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 19 XR COMMUNICATIONS, LLC  
 20 dba VIVATO TECHNOLOGIES

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

23 XR COMMUNICATIONS, LLC, dba  
 24 VIVATO TECHNOLOGIES,

25 *Plaintiff,*

26 *v.*

27 BELKIN INTERNATIONAL, INC.,

28 *Defendant.*

Case No. 8:17-cv-674-AG(JCGx)

**AMENDED COMPLAINT FOR  
 PATENT INFRINGEMENT**

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1 **I. JURISDICTION AND VENUE**

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

5 **II. THE PARTIES**

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

10 3. Belkin International, Inc. (“Belkin” or “Defendant”) is a corporation  
11 organized and existing under the laws of Delaware with its principal place of  
12 business at 12045 E. Waterfront Dr., Playa Vista, California 90094. Belkin has a  
13 registered agent for service of process at National Registered Agents, Inc. 160  
14 Greentree Drive, Suite 101, Dover, Delaware 19904. Vivato is informed and  
15 believes that Belkin’s activities relating to the Linksys branded products accused in  
16 this action are conducted, controlled, and directed at the former Linksys  
17 headquarters located at 121 Theory Drive, Irvine, CA 92617.

18 4. This Court has personal jurisdiction over Belkin because Belkin has  
19 its principal place of business in California.

20 5. Venue is proper in this federal district pursuant to 28 U.S.C.  
21 §§ 1391(b)-(d) and 1400(b) in that Belkin resides in this District, has its principal  
22 place of business in this District, has done business in this District, has regular and  
23 established places of business in this District, has committed acts of infringement  
24 in this District, and continues to commit acts of infringement in this District,  
25 entitling Plaintiffs to relief.

26 **III. BACKGROUND OF THE TECHNOLOGY**

27 6. Vivato was founded in 2000 as a \$80+million venture-backed  
28 company with several key innovators in the wireless communication field

1 including Siavash Alamouti, Ken Biba, William Crilly, James Brennan, Edward  
2 Casas, and Vahid Tarokh among many others. Wi-Fi/802.11 has become the  
3 ubiquitous wireless connection to the Internet and is now integrated into hundreds  
4 of millions of mobile devices globally. Vivato was founded to leverage its talent to  
5 generate intellectual property and deliver Wi-Fi/802.11 wireless connectivity  
6 solutions to service the growing demand for bandwidth.

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

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

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

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

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

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1 Linksys EA8500 Max-Stream AC2600 MU MIMO Router, EA7500 Max-Stream  
 2 AC1900 MU-MIMO Gigabit Wi-Fi Router, EA9500 max-stream AC5400 MU-  
 3 MIMO Gigabit Router, WRT3200ACM AC3200 MU-MIMO Gigabit Wi-Fi  
 4 Router, EA9300 Max-Stream AC4000 Tri-Band Wi-Fi Router, EA8300 Max-  
 5 Stream AC2200 Tri-Band Wi-Fi Router, EA7300 Max-Stream AC1750 MU-  
 6 MIMO Gigabit Wi-Fi Router, WRT32X AC3200 Dual-Band Gaming Router,  
 7 Re7000 Max-Stream AC1900+ Wi-Fi Range Extender, EA7400 Max-Stream  
 8 AC1750 MU-MIMO Gigabit Router, LAPAC2600 Business Pro Series Wireless-  
 9 AC Dual-Band MU-MIMO Access Point, and EA8350 AC2400 4X4 Dual-Band  
 10 Gigabit Wi-Fi Router) (collectively the “Accused Products”). Defendant is liable  
 11 for infringement of the ’296 Patent pursuant to 35 U.S.C. § 271(a).

12 11. Each of the Accused Products comprises an apparatus for use in a  
 13 wireless communication system. For example, the EA8500 Max-Stream AC2600  
 14 MU MIMO Router is an apparatus for use in a wireless communication system that  
 15 “delivers plenty of bandwidth to all of your connected devices such as streaming  
 16 media players, smart TVs, tablets, and game consoles--maintaining a fast,  
 17 uninterrupted Wi-Fi connection even if multiple family members are all connected  
 18 at the same time.”<sup>1</sup>

19 12. Each of the Accused Products comprises at least one smart antenna.  
 20 For example, the EA8500 Max-Stream AC2600 MU MIMO Router has at least  
 21 one smart antenna. *See, e.g.:* <http://www.linksys.com/us/p/P-EA8500/>:

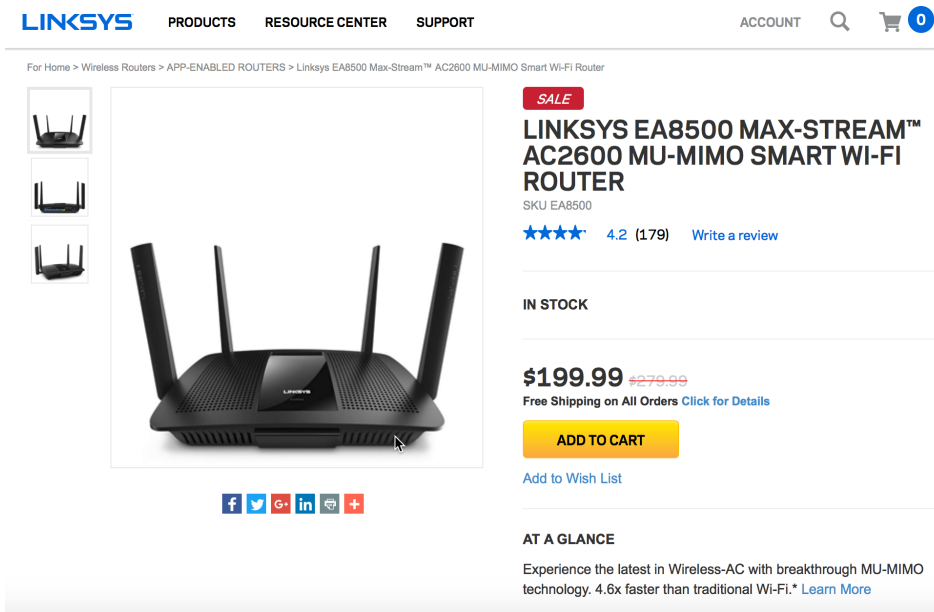
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28 <sup>1</sup> <http://www.linksys.com/ca/p/P-EA8500/#product-features> (on file).

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13. Each of the Accused Products comprises at least one transceiver operatively coupled to said smart antenna and configured to send and receive electromagnetic signals using said smart antenna. For example, the EA8500 Max-Stream AC2600 MU MIMO Router has a Qualcomm QCA9980 Wi-Fi radio coupled to the smart antenna to send and receive signals.<sup>2</sup> See, e.g., IEEE 802.11ac-2013 (“802.11ac Standard”) Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h), 22.3.4.8(p), 22.3.4.9.1(q), 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

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<sup>2</sup> “The QCA9980 is a Wave-2 802.11ac radio that helps high-performance Wi-Fi routers, gateways, set-top boxes and range extenders to support more devices and more demanding applications in the connected home. The dual-band, 4x4 solution is designed to deliver peak data rates up to 1.7 Gps, and uses Multi-User MIMO to maintain fast connections on increasingly crowded networks.” The QCA9980 supports a 4-stream MU-MIMO configuration. Source: <https://www.qualcomm.com/products/qca9980> (last visited March 22, 2017).

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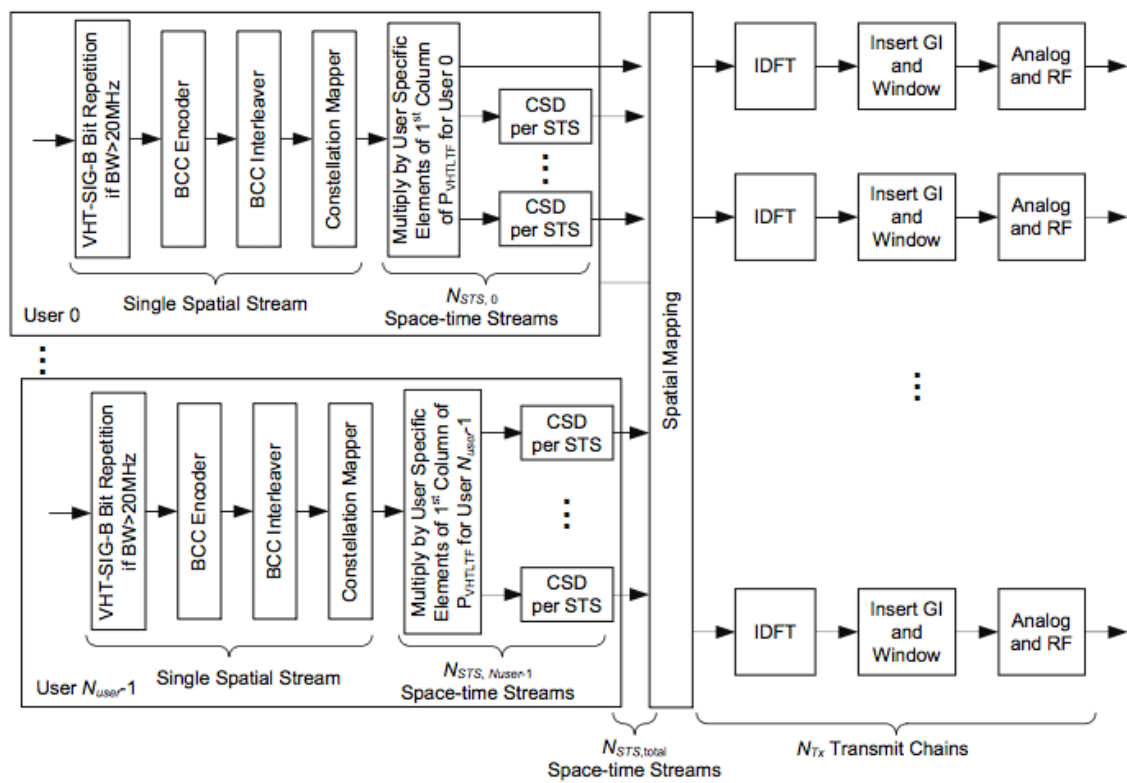


