

RUSS, AUGUST & KABAT

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 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 UBIQUITI NETWORKS, INC.,

28 *Defendant.*

Case No. 2:17-cv-02968-AG(JCGx)

**SECOND 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. Ubiquiti Networks, Inc. (“Ubiquiti” or “Defendant”) is a corporation
11 organized and existing under the laws of Delaware with its principal place of
12 business at 2580 Orchard Parkway, San Jose, CA 95131. Ubiquiti has a registered
13 agent for service of process at C T Corporation System, 818 W 7th St. Ste. 930,
14 Los Angeles, CA 90017.

15 4. This Court has personal jurisdiction over Ubiquiti because Ubiquiti
16 has its principal place of business in California.

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

22 **III. BACKGROUND OF THE TECHNOLOGY**

23 6. Vivato was founded in 2000 as a \$80+million venture-backed
24 company with several key innovators in the wireless communication field
25 including Siavash Alamouti, Ken Biba, William Crilly, James Brennan, Edward
26 Casas, and Vahid Tarokh among many others. Wi-Fi/802.11 has become the
27 ubiquitous wireless connection to the Internet and is now integrated into hundreds
28 of millions of mobile devices globally. Vivato was founded to leverage its talent to

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1 generate intellectual property and deliver Wi-Fi/802.11 wireless connectivity
2 solutions to service the growing demand for bandwidth.

3 7. Over the years, Vivato has developed proven technology, with over
4 400 deployments globally, including private, public and government, and has
5 become a recognized provider of extended range Wi-Fi network infrastructure
6 solutions. Vivato's wireless base stations integrate beamforming phased array
7 antenna design with packet steering technology to deliver high-bandwidth
8 extended range connections to serve multiple users and multiple devices.

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

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

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

20 10. Defendant has directly infringed and continues to directly infringe
21 numerous claims of the ’296 Patent, including at least claim 33, by manufacturing,
22 using, selling, offering to sell, and/or importing into the United States WiFi access
23 points and routers supporting MU-MIMO, including without limitation access
24 points and routers utilizing the IEEE 802.11ac-2013 standard (e.g. Defendant’s
25 UniFi AC HD Access Point) (collectively the “Accused Products”). Defendant is
26 liable for infringement of the ’296 Patent pursuant to 35 U.S.C. § 271(a).

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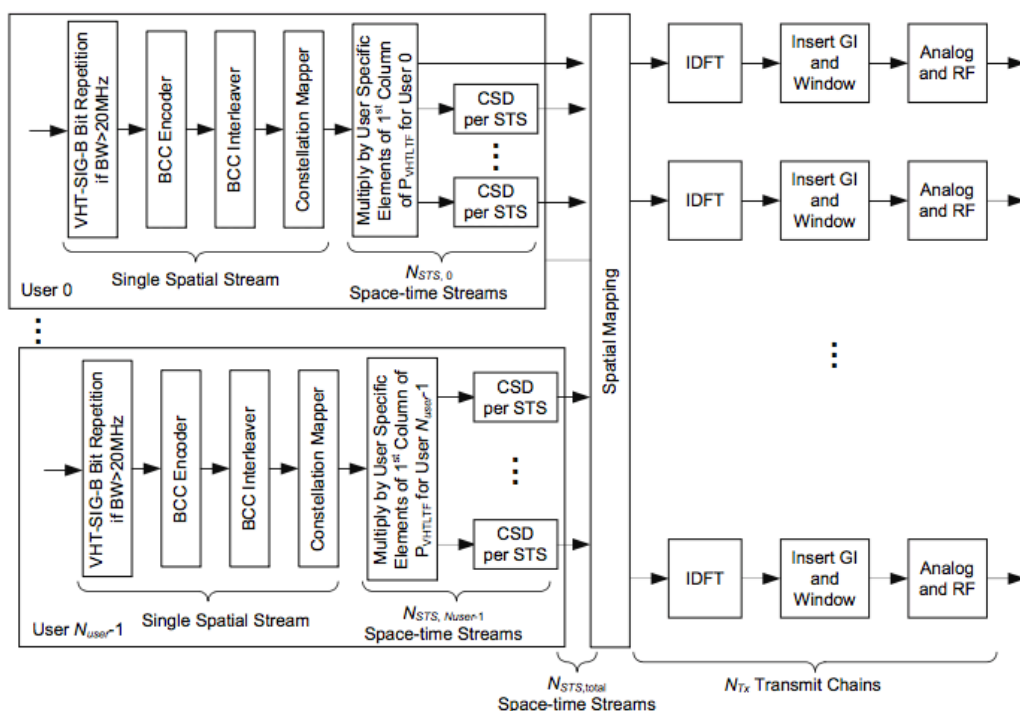
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1 11. Each of the Accused Products comprises an apparatus for use in a
 2 wireless communication system. For example, the UniFi AC HD Access Point is
 3 an apparatus for use in a wireless communication system.

