

RUSS, AUGUST & KABAT

1 **RUSS AUGUST & KABAT**
 2 Marc A. Fenster, CA SBN 181067
 3 mfenster@raklaw.com
 4 Reza Mirzaie, CA SBN 246953
 5 rmirzaie@raklaw.com
 6 Philip X. Wang, CA SBN 262239
 7 pwang@raklaw.com
 8 Kent N. Shum, CA SBN 259189
 9 kshum@raklaw.com
 10 Christian Conkle, CA SBN 306374
 11 cconkle@raklaw.com
 12 Minna Y. Chan, CA SBN 305941
 13 mchan@raklaw.com
 14 12424 Wilshire Boulevard, 12th Floor
 15 Los Angeles, California 90025
 16 Tele: 310/826-7474
 17 Fax: 310/826-6991

18 *Attorneys for Plaintiff*
 19 XR Communications, LLC
 20 dba Vivato Technologies

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

23 XR COMMUNICATIONS, LLC, dba
 24 VIVATO TECHNOLOGIES,

Case No. 3:18-cv-2736

Plaintiff,

**COMPLAINT FOR PATENT
 INFRINGEMENT**

v.

ARRIS SOLUTIONS, INC.,

Defendant.

RUSS, AUGUST & KABAT

1 **I. JURISDICTION**

2 1. This is an action for patent infringement. This Court has subject matter
3 jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises
4 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 under
8 the laws of Delaware with its principal place of business at 444 S. Cedros Ave.,
9 Solana Beach, CA 92075.

10 3. Arris Solutions, Inc. (“Arris” or “Defendant”) is a corporation
11 organized and existing under the laws of Delaware with its principal place of
12 business at 3871 Lakefield Dr., Suwanee, GA, 30024. Upon information and belief,
13 Arris has an office in this District located at 2450 Walsh Avenue, Santa Clara, CA
14 95051.

15 4. This Court has personal jurisdiction over Defendant because Defendant
16 has committed acts within this District giving rise to this action and has established
17 minimum contacts with this forum such that the exercise of jurisdiction over
18 Defendant would not offend traditional notions of fair play and substantial justice.
19 Defendant, directly and through subsidiaries or intermediaries, has committed and
20 continues to commit acts of infringement in this District by, among other things,
21 offering to sell and selling products and/or services that infringe the asserted patents.

22 5. Venue is proper in this federal district pursuant to 28 U.S.C. § 1400(b)
23 because at the time of this action’s filing, Defendant has committed acts of
24 infringement in this District and has a regular and established place of business in
25 this District. Defendant sells and offers to sell its infringing devices, for example,
26 the SBG7400AC2 SURFboard Cable Modem & Wi-Fi Router with McAfee (“the
27 SURFboard SBG7400AC2”), to customers in this District directly, as well as
28 through resellers and distributors. For example, Defendant sells the SURFboard

1 SBG7400AC2 to customers located in this District through the website
2 Amazon.com. Further, Defendant has a physical office in this District located in
3 Santa Clara, CA, as indicated above. Upon information and belief, Defendant has
4 numerous agents or employees that reside in this District, regularly work in this
5 District including at the Santa Clara office, and conduct business in this District.

6 **III. BACKGROUND OF THE TECHNOLOGY**

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

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

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

25 **IV. COUNT ONE: INFRINGEMENT OF UNITED STATES** 26 **PATENT NO. 7,062,296**

27 9. On June 13, 2006, United States Patent No. 7,062,296 ("the '296
28 Patent") was duly and legally issued for inventions entitled "Forced Beam Switching

1 in Wireless Communication Systems Having Smart Antennas.” Vivato owns the
2 ’296 Patent and holds the right to sue and recover damages for infringement thereof.
3 A copy of the ’296 Patent is attached hereto as Exhibit A.