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

14. Each of the Accused Products comprises logic operatively coupled to said transceiver and configured to selectively allow a second device to operatively associate with a beam downlink transmittable to said second device using said smart antenna. For example, the EA8500 Max-Stream AC2600 MU MIMO Router 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

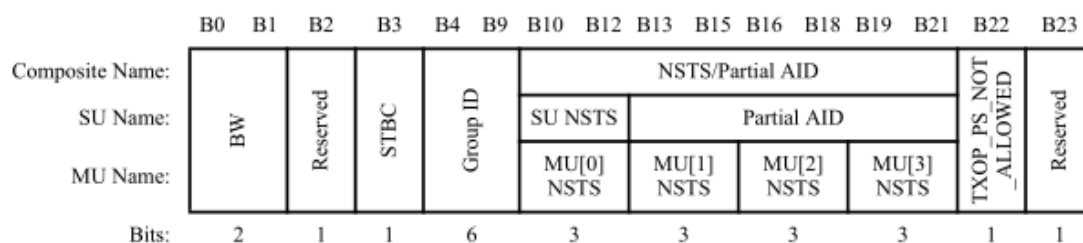
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1 Array field, the 1-bit Membership Status subfield for each group ID is set as  
 2 follows: — Set to 0 if the STA is not a member of the group — Set to 1 if STA is a  
 3 member of the group The Membership Status subfields for group ID 0  
 4 (transmissions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

12  
 13  
 14  
 15  
 16  
 17  
 18 *Id.* Clause 22.3.8.3.3 (“The VHT-SIG-A field carries information required to  
 19 interpret VHT PPDU. The structure of the VHT-SIG-A field for the first part  
 20 (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is  
 21 shown in Figure 22-19.”); *id.* Figure 22-18:



**Figure 22-18—VHT-SIG-A1 structure**

22  
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 26  
 27  
 28 *Id.* Clause 22.3.11.4:

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 15. Each of the Accused Products comprises logic configured to  
 6 determine information from at least one uplink transmission receivable from said  
 7 second device through said smart antenna. For example, the EA8500 Max-Stream  
 8 AC2600 MU MIMO Router determines information from a VHT Compressed  
 9 Beamforming frame received from a client device through its smart antenna. *See,*  
 10 *e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2;  
 11 IEEE 802.11-2012 Clause 20.3.12.3.6.

12 16. Each of the Accused Products comprises logic configured to  
 13 determine if said associated second device should operatively associate with a  
 14 different beam downlink transmittable using said smart antenna based on said  
 15 determined information. For example, the EA8500 Max-Stream AC2600 MU  
 16 MIMO Router determines, based on the information received in a VHT  
 17 Compressed Beamforming frame, if the client device should operatively associate  
 18 with a different beam downlink transmittable using the smart antenna. *See, e.g.*,  
 19 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; *id.*  
 20 Clause 22.3.11.2:

21 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 22 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 23 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed in  
 24 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.

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

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

1           17. Each of the Accused Products comprises logic configured to allow  
2 said second device to operatively associate with said different beam if said  
3 associated second device should operatively associate with a different beam and  
4 selectively identify that said second device is not allowed to operatively associate  
5 with said beam. For example, the EA8500 Max-Stream AC2600 MU MIMO  
6 Router allows a client device to operatively associate with a beam that is different  
7 from the beam with which the client was associated previously, and to identify that  
8 the client device is not allowed to operatively associate with the prior beam. *See,*  
9 *e.g.*, 802.11ac Standard Clause 10.40 (“An AP determines the possible  
10 combinations of STAs that can be addressed by a VHT MU PPDU by assigning  
11 STAs to groups and to specific user positions within those groups. Assignments or  
12 changes of user positions corresponding to one or more Group IDs shall be  
13 performed using a Group ID Management frame defined in 8.5.23.3...A VHT MU  
14 PPDU shall be transmitted to a STA based on the content of the Group ID  
15 Management frame most recently transmitted to the STA and for which an  
16 acknowledgement was received.”); *id.* Clause 8.5.23.3 (“The Group ID  
17 Management frame is an Action frame of category VHT. It is transmitted by the  
18 AP to assign or change the user position of a STA for one or more group IDs. The  
19 Action field of a Group ID Management frame contains the information shown in  
20 Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used  
21 in the Group ID Management frame (see 8.5.23.3). The length of the field is 8  
22 octets. An 8 octet Membership Status Array field (indexed by the group ID)  
23 consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as  
24 shown in Figure 8-80f. \* \* \* Within the 8 octet Membership Status Array field, the  
25 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if  
26 the STA is not a member of the group — Set to 1 if STA is a member of the group  
27 The Membership Status subfields for group ID 0 (transmissions to AP) and group  
28 ID 63 (downlink SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User

