart antenna to send and receive signals. *See, e.g.*, IEEE  
14 802.11ac-2013 (“802.11ac Standard”) Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h),  
15 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-  
16 convert the resulting complex baseband waveform associated with each transmit  
17 chain to an RF signal according to the center frequency of the desired channel and  
18 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**

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 Xirrus XD2 11ac Wave2 AP (XD2-240) 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

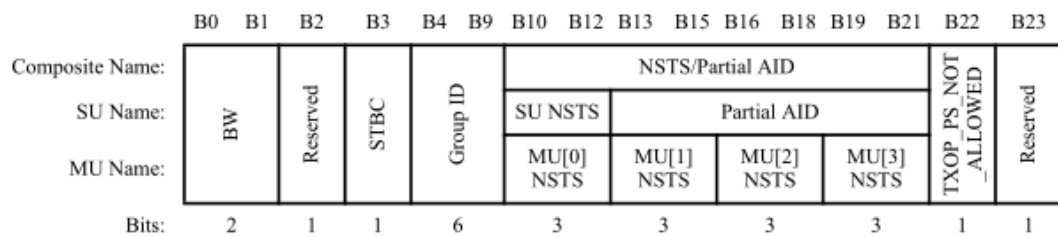
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1 member of the group The Membership Status subfields for group ID 0  
 2 (transmissions to AP) and group ID 63 (downlink SU transmissions) are  
 3 reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field is used in the  
 4 Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A  
 5 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit  
 6 User Position subfield for each of the 64 group IDs, as shown in Figure 8-80g. \* \*  
 7 \* If the Membership Status subfield for a particular group ID is 1, then the  
 8 corresponding User Position subfield is encoded as shown in Table 8-53l.”); *id.*  
 9 Table 8-53l:

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

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

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



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 23  
 24 **Figure 22-18—VHT-SIG-A1 structure**

25 *Id.* Clause 22.3.11.4:

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 27  
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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  
5 user position 0 come first, followed by the space-time streams for the user in position 1, followed by the  
6 space-time streams for the user in position 2, and followed by the space-time streams for the user in  
7 position 3.

8 A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-  
9 LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended  
10 for the STA and can also be used to measure the channel for the interfering space-time streams. To  
11 successfully demodulate the space-time streams intended for the STA, the STA may use the channel state  
12 information for all space-time streams to reduce the effect of interfering space-time streams.

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

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 Each of the Accused Products comprises logic configured to determine  
 6 information from at least one uplink transmission receivable from said second  
 7 device through said smart antenna. For example, the Xirrus XD2 11ac Wave2 AP  
 8 (XD2-240) determines information from a VHT Compressed Beamforming frame  
 9 received from a client device through its smart antenna. *See, e.g.*, 802.11ac  
 10 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-  
 11 2012 Clause 20.3.12.3.6.

12 Each of the Accused Products comprises logic configured to determine if  
 13 said associated second device should operatively associate with a different beam  
 14 downlink transmittable using said smart antenna based on said determined  
 15 information. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240) determines,  
 16 based on the information received in a VHT Compressed Beamforming frame, if  
 17 the 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,  $\phi(k,v)$  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  
 the  $N_{STS}$  of the NDP.

25 After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 26 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 27 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  
 28 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 is implementation specific.



1 Each of the Accused Products comprises logic configured to allow said  
2 second device to operatively associate with said different beam if said associated  
3 second device should operatively associate with a different beam and selectively  
4 identify that said second device is not allowed to operatively associate with said  
5 beam. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240) allows a client  
6 device to operatively associate with a beam that is different from the beam with  
7 which the client was associated previously, and to identify that the client device is  
8 not allowed to operatively associate with the prior beam. *See, e.g.*, 802.11ac  
9 Standard Clause 10.40 (“An AP determines the possible combinations of STAs  
10 that can be addressed by a VHT MU PPDU by assigning STAs to groups and to  
11 specific user positions within those groups. Assignments or changes of user  
12 positions corresponding to one or more Group IDs shall be performed using a  
13 Group ID Management frame defined in 8.5.23.3...A VHT MU PPDU shall be  
14 transmitted to a STA based on the content of the Group ID Management frame  
15 most recently transmitted to the STA and for which an acknowledgement was  
16 received.”); *id.* Clause 8.5.23.3 (“The Group ID Management frame is an Action  
17 frame of category VHT. It is transmitted by the AP to assign or change the user  
18 position of a STA for one or more group IDs. The Action field of a Group ID  
19 Management frame contains the information shown in Table 8-281aj”); *id.* Clause  
20 8.4.1.51 (“The Membership Status Array field is used in the Group ID  
21 Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet  
22 Membership Status Array field (indexed by the group ID) consists of a 1-bit  
23 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-  
24 80f. \* \* \* Within the 8 octet Membership Status Array field, the 1-bit Membership  
25 Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a  
26 member of the group — Set to 1 if STA is a member of the group The Membership  
27 Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink  
28 SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array