4 10. Defendant has directly infringed and continues to directly infringe
5 numerous claims of the ’296 Patent, including at least claim 33, by manufacturing,
6 using, selling, offering to sell, and/or importing into the United States Wi-Fi access
7 points and routers supporting MU-MIMO, including without limitation access points
8 and routers utilizing the IEEE 802.11ac-2013 standard (e.g. Defendant’s
9 SBG7400AC2 SURFboard Cable Modem & Wi-Fi Router with McAfee,
10 SBG6950AC2 SURFboard Cable Modem & Wi-Fi Router with McAfee, and
11 ARRIS Touchstone cable modem models TG3452, TG3442, TG3442S/CE,
12 DG3450, and DG3440) (collectively the “Accused Products”). Defendant is liable
13 for infringement of the ’296 Patent pursuant to 35 U.S.C. § 271(a).

14 11. Each of the Accused Products comprises an apparatus for use in a
15 wireless communication system. For example, the SURFboard SBG7400AC2 is an
16 apparatus for use in a wireless communication system.

17 12. Each of the Accused Products comprises at least one smart antenna. For
18 example, the SURFboard SBG7400AC2 has at least one smart antenna.

19 13. Each of the Accused Products comprises at least one transceiver
20 operatively coupled to said smart antenna and configured to send and receive
21 electromagnetic signals using said smart antenna. For example, the SURFboard
22 SBG7400AC2 has a Wi-Fi radio coupled to the smart antenna to send and receive
23 signals. *See, e.g.*, IEEE 802.11ac-2013 (“802.11ac Standard”) Clauses 22.3.4.5(j),
24 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)
25 (“Analog and RF: Up-convert the resulting complex baseband waveform associated
26 with each transmit chain to an RF signal according to the center frequency of the
27 desired channel and transmit.”); *id.* Clauses 22.3.7.4, 22.3.8; *id.* Clause 22.3.3 and
28 Figure 22-7:

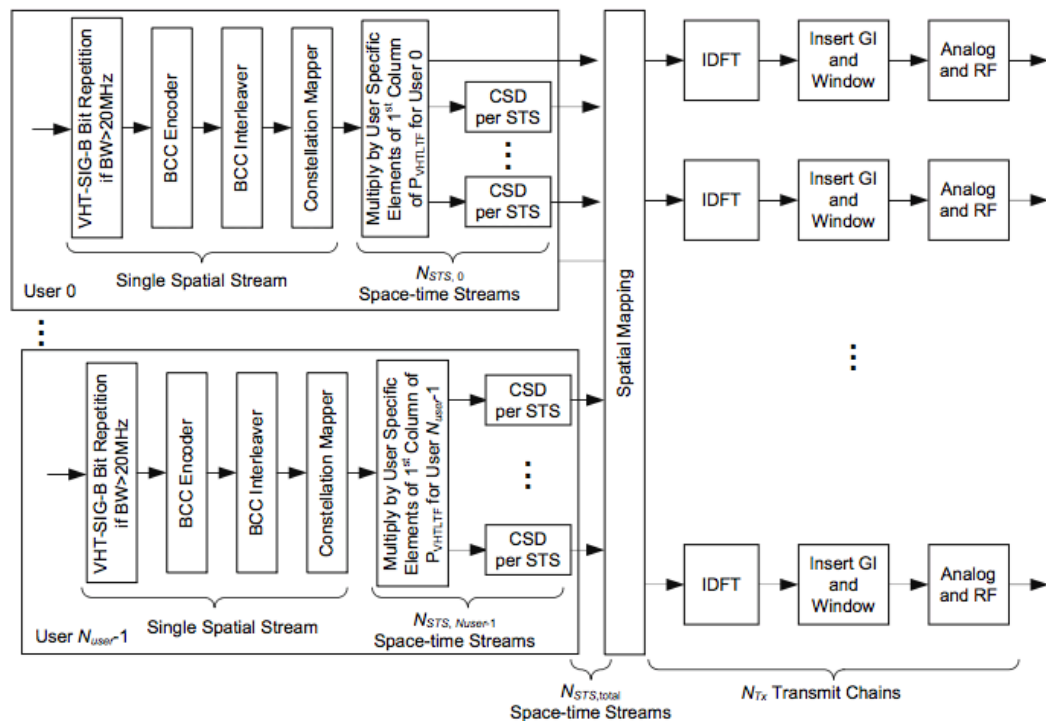


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

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 SURFboard SBG7400AC2 allows a client device to operatively associate with a beam downlink transmittable to that client device using the smart antenna. *See, e.g.*, 802.11ac Standard Clause 8.5.23.3 (“The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs. The Action field of a Group ID Management frame contains the information shown in Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if the STA is not a member