4 12. Each of the Accused Products comprises at least one smart antenna.
 5 For example, the UniFi AC HD Access Point has at least one smart antenna.

6 13. Each of the Accused Products comprises at least one transceiver
 7 operatively coupled to said smart antenna and configured to send and receive
 8 electromagnetic signals using said smart antenna. For example, the UniFi AC HD
 9 Access Point has a Qualcomm QCA9994 WiFi radio coupled to the smart antenna
 10 to send and receive signals. *See, e.g.*, IEEE 802.11ac-2013 (“802.11ac Standard”)
 11 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),
 12 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex
 13 baseband waveform associated with each transmit chain to an RF signal according
 14 to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,
 15 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

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

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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:

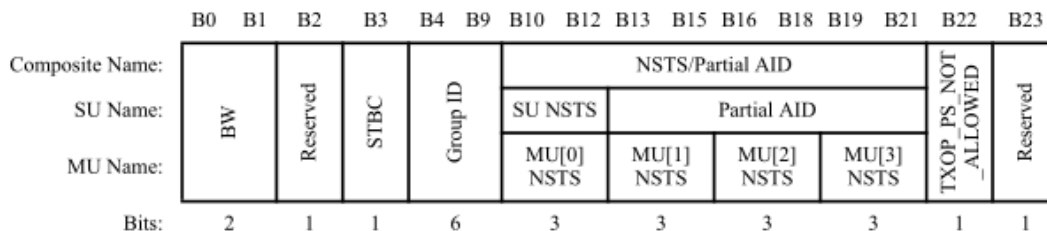


Figure 22-18—VHT-SIG-A1 structure

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 15. Each of the Accused Products comprises logic configured to
22 determine information from at least one uplink transmission receivable from said
23 second device through said smart antenna. For example, the UniFi AC HD Access
24 Point determines information from a VHT Compressed Beamforming frame
25 received from a client device through its smart antenna. *See, e.g.*, 802.11ac
26 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-
27 2012 Clause 20.3.12.3.6.

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1 16. Each of the Accused Products comprises logic configured to
 2 determine if said associated second device should operatively associate with a
 3 different beam downlink transmittable using said smart antenna based on said
 4 determined information. For example, the UniFi AC HD Access Point determines,
 5 based on the information received in a VHT Compressed Beamforming frame, if
 6 the client device should operatively associate with a different beam downlink
 7 transmittable using the smart antenna. *See, e.g.*, 802.11ac Standard Clauses
 8 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:

9 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in
 10 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.
 11 The beamforming feedback matrix, $V_{k,u}$, found by the beamformee u for subcarrier k shall be compressed in
 12 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.

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

15 After receiving the angle information, $\phi(k,u)$ and $\psi(k,u)$, the beamformer reconstructs $V_{k,u}$ using Equation
 16 (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
 17 $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$ 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.