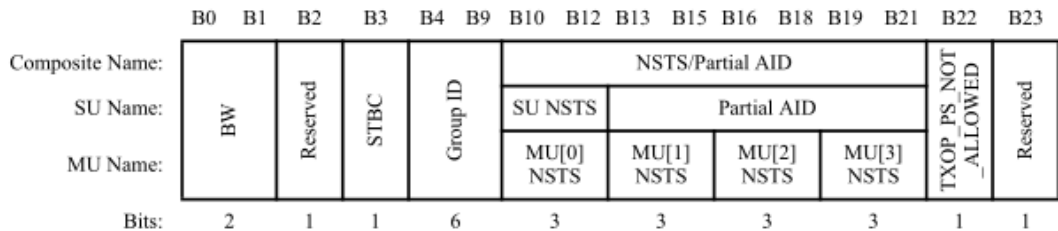
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1 Position Array field is used in the Group ID Management frame (see 8.5.23.3). The  
 2 length of the field is 16 octets. A 16 octet User Position Array field (indexed by the  
 3 Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs,  
 4 as shown in Figure 8-80g. \* \* \* If the Membership Status subfield for a particular  
 5 group ID is 1, then the corresponding User Position subfield is encoded as shown  
 6 in Table 8-531.”); *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 PPDUs. The structure of the VHT-SIG-A field for the first part  
 15 (VHT-SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is  
 16 shown in Figure 22-19.”); *id.* Figure 22-18:



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

22 *Id.* Clause 22.3.11.4:

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

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

3 19. By at least the filing and service of the original Complaint on April  
4 13, 2017, and May 4, 2017, respectively, Defendant had knowledge of the '296  
5 Patent, and that its actions resulted in a direct infringement of the '296 Patent.  
6 Defendant also knew or was willfully blind that its actions would induce direct  
7 infringement by others and intended that its actions would induce direct  
8 infringement by others.

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

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

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

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

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

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

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

15 **V. COUNT TWO: INFRINGEMENT OF UNITED STATES**  
16 **PATENT 7,729,728**

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

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

27 28. Each of the Accused Products comprises a wireless communication  
28 system. For example, the Linksys EA8500 AC2600 Router "delivers plenty of

1 bandwidth to all of your connected devices such as streaming media players, smart  
2 TVs, tablets, and game consoles--maintaining a fast, uninterrupted Wi-Fi  
3 connection even if multiple family members are all connected at the same time.”

4 29. Each of the Accused Products comprises a phased array antenna  
5 configured to transmit beam downlinks. *See, e.g.:* 802.11ac Standard Clause  
6 8.4.2.58.6, Table 8-128; <http://www.linksys.com/us/p/P-EA8500/>:



EVERYBODY'S ONLINE. NOBODY'S WAITING

The Max-Stream AC2600 Router delivers plenty of bandwidth to all of your connected devices such as streaming media players, smart TVs, tablets, and game consoles--maintaining a fast, uninterrupted Wi-Fi connection even if multiple family members are all connected at the same time. This allows everyone in your household to connect to the Internet at the same time without slowing down your network.

LINKSYS

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For Home > Wireless Routers > APP-ENABLED ROUTERS > Linksys EA8500 Max-Stream™ AC2600 MU-MIMO Smart Wi-Fi Router



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Experience the latest in Wireless-AC with breakthrough MU-MIMO technology. 4.6x faster than traditional Wi-Fi.\* [Learn More](#)

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1           30. Each of the Accused Products comprises a transceiver operatively  
 2 coupled to the phased array antenna and configured to send and receive  
 3 electromagnetic signals via the phased array antenna. For example, the EA8500  
 4 Max-Stream AC2600 MU MIMO Router has a Qualcomm QCA9980 Wi-Fi radio  
 5 that is configured to send and receive electromagnetic signals via the phased array  
 6 antenna. *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h),  
 7 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-  
 8 convert the resulting complex baseband waveform associated with each transmit  
 9 chain to an RF signal according to the center frequency of the desired channel and  
 10 transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:

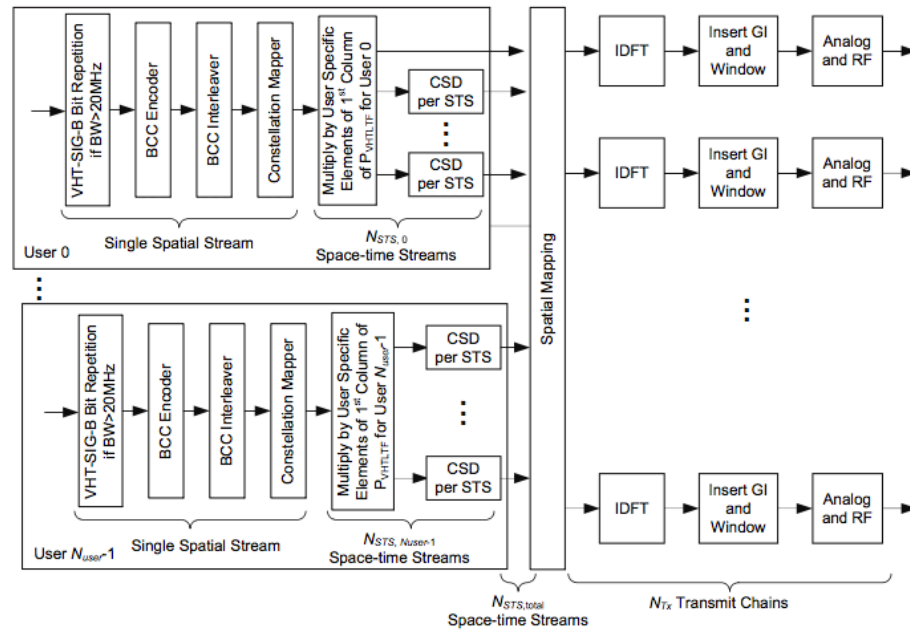


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

23           31. Each of the Accused Products comprises an access point that includes  
 24 the phased array antenna and the transceiver. For example, the EA8500 Max-  
 25 Stream AC2600 MU MIMO Router comprises an access point that includes a  
 26 phased antenna array and a Qualcomm QCA9980 Wi-Fi radio.

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

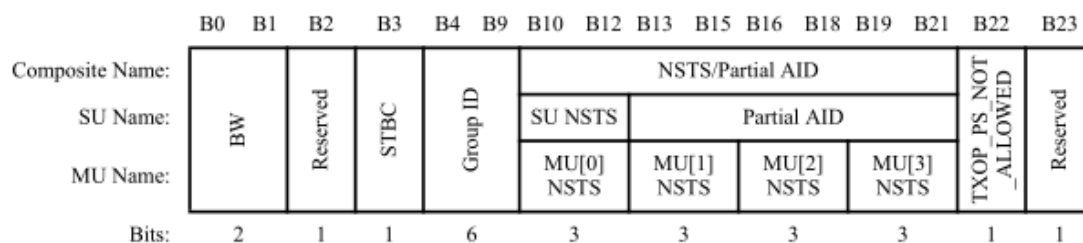


1 a receiving device to operatively associate with a beam downlink transmitted to the  
 2 receiving device via the phased array antenna. *See, e.g.*, 802.11ac Standard Clause  
 3 8.5.23.3 (“The Group ID Management frame is an Action frame of category VHT.  
 4 It is transmitted by the AP to assign 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:



5  
6  
7  
8  
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 EA8500 Max-Stream AC2600 MU MIMO Router is configured to  
19 receive a VHT Compressed Beamforming Feedback frame from a "receiving  
20 device" such as a connected laptop or smartphone through its phased-array  
21 antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1,  
22 9.31.5.2; IEEE 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 EA8500 Max-Stream  
27 AC2600 MU MIMO Router is configured to determine from information contained  
28 in the VHT Compressed Beamforming Feedback frame if the receiving device that

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

5 Upon receipt of a VHT NDP sounding PPDU, the beamformee shall remove the space-time stream CSD in  
 6 Table 22-11 from the measured channel before computing a set of matrices for feedback to the beamformer.  
 7 The beamforming feedback matrix,  $V_{k,u}$ , found by the beamformee  $u$  for subcarrier  $k$  shall be compressed  
 8 in 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  
 9 according to Table 8-53e. The number of bits for quantization is chosen by the beamformee, based on the  
 10 indication from the beamformer as to whether the feedback is requested for SU-MIMO beamforming or DL-  
 11 MU-MIMO beamforming. The compressed beamforming feedback using 20.3.12.3.6 is the only Clause 22  
 12 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  
 17 matrix  $Q_k$ . For DL-MU-MIMO beamforming, the beamformer may calculate a steering matrix  
 18  $Q_k = [Q_{k,0}, Q_{k,1}, \dots, Q_{k,N_{user}-1}]$  using  $V_{k,u}$  and  $SNR_{k,u}$  ( $0 \leq u \leq N_{user} - 1$ ) in order to suppress crosstalk  
 19 between participating beamformees. The method used by the beamformer to calculate the steering matrix  $Q_k$   
 20 is implementation specific.