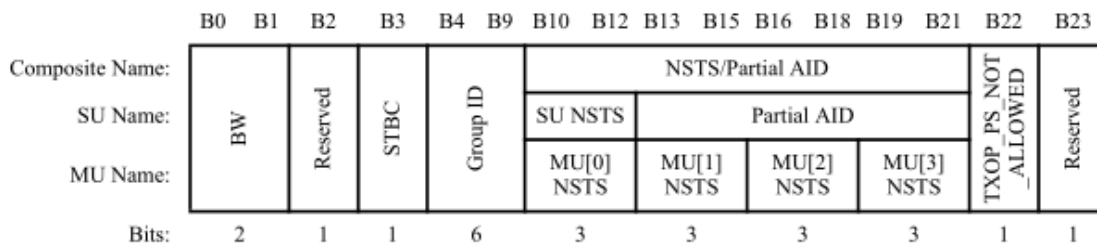
RUSS, AUGUST & KABAT

1 of the group — Set to 1 if STA is a member of the group The Membership Status
 2 subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU
 3 transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field
 4 is used in the Group ID Management frame (see 8.5.23.3). The length of the field is
 5 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists
 6 of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-
 7 80g. * * * If the Membership Status subfield for a particular group ID is 1, then the
 8 corresponding User Position subfield is encoded as shown in Table 8-531.”); *id.*
 9 Table 8-531:

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

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

11
 12
 13
 14
 15
 16
 17 *Id.* Clause 22.3.8.3.3 (“The VHT-SIG-A field carries information required to
 18 interpret VHT PPDU. The structure of the VHT-SIG-A field for the first part (VHT-
 19 SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown
 20 in Figure 22-19.”); *id.* Figure 22-18:



21
 22
 23
 24
 25 **Figure 22-18—VHT-SIG-A1 structure**

26 *Id.* Clause 22.3.11.4:

27 ///

28 ///

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

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

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

1 *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e),
 2 22.3.4.8(l), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply
 3 the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses 22.3.10.11.1, 22.3.11.2;
 4 IEEE 802.11-2012 Clause 20.3.12.3.6.

5 15. Each of the Accused Products comprises logic configured to determine
 6 information from at least one uplink transmission receivable from said second device
 7 through said smart antenna. For example, the SURFboard SBG7400AC2 determines
 8 information from a VHT Compressed Beamforming frame received from a client
 9 device through its smart antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24,
 10 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE 802.11-2012 Clause 20.3.12.3.6.

11 16. Each of the Accused Products comprises logic configured to determine
 12 if said associated second device should operatively associate with a different beam
 13 downlink transmittable using said smart antenna based on said determined
 14 information. For example, the SURFboard SBG7400AC2 determines, based on the
 15 information received in a VHT Compressed Beamforming frame, if the client device
 16 should operatively associate with a different beam downlink transmittable using the
 17 smart antenna. *See, e.g.*, 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2,
 18 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.2:

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

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

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

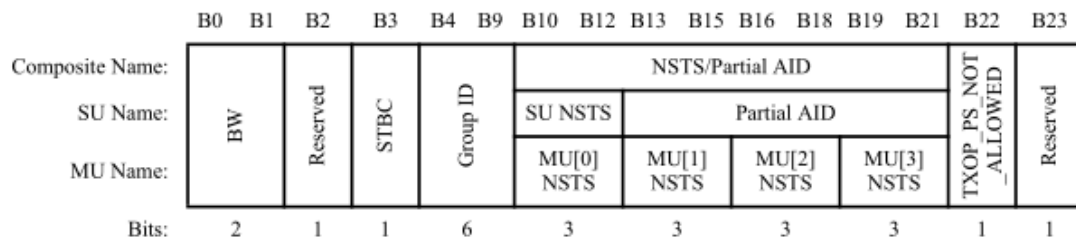
1 17. Each of the Accused Products comprises logic configured to allow said
2 second device to operatively associate with said different beam if said associated
3 second device should operatively associate with a different beam and selectively
4 identify that said second device is not allowed to operatively associate with said
5 beam. For example, the SURFboard SBG7400AC2 allows a client device to
6 operatively associate with a beam that is different from the beam with which the
7 client was associated previously, and to identify that the client device is not allowed
8 to operatively associate with the prior beam. *See, e.g.*, 802.11ac Standard Clause
9 10.40 (“An AP determines the possible combinations of STAs that can be addressed
10 by a VHT MU PPDU by assigning STAs to groups and to specific user positions
11 within those groups. Assignments or changes of user positions corresponding to one
12 or more Group IDs shall be performed using a Group ID Management frame defined
13 in 8.5.23.3...A VHT MU PPDU shall be transmitted to a STA based on the content
14 of the Group ID Management frame most recently transmitted to the STA and for
15 which an acknowledgement was received.”); *id.* Clause 8.5.23.3 (“The Group ID
16 Management frame is an Action frame of category VHT. It is transmitted by the AP
17 to assign or change the user position of a STA for one or more group IDs. The Action
18 field of a Group ID Management frame contains the information shown in Table 8-
19 281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used in the
20 Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An
21 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit
22 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f.
23 * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status
24 subfield for each group ID is set as follows: — Set to 0 if the STA is not a member
25 of the group — Set to 1 if STA is a member of the group The Membership Status
26 subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU
27 transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field
28 is used in the Group ID Management frame (see 8.5.23.3). The length of the field is

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

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

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

7
8
9
10
11
12 *Id.* Clause 22.3.8.3.3 (“The VHT-SIG-A field carries information required to
 13 interpret VHT PPDU. The structure of the VHT-SIG-A field for the first part (VHT-
 14 SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown
 15 in Figure 22-19.”); *id.* Figure 22-18:



17
18
19
20 **Figure 22-18—VHT-SIG-A1 structure**

21 *Id.* Clause 22.3.11.4:

22 When a STA receives a VHT MU PDU where the Group ID field in VHT-SIG-A has the value k and where
 23 MembershipStatusInGroupID[k] is equal to 1, then the number of space-time streams for that STA is
 24 indicated in the MU[UserPositionInGroupID[k]] NSTS field in VHT-SIG-A. The space-time streams of
 25 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.

26 A STA is also able to identify the space-time streams intended for other STAs that act as interference. VHT-
 27 LTF symbols in the VHT MU PDU are used to measure the channel for the space-time streams intended
 28 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 from
7 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 NDP
12 Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer
13 shall include in the VHT NDP Announcement frame one STA Info field for each
14 VHT beamformee that is expected to prepare VHT Compressed Beamforming
15 feedback and shall identify the VHT beamformee by including the VHT
16 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 transmit
19 its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming
20 Report Poll with RA matching its MAC address and a non-bandwidth signaling TA
21 obtained from the TA field matching the MAC address of the VHT beamformer.”);
22 *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e),
23 22.3.4.8(l), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply
24 the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses 22.3.10.11.1, 22.3.11.2;
25 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 customers
2 who use, sell, or offer for sale the Accused Products).

3 19. By at least the filing and service of the complaint in the case *XR*
4 *Communications, LLC d/b/a Vivato Technologies v. ARRIS International plc, et al.*,
5 No. 8:18-cv-00192-AG(JDEx) (C.D. Cal.), Defendant had, at least as early as
6 February 5, 2018, knowledge of the '296 Patent, and that its actions resulted in a
7 direct infringement of the '296 Patent. As explained below, Defendant likely had
8 knowledge of the '296 Patent at least as early as December 1, 2017, or May 3, 2017.
9 Defendant also knew or was willfully blind that its actions would induce direct
10 infringement by others and intended that its actions would induce direct
11 infringement by others.

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

1 infringement.