18 17. Each of the Accused Products comprises logic configured to allow
 19 said second device to operatively associate with said different beam if said
 20 associated second device should operatively associate with a different beam and
 21 selectively identify that said second device is not allowed to operatively associate
 22 with said beam. For example, the UniFi AC HD Access Point allows a client
 23 device to operatively associate with a beam that is different from the beam with
 24 which the client was associated previously, and to identify that the client device is
 25 not allowed to operatively associate with the prior beam. *See, e.g.*, 802.11ac
 26 Standard Clause 10.40 (“An AP determines the possible combinations of STAs
 27 that can be addressed by a VHT MU PPDU by assigning STAs to groups and to
 28 specific user positions within those groups. Assignments or changes of user

1 positions corresponding to one or more Group IDs shall be performed using a
2 Group ID Management frame defined in 8.5.23.3...A VHT MU PPDU shall be
3 transmitted to a STA based on the content of the Group ID Management frame
4 most recently transmitted to the STA and for which an acknowledgement was
5 received.”); *id.* Clause 8.5.23.3 (“The Group ID Management frame is an Action
6 frame of category VHT. It is transmitted by the AP to assign or change the user
7 position of a STA for one or more group IDs. The Action field of a Group ID
8 Management frame contains the information shown in Table 8-281aj”); *id.* Clause
9 8.4.1.51 (“The Membership Status Array field is used in the Group ID
10 Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet
11 Membership Status Array field (indexed by the group ID) consists of a 1-bit
12 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-
13 80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership
14 Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a
15 member of the group — Set to 1 if STA is a member of the group The Membership
16 Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink
17 SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array
18 field is used in the Group ID Management frame (see 8.5.23.3). The length of the
19 field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID)
20 consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in
21 Figure 8-80g. * * * If the Membership Status subfield for a particular group ID is
22 1, then the corresponding User Position subfield is encoded as shown in Table 8-
23 53l.”); *id.* Table 8-53l:

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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:

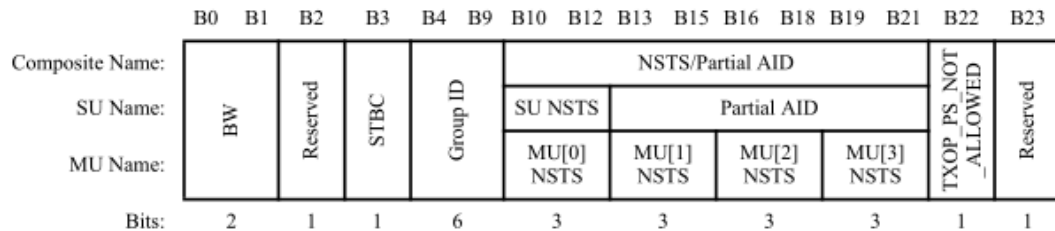


Figure 22-18—VHT-SIG-A1 structure

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 18. Defendant has been and is now indirectly infringing at least one claim
22 of the ’296 Patent in accordance with 35 U.S.C. § 271(b) in this district and
23 elsewhere in the United States. More specifically, Defendant has been and is now
24 actively inducing direct infringement by other persons (e.g., Defendant’s
25 customers who use, sell or offer for sale the Accused Products).

26 19. By at least the filing and service of the original Complaint on April
27 19, 2017, and May 3, 2017, respectively, Defendant had knowledge of the ’296
28 Patent, and that its actions resulted in a direct infringement of the ’296 Patent.

1 Defendant also knew or was willfully blind that its actions would induce direct
2 infringement by others and intended that its actions would induce direct
3 infringement by others.

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

22 21. Accordingly, a reasonable inference is that Defendant specifically
23 intended for others, such as its customers, to directly infringe one or more claims
24 of the '296 Patent in the United States because Defendant had knowledge of the
25 '296 Patent and actively induced others (e.g., its customers) to directly infringe the
26 '296 Patent by using, selling, or offering to sell the Accused Products and the MU-
27 MIMO functionality within the Accused Products.

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

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

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

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

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

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

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

23 28. Each of the Accused Products comprises a wireless communication
24 system. For example, the UniFi AC HD Access Point is a wireless access point for
25 use in a Wi-Fi network.