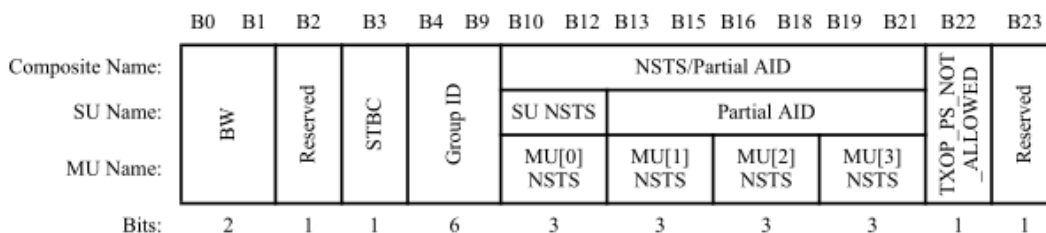
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1 field is used in the Group ID Management frame (see 8.5.23.3). The length of the  
 2 field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID)  
 3 consists of a 2-bit User Position subfield for each of the 64 group IDs,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

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

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

3 By at least the filing of this complaint, Defendant had knowledge of the '296  
4 Patent, and that its actions resulted in a direct infringement of the '296 Patent, and  
5 knew or were willfully blind that their actions would induce direct infringement by  
6 others and intended that their actions would induce direct infringement by others.

7 Defendant actively induces such infringement by, among other things,  
8 providing user manuals and other instruction material for their devices that induce  
9 their customers to use Defendant's devices in their normal and customary way to  
10 infringe the '296 Patent. For example, Defendant's website provides instructions  
11 for using the Accused Products on wireless communication systems, and to utilize  
12 their beamforming and MU-MIMO functionalities. Through its manufacture and  
13 sales of their devices, Defendant specifically intended for its customers to infringe  
14 claims of the '296 Patent. Further, Defendant was aware that these normal and  
15 customary activities would infringe the '296 Patent. Defendant performed the acts  
16 that constitute induced infringement, and that would induce actual infringement,  
17 with knowledge of the '296 Patent and with the knowledge or willful blindness that  
18 the induced acts would constitute direct infringement.

19 Accordingly, a reasonable inference is that Defendant specifically intended  
20 for others, such as their customers, to directly infringe one or more claims of the  
21 '296 Patent in the United States because Defendant had knowledge of the '296  
22 Patent and actively induced others (e.g., its customers) to directly infringe the '296  
23 Patent by using, selling, or offering to sell the Accused Products and the MU-  
24 MIMO functionality within the Accused Products.

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

28 The '296 Patent is valid and enforceable.

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

7 **V. COUNT TWO: INFRINGEMENT OF THE '728 PATENT**

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

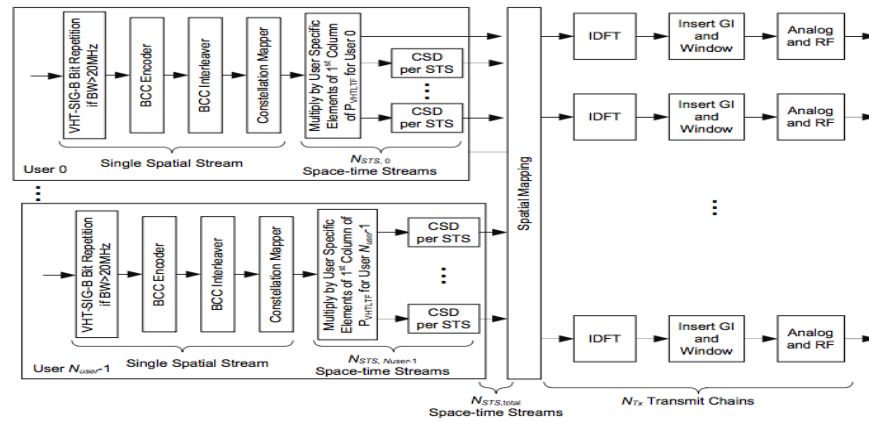
13 Defendant has directly infringed and continues to directly infringe numerous  
14 claims of the '728 Patent, including at least claim 16, by manufacturing, using,  
15 selling, offering to sell, and/or importing into the United States the Accused  
16 Products. Defendant is liable for infringement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

18 Each of the Accused Products comprises a wireless communication system.  
19 For example, the Xirrus XD2 11ac Wave2 AP (XD2-240) is a wireless access  
20 point.