21 35. Each of the Accused Products comprises an access point that includes  
 22 the phased array antenna and the transceiver that is configured to at least one of: (i)  
 23 allow the receiving device to operatively associate with the different beam  
 24 downlink if determined that the receiving device should operatively associate with  
 25 the different beam downlink; (ii) force the receiving device to operatively associate  
 26 with the different beam downlink if determined that the receiving device should be  
 27 operatively associated with the different beam downlink. For example, the EA8500  
 28 Max-Stream AC2600 MU MIMO Router is configured to transmit a Group ID  
 Management frame or VHT MU PPDU VHT-SIG-A or combination thereof to  
 allow the receiving device to operatively associate with the different beam  
 downlink if determined that the receiving device should operatively associate with  
 the different beam downlink; (ii) force the receiving device to operatively associate  
 with the different beam downlink if determined that the receiving device should be  
 operatively associated with the different beam downlink. *See, e.g.*, 802.11ac  
 Standard Clause 10.40 (“An AP determines the possible combinations of STAs

1 that can be addressed by a VHT MU PPDU by assigning STAs to groups and to  
2 specific user positions within those groups. Assignments or changes of user  
3 positions corresponding to one or more Group IDs shall be performed using a  
4 Group ID Management frame defined in 8.5.23.3...A VHT MU PPDU shall be  
5 transmitted to a STA based on the content of the Group ID Management frame  
6 most recently transmitted to the STA and for which an acknowledgement was  
7 received.”); *id.* Clause 8.5.23.3 (“The Group ID Management frame is an Action  
8 frame of category VHT. It is transmitted by the AP to assign or change the user  
9 position of a STA for one or more group IDs. The Action field of a Group ID  
10 Management frame contains the information shown in Table 8-281aj”); *id.* Clause  
11 8.4.1.51 (“The Membership Status Array field is used in the Group ID  
12 Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet  
13 Membership Status Array field (indexed by the group ID) consists of a 1-bit  
14 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-  
15 80f. \* \* \* Within the 8 octet Membership Status Array field, the 1-bit Membership  
16 Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a  
17 member of the group — Set to 1 if STA is a member of the group The Membership  
18 Status subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink  
19 SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array  
20 field is used in the Group ID Management frame (see 8.5.23.3). The length of the  
21 field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID)  
22 consists of a 2-bit User Position subfield for each of the 64 group IDs, as shown in  
23 Figure 8-80g. \* \* \* If the Membership Status subfield for a particular group ID is  
24 1, then the corresponding User Position subfield is encoded as shown in Table 8-  
25 53l.”); *id.* Table 8-53l:

26 ///

27 ///

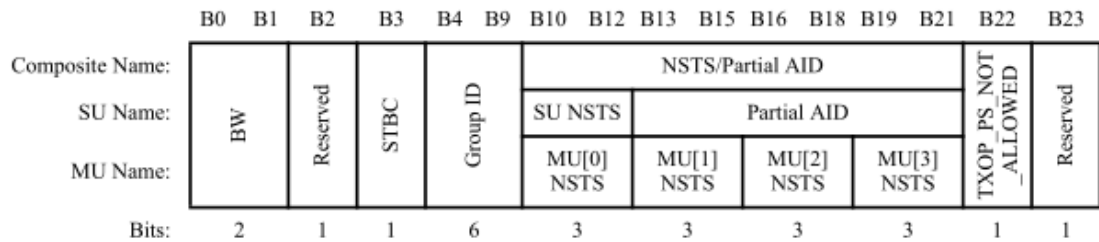
28 ///

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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 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 EA8500 Max-Stream AC2600 MU MIMO Router is configured to actively  
28 probe the receiving device by generating a signal to initiate that the phased array

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

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



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

2 38. By at least the filing and service of the original Complaint on April  
3 13, 2017, and May 4, 2017, respectively, Defendant had knowledge of the '728  
4 Patent, and that its actions resulted in a direct infringement of the '728 Patent.  
5 Defendant also knew or was willfully blind that its actions would induce direct  
6 infringement by others and intended that its actions would induce direct  
7 infringement by others.

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

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

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

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

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

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

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

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

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

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

27 47. Each of the Accused Products comprises an apparatus for use in a  
28 wireless routing network. For example, the EA8500 Max-Stream AC2600 MU

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1 MIMO Router is an apparatus for use in a wireless routing network that “delivers  
 2 plenty of bandwidth to all of your connected devices such as streaming media  
 3 players, smart TVs, tablets, and game consoles--maintaining a fast, uninterrupted  
 4 Wi-Fi connection even if multiple family members are all connected at the same  
 5 time.”<sup>3</sup>

6 48. Each of the Accused Products comprises an adaptive antenna. For  
 7 example, the EA8500 Max-Stream AC2600 MU MIMO Router has at least one  
 8 adaptive antenna. *See, e.g.*: 802.11ac Standard Clause 8.4.2.58.6, Table 8-128;