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

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

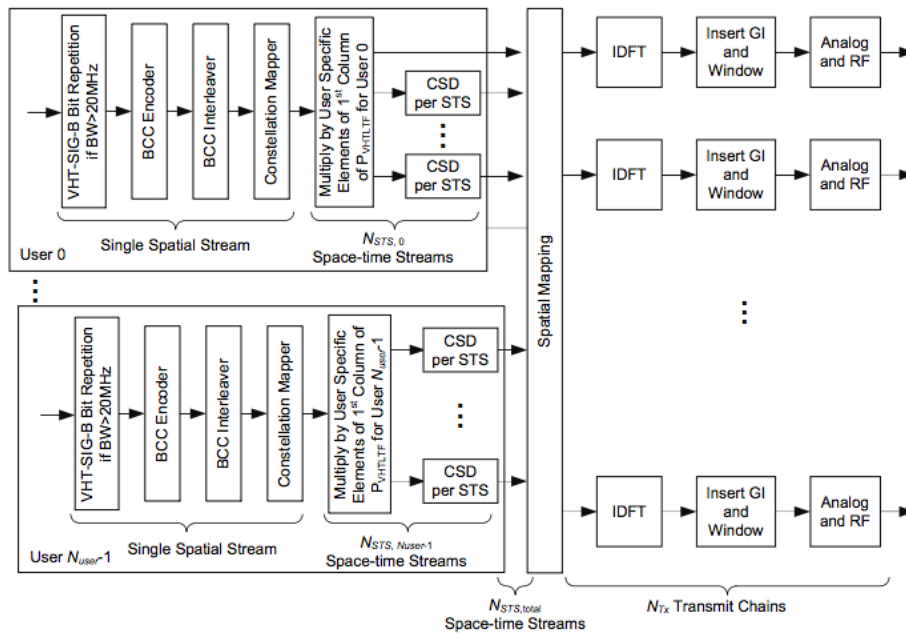


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

31. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver. For example, the UniFi AC HD Access Point comprises an access point that includes a phased antenna array and a Qualcomm QCA9994 WiFi radio.

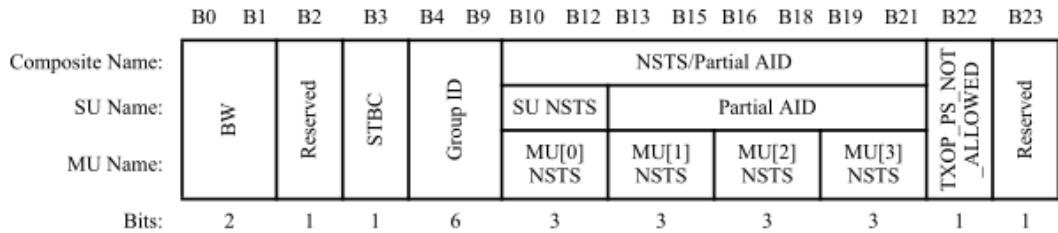
32. Each of the Accused Products comprises an access point that includes the phased array antenna and the transceiver that is configured to selectively allow

1 a receiving device to operatively associate with a beam downlink transmitted to the
 2 receiving device via the phased array antenna. *See, e.g.*, 802.11ac Standard Clause
 3 8.5.23.3 (“The Group ID Management frame is an Action frame of category VHT.
 4 It is transmitted by the AP to assign or change the user position of a STA for one
 5 or more group IDs. The Action field of a Group ID Management frame contains
 6 the information shown in Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership
 7 Status Array field is used in the Group ID Management frame (see 8.5.23.3). The
 8 length of the field is 8 octets. An 8 octet Membership Status Array field (indexed
 9 by the group ID) consists of a 1-bit Membership Status subfield for each of the 64
 10 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status
 11 Array field, the 1-bit Membership Status subfield for each group ID is set as
 12 follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a
 13 member of the group The Membership Status subfields for group ID 0
 14 (transmissions to AP) and group ID 63 (downlink SU transmissions) are
 15 reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field is used in the
 16 Group ID Management frame (see 8.5.23.3). The length of the field is 16 octets. A
 17 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit
 18 User Position subfield for each of the 64 group IDs, as shown in Figure 8-
 19 80g. * * * If the Membership Status subfield for a particular group ID is 1, then the
 20 corresponding User Position subfield is encoded as shown in Table 8-531.”); *id.*
 21 Table 8-531:

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

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

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



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

10 *Id.* Clause 22.3.11.4:

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

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

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

1 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT
2 beamformer shall include in the VHT NDP Announcement frame one STA Info
3 field for each VHT beamformee that is expected to prepare VHT Compressed
4 Beamforming feedback and shall identify the VHT beamformee by including the
5 VHT beamformee's AID in the AID subfield of the STA Info field. The VHT NDP
6 Announcement frame shall include at least one STA Info field."); *id.* ("A non-AP
7 VHT beamformee that receives a VHT NDP Announcement frame... shall
8 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a
9 Beamforming Report Poll with RA matching its MAC address and a non-
10 bandwidth signaling TA obtained from the TA field matching the MAC address of
11 the VHT beamformer."); *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses
12 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)
13 ("Spatial mapping: Apply the Q matrix as described in 22.3.10.11.1."); *id.* Clauses
14 22.3.10.11.1, 22.3.11.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

15 33. Each of the Accused Products comprises an access point that includes
16 the phased array antenna and the transceiver that is configured to receive an uplink
17 transmission from the receiving device through the phased array antenna. For
18 example, the UniFi AC HD Access Point is configured to receive a VHT
19 Compressed Beamforming Feedback frame from a "receiving device" such as a
20 connected laptop or smartphone through its phased-array antenna. *See, e.g.,*
21 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE
22 802.11-2012 Clause 20.3.12.3.6.

23 34. Each of the Accused Products comprises an access point that includes
24 the phased array antenna and the transceiver that is configured to determine from
25 the uplink transmission if the receiving device should operatively associate with a
26 different beam downlink transmission. For example, the UniFi AC HD Access
27 Point is configured to determine from information contained in the VHT
28 Compressed Beamforming Feedback frame if the receiving device that sent the

1 VHT Compressed Beamforming Feedback frame should operatively associate with
 2 a different beam downlink transmission. *See, e.g.*, 802.11ac Standard Clauses 3.2,
 3 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:

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

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

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

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

1 groups. Assignments or changes of user positions corresponding to one or more
2 Group IDs shall be performed using a Group ID Management frame defined in
3 8.5.23.3...A VHT MU PPDU shall be transmitted to a STA based on the content of
4 the Group ID Management frame most recently transmitted to the STA and for
5 which an acknowledgement was received.”); *id.* Clause 8.5.23.3 (“The Group ID
6 Management frame is an Action frame of category VHT. It is transmitted by the
7 AP to assign or change the user position of a STA for one or more group IDs. The
8 Action field of a Group ID Management frame contains the information shown in
9 Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used
10 in the Group ID Management frame (see 8.5.23.3). The length of the field is 8
11 octets. An 8 octet Membership Status Array field (indexed by the group ID)
12 consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as
13 shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the
14 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if
15 the STA is not a member of the group — Set to 1 if STA is a member of the group
16 The Membership Status subfields for group ID 0 (transmissions to AP) and group
17 ID 63 (downlink SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User
18 Position Array field is used in the Group ID Management frame (see 8.5.23.3). The
19 length of the field is 16 octets. A 16 octet User Position Array field (indexed by the
20 Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs,
21 as shown in Figure 8-80g. * * * If the Membership Status subfield for a particular
22 group ID is 1, then the corresponding User Position subfield is encoded as shown
23 in Table 8-53l.”); *id.* Table 8-53l:

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Table 8-531—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:

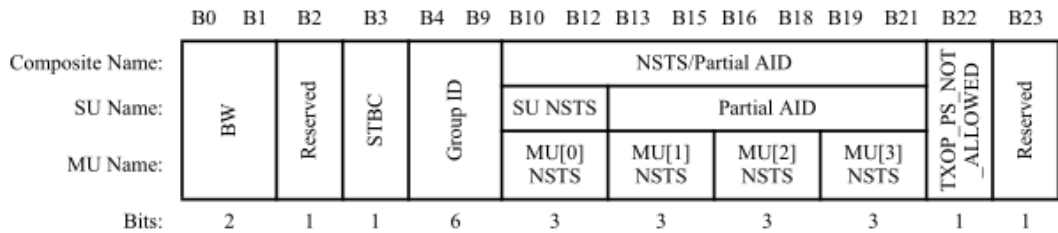


Figure 22-18—VHT-SIG-A1 structure

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

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

1 e.g. a VHT null data packet announcement frame over the beam downlinks, and to
2 gather signal parameter information from uplink transmittable messages received
3 from the receiving device through the phased array antenna, e.g. one or more VHT
4 Compressed Beamforming Feedback frames. *See, e.g.*, 802.11ac Standard Clause
5 9.31.5, 9.31.5.2 (“A VHT beamformer shall initiate a sounding feedback sequence
6 by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a
7 SIFS. The VHT beamformer shall include in the VHT NDP Announcement frame
8 one STA Info field for each VHT beamformee that is expected to prepare VHT
9 Compressed Beamforming feedback and shall identify the VHT beamformee by
10 including the VHT beamformee’s AID in the AID subfield of the STA Info field.
11 The VHT NDP Announcement frame shall include at least one STA Info field.”);
12 *id.* (“A non-AP VHT beamformee that receives a VHT NDP Announcement
13 frame... shall transmit its VHT Compressed Beamforming feedback a SIFS after
14 receiving a Beamforming Report Poll with RA matching its MAC address and a
15 non-bandwidth signaling TA obtained from the TA field matching the MAC
16 address of the VHT beamformer.”); *id.* Clause 8.4.1.24; IEEE 802.11-2012 Clause
17 20.3.12.3.6; 802.11ac Standard Clause 8.5.23.2 (defining format and subfields
18 within the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including
19 Tables 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.

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

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

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

25 40. Accordingly, a reasonable inference is that Defendant specifically
26 intended for others, such as its customers, to directly infringe one or more claims
27 of the '728 Patent in the United States because Defendant had knowledge of the
28 '728 Patent and actively induced others (e.g., its customers) to directly infringe the

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1 '728 Patent by using, selling, or offering to sell the Accused Products and the MU-
2 MIMO functionality within the Accused Products.

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

6 42. The '728 Patent is valid and enforceable.

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

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

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

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

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

26 47. Each of the Accused Products comprises an apparatus for use in a
27 wireless routing network. For example, the UniFi AC HD Access Point is an
28 apparatus for use in a wireless routing network

1 48. Each of the Accused Products comprises an adaptive antenna. For
 2 example, the UniFi AC HD Access Point has at least one adaptive antenna. *See,*
 3 *e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table 8-128:

4 8.4.2.58.6 Transmit Beamforming Capabilities

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

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

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

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17
 18 49. Each of the Accused Products comprises at least one transmitter
 19 operatively coupled to said adaptive antenna and at least one receiver operatively
 20 coupled to said adaptive antenna. For example, the UniFi AC HD Access Point has
 21 a Qualcomm QCA9994 WiFi radio operatively coupled to the adaptive antenna.
 22 *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h),
 23 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-
 24 convert the resulting complex baseband waveform associated with each transmit
 25 chain to an RF signal according to the center frequency of the desired channel and
 26 transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