21 Each of the Accused Products comprises a phased array antenna configured  
22 to transmit beam downlinks. *See, e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table  
23 8-128.

24 Each of the Accused Products comprises a transceiver operatively coupled to  
25 the phased array antenna and configured to send and receive electromagnetic  
26 signals via the phased array antenna. For example, the Xirrus XD2 11ac Wave2 AP  
27 (XD2-240) has a Broadcom BCM43465 Enterprise Wave 2 4x4 11ac Dual-band  
28 Radio that is configured to send and receive electromagnetic signals via the phased

1 array antenna. *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g),  
 2 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  
 3 RF: Up-convert the resulting complex baseband waveform associated with each  
 4 transmit chain to an RF signal according to the center frequency of the desired  
 5 channel and transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure  
 6 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

Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240) comprises an access point that includes a phased antenna array and a Broadcom BCM43465 Enterprise Wave 2 4x4 11ac Dual-band Radio.

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

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

Table 8-53l—Encoding of User Position subfield

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

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

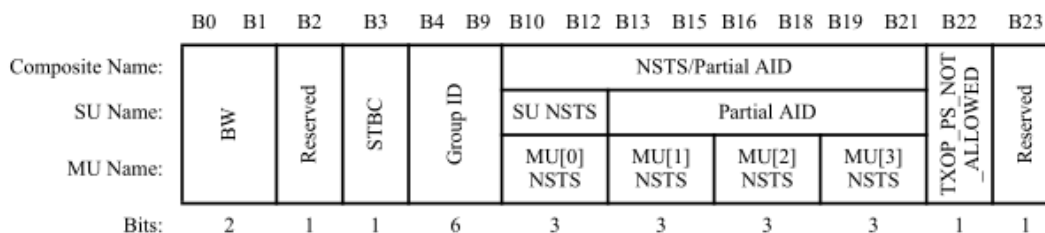


Figure 22-18—VHT-SIG-A1 structure

1 *Id.* Clause 22.3.11.4:

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

9 A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-  
10 LTF symbols in the VHT MU PPDU are used to measure the channel for the space-time streams intended  
11 for the STA and can also be used to measure the channel for the interfering space-time streams. To  
12 successfully demodulate the space-time streams intended for the STA, the STA may use the channel state  
13 information for all space-time streams to reduce the effect of interfering space-time streams.

14 *Id.* Clause 9.31.5.1 (“Transmit beamforming and DL-MU-MIMO require  
15 knowledge of the channel state to compute a steering matrix that is applied to the  
16 transmitted signal to optimize reception at one or more receivers. The STA  
17 transmitting using the steering matrix is called the VHT beamformer and a STA for  
18 which reception is optimized is called a VHT beamformee. An explicit feedback  
19 mechanism is used where the VHT beamformee directly measures the channel  
20 from the training symbols transmitted by the VHT beamformer and sends back a  
21 transformed estimate of the channel state to the VHT beamformer. The VHT  
22 beamformer then uses this estimate, perhaps combining estimates from multiple  
23 VHT beamformees, to derive the steering matrix.”); *id.* Clause 9.31.5.2 (“A VHT  
24 beamformer shall initiate a sounding feedback sequence by transmitting a VHT  
25 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT  
26 beamformer shall include in the VHT NDP Announcement frame one STA Info  
27 field for each VHT beamformee that is expected to prepare VHT Compressed  
28 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-



1 bandwidth signaling TA obtained from the TA field matching the MAC address of  
2 the VHT beamformer.”); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
3 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)  
4 (“Spatial mapping: Apply the  $Q$  matrix as described in 22.3.10.11.1.”); *id.* Clauses  
5 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

6 Each of the Accused Products comprises an access point that includes the  
7 phased array antenna and the transceiver that is configured to receive an uplink  
8 transmission from the receiving device through the phased array antenna. For  
9 example, the Xirrus XD2 11ac Wave2 AP (XD2-240) is configured to receive a  
10 VHT Compressed Beamforming Feedback frame from a “receiving device” such  
11 as a connected laptop or smartphone through its phased-array antenna. *See, e.g.,*  
12 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE  
13 802.11-2012 Clause 20.3.12.3.6.