9  
 10 **8.4.2.58.6 Transmit Beamforming Capabilities**

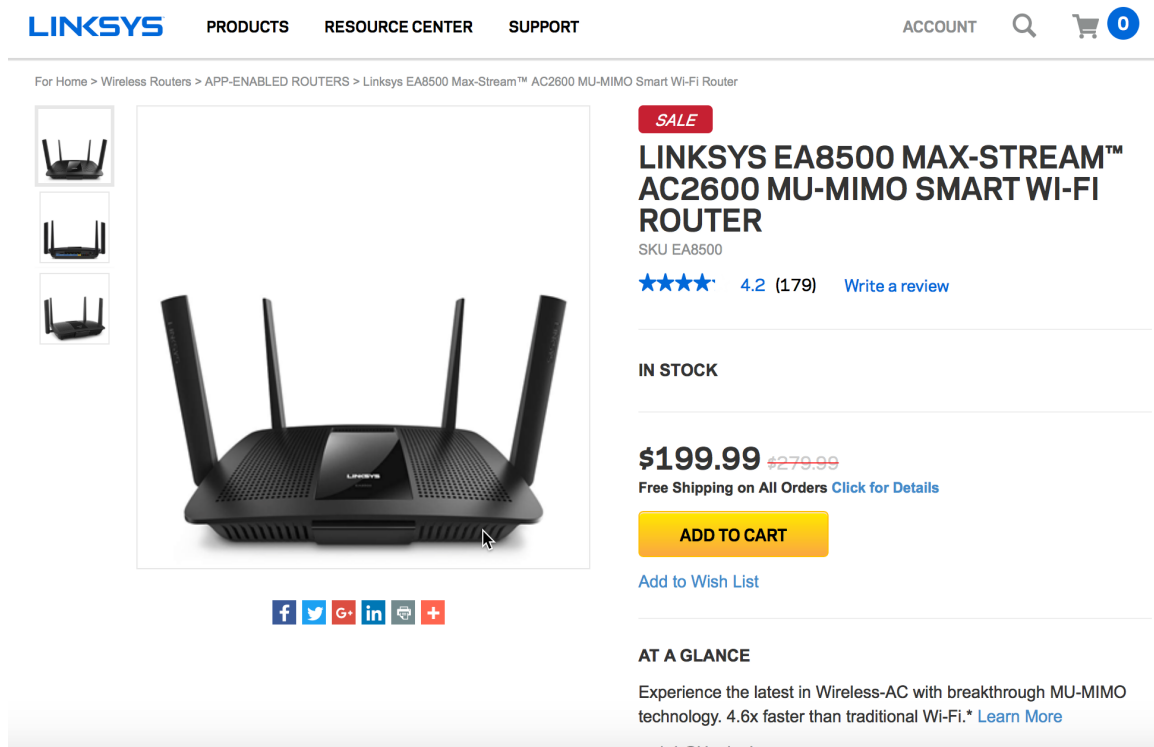
11 *Change the following rows in Table 8-128:*

12  
 13 **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 <u>HT</u> 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 <u>HT</u> 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 <u>HT</u> 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 <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 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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 28 <sup>3</sup> <http://www.linksys.com/ca/p/P-EA8500/#product-features> (on file).

1 See also:



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15 49. Each of the Accused Products comprises at least one transmitter  
16 operatively coupled to said adaptive antenna and at least one receiver operatively  
17 coupled to said adaptive antenna. For example, the EA8500 Max-Stream AC2600  
18 MU MIMO Router has a Qualcomm QCA9980 Wi-Fi radio operatively coupled to  
19 the adaptive antenna. *See, e.g.*, 802.11ac Standard Clauses 22.3.4.5(j), 22.3.4.6(g),  
20 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  
21 RF: Up-convert the resulting complex baseband waveform associated with each  
22 transmit chain to an RF signal according to the center frequency of the desired  
23 channel and transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and Figure  
24 22-7:

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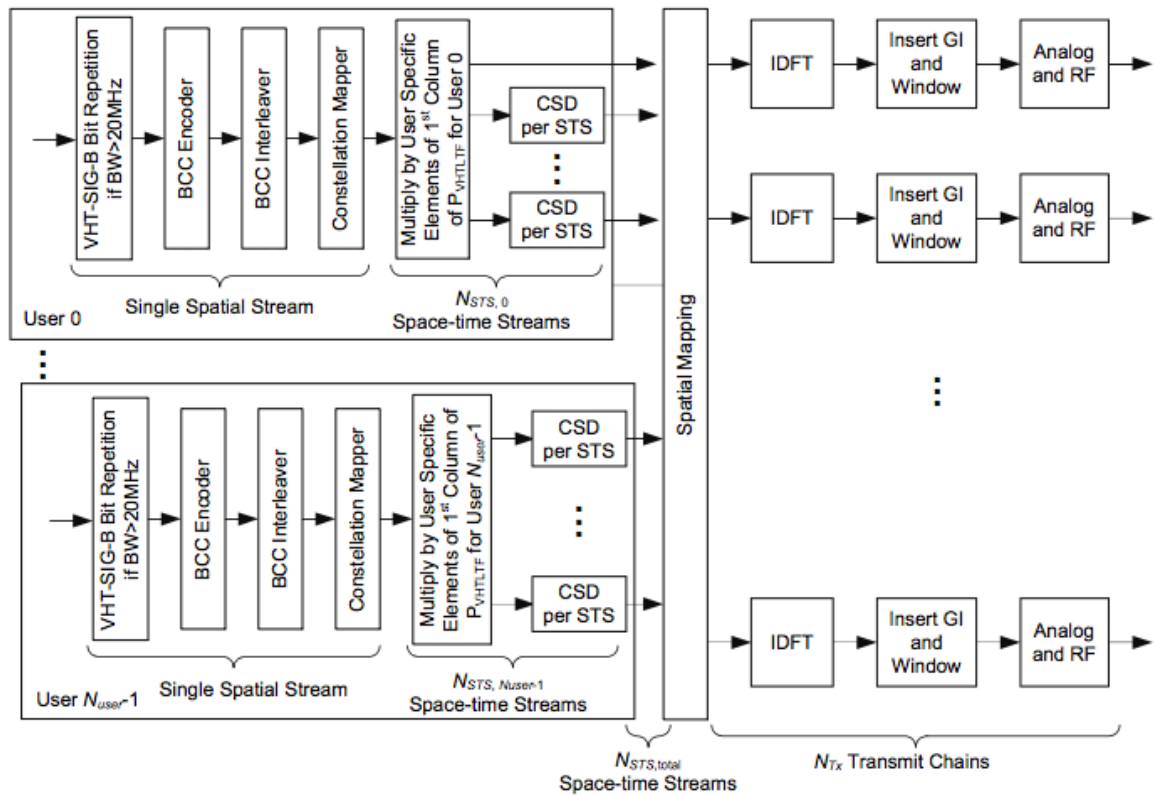


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

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 EA8500 Max-Stream AC2600 MU MIMO Router is configured to output at least one transmission signal to said adaptive antenna. For a further example, the EA8500 Max-Stream AC2600 MU MIMO Router 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*

1 Standard 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.* Clauses 22.3.4.6(d),  
 11 22.3.4.7(e), 22.3.4.8(l), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial  
 12 mapping: Apply the  $Q$  matrix as described in 22.3.10.11.1.”); *id.* Clause  
 13 22.3.10.11.1; IEEE 802.11-2012 Standard Clause 20.3.12.3.6; 802.11ac Standard  
 14 Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.1:

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 ( $Nr$ ) 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           51. Each of the Accused Products comprises search receiver logic  
2           operatively coupled to said control logic and said at least one receiver and  
3           configured to update said routing information based at least in part on cross-  
4           correlated signal information that is received by said receiver using said adaptive  
5           antenna. For example, the EA8500 Max-Stream AC2600 MU MIMO Router  
6           updates the routing information based at least in part on cross-correlated signal  
7           information received in a VHT Compressed Beamforming frame. *See, e.g.*,  
8           802.11ac Standard Clause 9.31.5.2 (“A VHT beamformer shall initiate a sounding  
9           feedback sequence by transmitting a VHT NDP Announcement frame followed by  
10          a VHT NDP after a SIFS. The VHT beamformer shall include in the VHT NDP  
11          Announcement frame one STA Info field for each VHT beamformee that is  
12          expected to prepare VHT Compressed Beamforming feedback and shall identify  
13          the VHT beamformee by including the VHT beamformee’s AID in the AID  
14          subfield of the STA Info field. The VHT NDP Announcement frame shall include  
15          at least one STA Info field.”); *id.* (“A non-AP VHT beamformee that receives a  
16          VHT NDP Announcement frame... shall transmit its VHT Compressed  
17          Beamforming feedback a SIFS after receiving a Beamforming Report Poll with RA  
18          matching its MAC address and a non-bandwidth signaling TA obtained from the  
19          TA field matching the MAC address of the VHT beamformer.”); *id.* Clause  
20          8.5.23.2 (defining format and subfields within the VHT Compressed Beamforming  
21          frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-(h)) (“Each SNR value per  
22          tone in stream  $i$  (before being averaged) corresponds to the SNR associated with  
23          the column  $i$  of the beamforming feedback matrix  $V$  determined at the  
24          beamformee”); *id.* Clause 8.4.1.49 (including Table 8-53i – MU Exclusive  
25          Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.*  
26          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 ( $N_r$ ) 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  
 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 52. 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 53. By at least the filing and service of the original Complaint on April  
 16 13, 2017, and May 4, 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 54. 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 55. 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 56. 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 57. The '231 Patent is valid and enforceable.

21 58. 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 59. 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: June 26, 2017

Respectfully submitted,

**RUSS AUGUST & KABAT**

By: /s/ Reza Mirzaie  
Marc A. Fenster  
Reza Mirzaie  
Philip X. Wang  
Kent N. Shum  
Christian Conkle  
James N. Pickens

*Attorneys for Plaintiff*

XR COMMUNICATIONS, LLC,  
dba VIVATO TECHNOLOGIES

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