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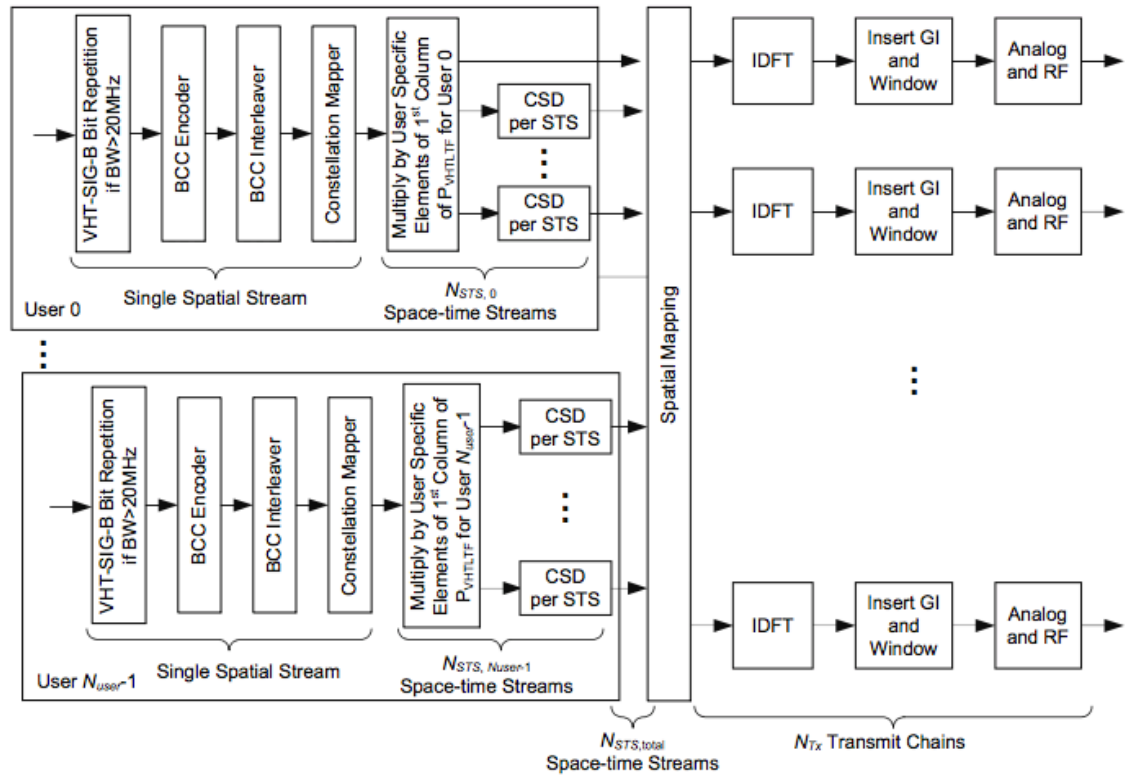


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

50. 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 UniFi AC HD Access Point is configured to output at least one transmission signal to said adaptive antenna. For a further example, the UniFi AC HD Access Point 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

1 compute a steering matrix that is applied to the transmitted signal to optimize
 2 reception at one or more receivers. The STA transmitting using the steering matrix
 3 is called the VHT beamformer and a STA for which reception is optimized is
 4 called a VHT beamformee. An explicit feedback mechanism is used where the
 5 VHT beamformee directly measures the channel from the training symbols
 6 transmitted by the VHT beamformer and sends back a transformed estimate of the
 7 channel state to the VHT beamformer. The VHT beamformer then uses this
 8 estimate, perhaps combining estimates from multiple VHT beamformees, to derive
 9 the steering matrix.”); *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(l),
 10 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply the Q matrix
 11 as described in 22.3.10.11.1.”); *id.* Clause 22.3.10.11.1; IEEE 802.11-2012
 12 Standard Clause 20.3.12.3.6; 802.11ac Standard Clauses 8.4.1.24, 9.31.5.1,
 13 9.31.5.2; *id.* Clause 22.3.11.1:

14
 15 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
 16 beamformer using the beamforming feedback matrices for subcarrier k from beamformee u , $V_{k,u}$, and SNR
 17 information for subcarrier k from beamformee u , $SNR_{k,u}$, where $u = 0, 1, \dots, N_{user} - 1$. The steering matrix
 18 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).