14 Each of the Accused Products comprises an access point that includes the  
15 phased array antenna and the transceiver that is configured to determine from the  
16 uplink transmission if the receiving device should operatively associate with a  
17 different beam downlink transmission. For example, the Xirrus XD2 11ac Wave2  
18 AP (XD2-240) is configured to determine from information contained in the VHT  
19 Compressed Beamforming Feedback frame if the receiving device that sent the  
20 VHT Compressed Beamforming Feedback frame should operatively associate with  
21 a different beam downlink transmission. *See, e.g.,* 802.11ac Standard Clauses 3.2,  
22 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:

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 ( $N_r$ ) 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  
 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  
 9 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 is implementation specific.

10 Each of the Accused Products comprises an access point that includes the  
 11 phased array antenna and the transceiver that is configured to at least one of: (i)  
 12 allow the receiving device to operatively associate with the different beam  
 13 downlink if determined that the receiving device should operatively associate with  
 14 the different beam downlink; (ii) force the receiving device to operatively associate  
 15 with the different beam downlink if determined that the receiving device should be  
 16 operatively associated with the different beam downlink. For example, the Xirrus  
 17 XD2 11ac Wave2 AP (XD2-240) is configured to transmit a Group ID  
 18 Management frame or VHT MU PPDU VHT-SIG-A or combination thereof to  
 19 allow the receiving device to operatively associate with the different beam  
 20 downlink if determined that the receiving device should operatively associate with  
 21 the different beam downlink; (ii) force the receiving device to operatively associate  
 22 with the different beam downlink if determined that the receiving device should be  
 23 operatively associated with the different beam downlink. *See, e.g., 802.11ac*  
 24 *Standard Clause 10.40* (“An AP determines the possible combinations of STAs  
 25 that can be addressed by a VHT MU PPDU by assigning STAs to groups and to  
 26 specific user positions within those groups. Assignments or changes of user  
 27 positions corresponding to one or more Group IDs shall be performed using a  
 28 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

1 most recently transmitted to the STA and for which an acknowledgement was  
 2 received.”); *id.* Clause 8.5.23.3 (“The Group ID Management frame is an Action  
 3 frame of category VHT. It is transmitted by the AP to assign or change the user  
 4 position of a STA for one or more group IDs. The Action field of a Group ID  
 5 Management frame contains the information shown in Table 8-281aj”); *id.* Clause  
 6 8.4.1.51 (“The Membership Status Array field is used in the Group ID  
 7 Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet  
 8 Membership Status Array field (indexed by the group ID) consists of a 1-bit  
 9 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-  
 10 80f. \* \* \* Within the 8 octet Membership Status Array field, the 1-bit Membership  
 11 Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a  
 12 member of the group — Set to 1 if STA is a member of the group The Membership  
 13 Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink  
 14 SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array  
 15 field is used in the Group ID Management frame (see 8.5.23.3). The length of the  
 16 field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID)  
 17 consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in  
 18 Figure 8-80g. \* \* \* If the Membership Status subfield for a particular group ID is  
 19 1, then the corresponding User Position subfield is encoded as shown in Table 8-  
 20 531.”); *id.* Table 8-531:

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

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

22  
 23  
 24  
 25  
 26  
 27 *Id.* Clause 22.3.8.3.3 (“The VHT-SIG-A field carries information required to  
 28 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:

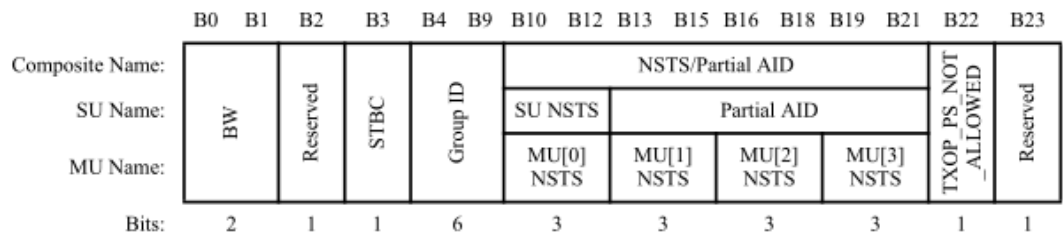


Figure 22-18—VHT-SIG-A1 structure

*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 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

1 Beamforming feedback and shall identify the VHT beamformee by including the  
2 VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP  
3 Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP  
4 VHT beamformee that receives a VHT NDP Announcement frame... shall  
5 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a  
6 Beamforming Report Poll with RA matching its MAC address and a non-  
7 bandwidth signaling TA obtained from the TA field matching the MAC address of  
8 the VHT beamformer."); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses  
9 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)  
10 ("Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1."); *id.* Clauses  
11 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

12 Each of the Accused Products comprises an access point that includes the  
13 phased array antenna and the transceiver that is configured to actively probe the  
14 receiving device by generating a signal to initiate that the phased array antenna  
15 transmit at least one downlink transmittable message over the beam downlinks,  
16 and gather signal parameter information from uplink transmittable messages  
17 received from the receiving device through the phased array antenna. For example,  
18 the Xirrus XD2 11ac Wave2 AP (XD2-240) is configured to actively probe the  
19 receiving device by generating a signal to initiate that the phased array antenna  
20 transmit a signal, e.g. a VHT null data packet announcement frame over the beam  
21 downlinks, and to gather signal parameter information from uplink transmittable  
22 messages received from the receiving device through the phased array antenna, e.g.  
23 one or more VHT Compressed Beamforming Feedback frames. *See, e.g.*, 802.11ac  
24 Standard Clause 9.31.5, 9.31.5.2 ("A VHT beamformer shall initiate a sounding  
25 feedback sequence by transmitting a VHT NDP Announcement frame followed by  
26 a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP  
27 Announcement frame one STA Info field for each VHT beamformee that is  
28 expected to prepare VHT Compressed Beamforming feedback and shall identify

1 the VHT beamformee by including the VHT beamformee's AID in the AID  
2 subfield of the STA Info field. The VHT NDP Announcement frame shall include  
3 at least one STA Info field."); *id.* ("A non-AP VHT beamformee that receives a  
4 VHT NDP Announcement frame... shall transmit its VHT Compressed  
5 Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA  
6 matching its MAC address and a non-bandwidth signaling TA obtained from the  
7 TA field matching the MAC address of the VHT beamformer."); *id.* Clause  
8 8.4.1.24; IEEE 802.11-2012 Clause 20.3.12.3.6; 802.11ac Standard Clause  
9 8.5.23.2 (defining format and subfields within the VHT Compressed Beamforming  
10 frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-(h)) ("Each SNR value per  
11 tone in stream  $i$  (before being averaged) corresponds to the SNR associated with  
12 the column  $i$  of the beamforming feedback matrix  $V$  determined at the  
13 beamformee"); *id.* Clause 8.4.1.49 (including Table 8-53i – MU Exclusive  
14 Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.*  
15 Clause 22.3.8.3.5; *id.* Clause 22.3.11.2.

16 Defendant has been and is now indirectly infringing at least one claim of the  
17 '728 Patent in accordance with 35 U.S.C. § 271(b) in this district and elsewhere in  
18 the United States. More specifically, Defendant have been and are now actively  
19 inducing direct infringement by other persons (e.g., Defendant's customers who  
20 use, sell or offer for sale the Accused Products).

21 By at least the filing of this complaint, Defendant had knowledge of the '728  
22 Patent, and that its actions resulted in a direct infringement of the '728 Patent, and  
23 knew or were willfully blind that their actions would induce direct infringement by  
24 others and intended that their actions would induce direct infringement by others.

25 Defendant actively induce such infringement by, among other things,  
26 providing user manuals and other instruction material for their devices that induce  
27 their customers to use Defendant's devices in their normal and customary way to  
28 infringe the '728 Patent. For example, Defendant's website provides instructions

1 for using the Accused Products on wireless communication systems, and to utilize  
 2 their beamforming and MU-MIMO functionalities. Through its manufacture and  
 3 sales of their devices, Defendant specifically intended for its customers to infringe  
 4 claims of the '296 Patent. Further, Defendant was aware that these normal and  
 5 customary activities would infringe the '296 Patent. Defendant performed the acts  
 6 that constitute induced infringement, and that would induce actual infringement,  
 7 with knowledge of the '296 Patent and with the knowledge or willful blindness that  
 8 the induced acts would constitute direct infringement.

9 Accordingly, a reasonable inference is that Defendant specifically intended  
 10 for others, such as their customers, to directly infringe one or more claims of the  
 11 '728 Patent in the United States because Defendant had knowledge of the '728  
 12 Patent and actively induced others (e.g., its customers) to directly infringe the '728  
 13 Patent by using, selling, or offering to sell the Accused Products and the MU-  
 14 MIMO functionality within the Accused Products.