19 *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
 (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 search receiver logic operatively
2 coupled to said control logic and said at least one receiver and configured to update
3 said routing information based at least in part on cross-correlated signal
4 information that is received by said receiver using said adaptive antenna. For
5 example, the UniFi AC HD Access Point updates the routing information based at
6 least in part on cross-correlated signal information received in a VHT Compressed
7 Beamforming frame. *See, e.g.*, 802.11ac Standard Clause 9.31.5.2 (“A VHT
8 beamformer shall initiate a sounding feedback sequence by transmitting a VHT
9 NDP Announcement frame followed by a VHT NDP after a SIFS. The VHT
10 beamformer shall include in the VHT NDP Announcement frame one STA Info
11 field for each VHT beamformee that is expected to prepare VHT Compressed
12 Beamforming feedback and shall identify the VHT beamformee by including the
13 VHT beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP
14 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP
15 VHT beamformee that receives a VHT NDP Announcement frame... shall
16 transmit its VHT Compressed Beamforming feedback a SIFS after receiving a
17 Beamforming Report Poll with RA matching its MAC address and a non-
18 bandwidth signaling TA obtained from the TA field matching the MAC address of
19 the VHT beamformer.”); *id.* Clause 8.5.23.2 (defining format and subfields within
20 the VHT Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including Tables
21 8-53(d)-(h)) (“Each SNR value per tone in stream i (before being averaged)
22 corresponds to the SNR associated with the column i of the beamforming feedback
23 matrix V determined at the beamformee”); *id.* Clause 8.4.1.49 (including Table 8-
24 53i – MU Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24,
25 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 51. 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 52. By at least the filing and service of the original Complaint on April
 16 19, 2017, and May 3, 2017, respectively, Defendant had knowledge of the '231
 17 Patent, and that its actions resulted in a direct infringement of the '231 Patent.
 18 Defendant also knew or was willfully blind that its actions would induce direct
 19 infringement by others and intended that its actions would induce direct
 20 infringement by others.

21 53. Defendant actively induced, and continues to induce, such
 22 infringement by, among other things, providing user manuals and other instruction
 23 material for its Accused Products that induce its customers to use the Accused
 24 Products in their normal and customary way to infringe the '231 Patent. For
 25 example, Defendant's website provided, and continues to provide, instructions for
 26 using the Accused Products on wireless communication systems, and to utilize
 27 their beamforming and MU-MIMO functionalities. Defendant sold, and continues
 28 to sell, for example, on Amazon.com, the Accused Products to customers despite

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1 its knowledge of the '231 Patent. Defendant manufactured and imported into the
2 United States, and continues to do so, the Accused Products for sale and
3 distribution to its customers, despite its knowledge of the '231 Patent. Through its
4 continued manufacture, importation, and sales of its Accused Products, Defendant
5 specifically intended for its customers to infringe claims of the '231 Patent.
6 Further, Defendant was aware that these normal and customary activities would
7 infringe the '231 Patent. Defendant performed, and continues to perform, acts that
8 constitute induced infringement, and that would induce actual infringement, with
9 knowledge of the '231 Patent and with the knowledge or willful blindness that the
10 induced acts would constitute direct infringement.

11 54. Accordingly, a reasonable inference is that Defendant specifically
12 intended for others, such as its customers, to directly infringe one or more claims
13 of the '231 Patent in the United States because Defendant had knowledge of the
14 '231 Patent and actively induced others (e.g., its customers) to directly infringe the
15 '231 Patent by using, selling, or offering to sell the Accused Products and the MU-
16 MIMO functionality within the Accused Products.

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

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

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

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

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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, including enhanced damages pursuant to 35 U.S.C. § 284, 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) A judgment in favor of Vivato against Defendant that this is an exceptional case under 35 U.S.C. § 285 and awarding attorneys’ fees and costs in this action;

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

DEMAND FOR JURY TRIAL

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

DATED: July 6, 2017

Respectfully submitted,

RUSS AUGUST & KABAT

By: /s/ Reza Mirzaie
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XR COMMUNICATIONS, LLC,
dba VIVATO TECHNOLOGIES

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