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

18 The '728 Patent is valid and enforceable.

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

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

25 **VI. COUNT THREE: INFRINGEMENT OF U.S. PATENT NO. 6,611,231**

26 On August 26, 2003, United States Patent No. 6,611,231 ("the '231 Patent")  
 27 was duly and legally issued for inventions entitled "Wireless Packet Switched  
 28 Communication Systems and Networks Using Adaptively Steered Antenna

1 Arrays.” Vivato owns the ’231 Patent and holds the right to sue and recover  
2 damages for infringement thereof. A copy of the ’231 Patent is attached hereto as  
3 Exhibit C.

4 Defendant has directly infringed and continues to directly infringe numerous  
5 claims of the ’231 Patent, including at least claim 1, by manufacturing, using,  
6 selling, offering to sell, and/or importing into the United States the Accused  
7 Products. Defendant is liable for infringement of the ’231 Patent pursuant to 35  
8 U.S.C. § 271(a).

9 Each of the Accused Products comprises an apparatus for use in a wireless  
10 routing network. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240) is an  
11 apparatus for use in a wireless routing network.

12 Each of the Accused Products comprises an adaptive antenna. For example,  
13 the Xirrus XD2 11ac Wave2 AP (XD2-240) has at least one adaptive antenna. *See*,  
14 *e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table 8-128:

#### 15 8.4.2.58.6 Transmit Beamforming Capabilities

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

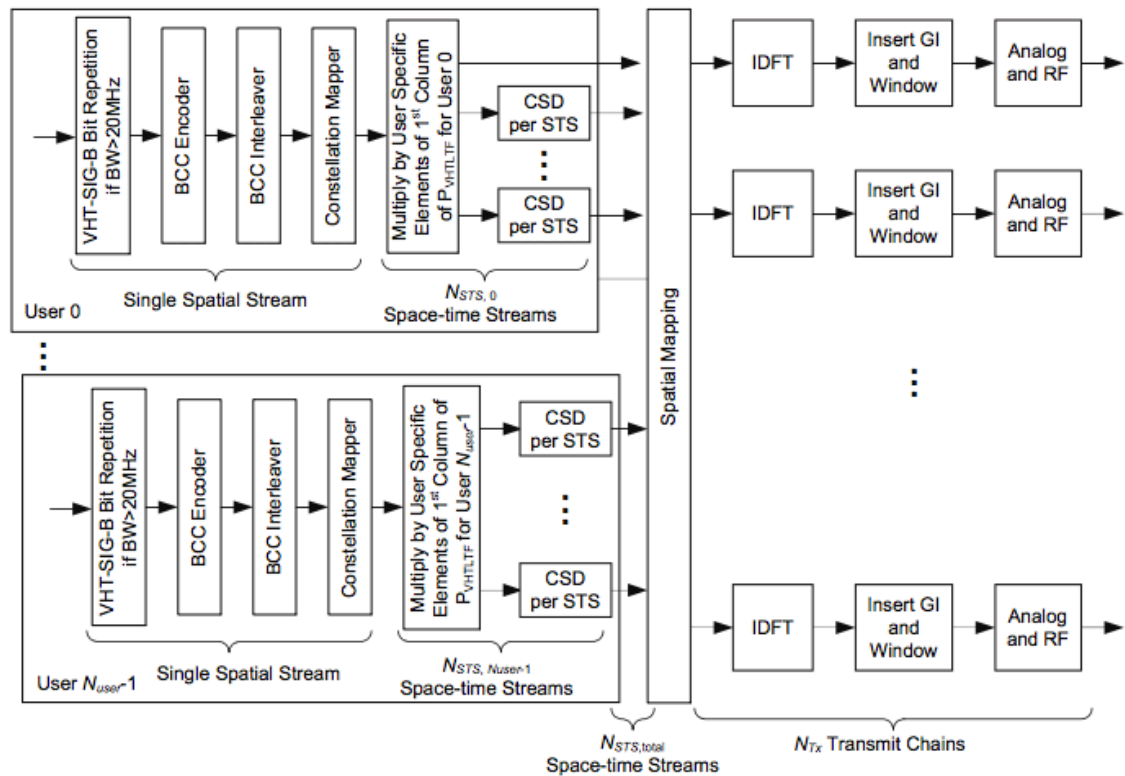
17 **Table 8-128—Subfields of the Transmit Beamforming Capabilities field**

| 18 Subfield   | 19 Definition   | 20 Encoding  |
|---|---|--|
| 21 CSI Number of Beamformer Antennas Supported                    | 22 Indicates the maximum number of beamformer antennas the <u>HT</u> beamformee can support when CSI feedback is required   | 23 Set to 0 for single Tx antenna sounding<br>Set to 1 for 2 Tx antenna sounding<br>Set to 2 for 3 Tx antenna sounding<br>Set to 3 for 4 Tx antenna sounding |
| 24 Noncompressed Steering Number of Beamformer Antennas Supported | 25 Indicates the maximum number of beamformer antennas the <u>HT</u> beamformee can support when noncompressed beamforming feedback matrix is required  | 26 Set to 0 for single Tx antenna sounding<br>Set to 1 for 2 Tx antenna sounding<br>Set to 2 for 3 Tx antenna sounding<br>Set to 3 for 4 Tx antenna sounding |
| 27 Compressed Steering Number of Beamformer Antennas Supported    | 28 Indicates the maximum number of beamformer antennas the <u>HT</u> beamformee can support when compressed beamforming feedback matrix is required   | Set to 0 for single Tx antenna sounding<br>Set to 1 for 2 Tx antenna sounding<br>Set to 2 for 3 Tx antenna sounding<br>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 <u>HT</u> beamformee or calibration responder or transmit ASEL responder that an <u>HT</u> beamformer or calibration initiator or transmit ASEL initiator can support when CSI feedback is required. | Set to 0 for a single row of CSI<br>Set to 1 for 2 rows of CSI<br>Set to 2 for 3 rows of CSI<br>Set to 3 for 4 rows of CSI                                   |



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1 Each of the Accused Products comprises at least one transmitter operatively  
 2 coupled to said adaptive antenna and at least one receiver operatively coupled to  
 3 said adaptive antenna. For example, the Xirrus XD2 11ac Wave2 AP (XD2-240)  
 4 has a Broadcom BCM43465 Enterprise Wave 2 4x4 11ac Dual-band Radio  
 5 operatively coupled to the adaptive antenna. *See, e.g.*, 802.11ac Standard Clauses  
 6 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),  
 7 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex baseband  
 8 waveform associated with each transmit chain to an RF signal according to the  
 9 center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,  
 10 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**

25 Each of the Accused Products comprises a control logic operatively coupled  
 26 to said transmitter and configured to cause said at least one transmitter to output at  
 27 least one transmission signal to said adaptive antenna to transmit corresponding  
 28 outgoing multi-beam electromagnetic signals exhibiting a plurality of selectively

1 placed transmission peaks and transmission nulls within a far field region of a  
 2 coverage area based on routing information. For example, the Xirrus XD2 11ac  
 3 Wave2 AP (XD2-240) is configured to output at least one transmission signal to  
 4 said adaptive antenna. For a further example, the Xirrus XD2 11ac Wave2 AP  
 5 (XD2-240) is configured to cause said at least one transmitter to output at least one  
 6 transmission signal to said adaptive antenna to transmit corresponding outgoing  
 7 multi-beam electromagnetic signals exhibiting a plurality of selectively placed  
 8 transmission peaks and transmission nulls within a far field region of a coverage  
 9 area based on routing information. *See, e.g.*, 802.11ac Standard Clause 9.31.5.1  
 10 (“Transmit beamforming and DL-MU-MIMO require knowledge of the channel  
 11 state to compute a steering matrix that is applied to the transmitted signal to  
 12 optimize reception at one or more receivers. The STA transmitting using the  
 13 steering matrix is called the VHT beamformer and a STA for which reception is  
 14 optimized is called a VHT beamformee. An explicit feedback mechanism is used  
 15 where the VHT beamformee directly measures the channel from the training  
 16 symbols transmitted by the VHT beamformer and sends back a transformed  
 17 estimate of the channel state to the VHT beamformer. The VHT beamformer then  
 18 uses this estimate, perhaps combining estimates from multiple VHT beamformees,  
 19 to derive the steering matrix.”); *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(l),  
 20 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply the  $Q$  matrix  
 21 as described in 22.3.10.11.1.”); *id.* Clause 22.3.10.11.1; IEEE 802.11-2012  
 22 Standard Clause 20.3.12.3.6; 802.11ac Standard Clauses 8.4.1.24, 9.31.5.1,  
 23 9.31.5.2; *id.* Clause 22.3.11.1:

24 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  
 25 beamformer using the beamforming feedback matrices for subcarrier  $k$  from beamformee  $u$ ,  $V_{k,u}$ , and SNR  
 26 information for subcarrier  $k$  from beamformee  $u$ ,  $SNR_{k,u}$ , where  $u = 0, 1, \dots, N_{user} - 1$ . The steering matrix  
 27 that is computed (or updated) using new beamforming feedback matrices and new SNR information from  
 28 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).

1 *Id.* Clause 22.3.11.2:

2 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 3 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 4 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed in  
 5 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  
 6 according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the  
 7 indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-  
 8 MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22  
 9 beamforming feedback format defined.

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

12 After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 13 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 14 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 15  $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 16 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 17 is implementation specific.

18 Each of the Accused Products comprises search receiver logic operatively  
 19 coupled to said control logic and said at least one receiver and configured to update  
 20 said routing information based at least in part on cross-correlated signal  
 21 information that is received by said receiver using said adaptive antenna. For  
 22 example, the Xirrus XD2 11ac Wave2 AP (XD2-240) updates the routing  
 23 information based at least in part on cross-correlated signal information received in  
 24 a VHT Compressed Beamforming frame. *See, e.g.*, 802.11ac Standard Clause  
 25 9.31.5.2 (“A VHT beamformer shall initiate a sounding feedback sequence by  
 26 transmitting a VHT NDP Announcement frame followed by a VHT NDP after a  
 27 SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame  
 28 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

1 (including Tables 8-53(d)-(h)) (“Each SNR value per tone in stream  $i$  (before being  
 2 averaged) corresponds to the SNR associated with the column  $i$  of the  
 3 beamforming feedback matrix  $V$  determined at the beamformee”); *id.* Clause  
 4 8.4.1.49 (including Table 8-53i – MU Exclusive Beamforming Report  
 5 information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.8.3.5; *id.*  
 6 Clause 22.3.11.2:

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

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

17 After receiving the angle information,  $\phi(k,u)$  and  $\psi(k,u)$ , the beamformer reconstructs  $V_{k,u}$  using Equation  
 18 (20-79). For SU-MIMO beamforming, the beamformer can use this  $V_{k,0}$  matrix to determine the steering  
 19 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 20  $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 21 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 22 is implementation specific.

23 Defendant has been and is now indirectly infringing at least one claim of the  
 24 '231 Patent in accordance with 35 U.S.C. § 271(b) in this district and elsewhere in  
 25 the United States. More specifically, Defendant have been and are now actively  
 26 inducing direct infringement by other persons (e.g., Defendant's customers who  
 27 use, sell or offer for sale the Accused Products).

28 By at least the filing of this complaint, Defendant had knowledge of the '231  
 Patent, and that its actions resulted in a direct infringement of the '231 Patent, and  
 knew or were willfully blind that their actions would induce direct infringement by  
 others and intended that their actions would induce direct infringement by others.

Defendant actively induce such infringement by, among other things,  
 providing user manuals and other instruction material for their devices that induce  
 their customers to use Defendant's devices in their normal and customary way to  
 infringe the '231 Patent. For example, Defendant's website provides instructions  
 for using the Accused Products on wireless communication systems, and to utilize

1 their beamforming and MU-MIMO functionalities. Through its manufacture and  
2 sales of their devices, Defendant specifically intended for its customers to infringe  
3 claims of the '296 Patent. Further, Defendant was aware that these normal and  
4 customary activities would infringe the '296 Patent. Defendant performed the acts  
5 that constitute induced infringement, and that would induce actual infringement,  
6 with knowledge of the '296 Patent and with the knowledge or willful blindness that  
7 the induced acts would constitute direct infringement.

8 Accordingly, a reasonable inference is that Defendant specifically intended  
9 for others, such as their customers, to directly infringe one or more claims of the  
10 '231 Patent in the United States because Defendant had knowledge of the '231  
11 Patent and actively induced others (e.g., its customers) to directly infringe the '231  
12 Patent by using, selling, or offering to sell the Accused Products and the MU-  
13 MIMO functionality within the Accused Products.

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

17 The '231 Patent is valid and enforceable.

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

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

#### 24 **PRAYER FOR RELIEF**

25 WHEREFORE, Vivato prays for the following relief:

26 (a) A judgment in favor of Vivato that Defendant has infringed and is  
27 infringing U.S. Patent Nos. 7,062,296, 7,729,728, and 6,611,231;  
28

RUSS, AUGUST & KABAT

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

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

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

10 (e) Granting Vivato its costs and further relief as the Court may deem just  
11 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.

Dated: April 3, 2017

Respectfully submitted,

**RUSS AUGUST & KABAT**

By: /s/ Reza Mirzaie  
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