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

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

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

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

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

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

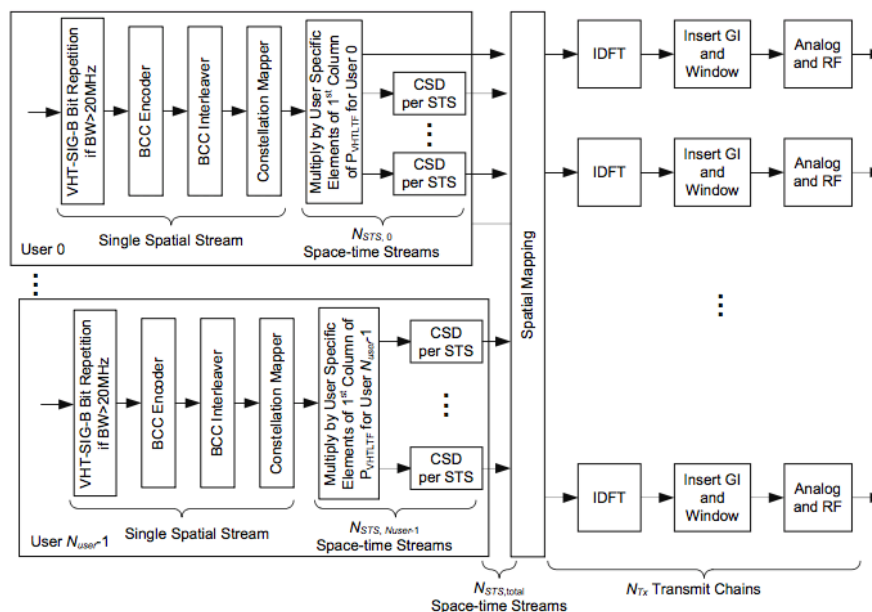
19 26. On June 1, 2010, United States Patent No. 7,729,728 ("the '728
20 Patent") was duly and legally issued for inventions entitled "Forced Beam Switching
21 in Wireless Communication Systems Having Smart Antennas." Vivato owns the
22 '728 Patent and holds the right to sue and recover damages for infringement thereof.
23 A copy of the '728 Patent is attached hereto as Exhibit B.

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

1 28. Each of the Accused Products comprises a wireless communication
 2 system. For example, the SURFboard SBG7400AC2 is a wireless access point for
 3 use in a Wi-Fi network.

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.

7 30. Each of the Accused Products comprises a transceiver operatively
 8 coupled to the phased array antenna and configured to send and receive
 9 electromagnetic signals via the phased array antenna. For example, the SURFboard
 10 SBG7400AC2 has a Wi-Fi radio that is configured to send and receive
 11 electromagnetic signals via the phased array antenna. *See, e.g.,* 802.11ac Standard
 12 Clauses 22.3.4.5(j), 22.3.4.6(g), 22.3.4.7(h), 22.3.4.8(p), 22.3.4.9.1(q),
 13 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex
 14 baseband waveform associated with each transmit chain to an RF signal according
 15 to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,
 16 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:



17
18
19
20
21
22
23
24
25
26
27
28
 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 31. Each of the Accused Products comprises an access point that includes
2 the phased array antenna and the transceiver. For example, the SURFboard
3 SBG7400AC2 comprises an access point that includes a phased antenna array and a
4 Wi-Fi radio.

5 32. Each of the Accused Products comprises an access point that includes
6 the phased array antenna and the transceiver that is configured to selectively allow
7 a receiving device to operatively associate with a beam downlink transmitted to the
8 receiving device via the phased array antenna. *See, e.g.*, 802.11ac Standard Clause
9 8.5.23.3 (“The Group ID Management frame is an Action frame of category VHT.
10 It is transmitted by the AP to assign or change the user position of a STA for one or
11 more group IDs. The Action field of a Group ID Management frame contains the
12 information shown in Table 8-281aj”); *id.* Clause 8.4.1.51 (“The Membership Status
13 Array field is used in the Group ID Management frame (see 8.5.23.3). The length of
14 the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group
15 ID) consists of a 1-bit Membership Status subfield for each of the 64 group IDs, as
16 shown in Figure 8-80f. * * * Within the 8 octet Membership Status Array field, the
17 1-bit Membership Status subfield for each group ID is set as follows: — Set to 0 if
18 the STA is not a member of the group — Set to 1 if STA is a member of the group
19 The Membership Status subfields for group ID 0 (transmissions to AP) and group
20 ID 63 (downlink SU transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User
21 Position Array field is used in the Group ID Management frame (see 8.5.23.3). The
22 length of the field is 16 octets. A 16 octet User Position Array field (indexed by the
23 Group ID) consists of a 2-bit User Position subfield for each of the 64 group IDs, as
24 shown in Figure 8-80g. * * * If the Membership Status subfield for a particular group
25 ID is 1, then the corresponding User Position subfield is encoded as shown in Table
26 8-531.”); *id.* Table 8-531:

27 ///

28 ///

Table 8-53I—Encoding of User Position subfield

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

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

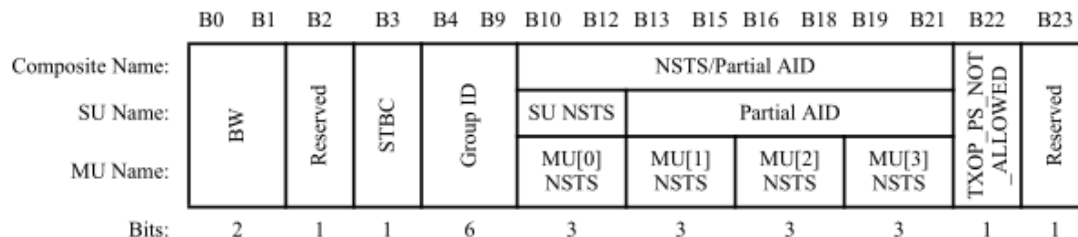


Figure 22-18—VHT-SIG-A1 structure

Id. Clause 22.3.11.4:

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

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

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

1 mechanism is used where the VHT beamformee directly measures the channel from
2 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 NDP
7 Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer
8 shall include in the VHT NDP Announcement frame one STA Info field for each
9 VHT beamformee that is expected to prepare VHT Compressed Beamforming
10 feedback and shall identify the VHT beamformee by including the VHT
11 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 transmit
14 its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming
15 Report Poll with RA matching its MAC address and a non-bandwidth signaling TA
16 obtained from the TA field matching the MAC address of the VHT beamformer.”);
17 *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e),
18 22.3.4.8(l), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply
19 the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses 22.3.10.11.1, 22.3.11.2;
20 IEEE 802.11-2012 Clause 20.3.12.3.6.

21 33. Each of the Accused Products comprises an access point that includes
22 the phased array antenna and the transceiver that is configured to receive an uplink
23 transmission from the receiving device through the phased array antenna. For
24 example, the SURFboard SBG7400AC2 is configured to receive a VHT
25 Compressed Beamforming Feedback frame from a “receiving device” such as a
26 connected laptop or smartphone through its phased-array antenna. *See, e.g.,*
27 802.11ac Standard Clauses 8.4.1.24, 8.4.1.49, 8.5.23.2, 9.31.5.1, 9.31.5.2; IEEE
28 802.11-2012 Clause 20.3.12.3.6.

1 34. Each of the Accused Products comprises an access point that includes
 2 the phased array antenna and the transceiver that is configured to determine from the
 3 uplink transmission if the receiving device should operatively associate with a
 4 different beam downlink transmission. For example, the SURFboard SBG7400AC2
 5 is configured to determine from information contained in the VHT Compressed
 6 Beamforming Feedback frame if the receiving device that sent the VHT Compressed
 7 Beamforming Feedback frame should operatively associate with a different beam
 8 downlink transmission. *See, e.g.*, 802.11ac Standard Clauses 3.2, 8.4.1.24, 8.4.1.49,
 9 8.5.23.2, 9.31.5, 9.31.5.1, 9.31.5.2; *id.* Clause 22.3.11.2:

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

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

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

26 35. Each of the Accused Products comprises an access point that includes
 27 the phased array antenna and the transceiver that is configured to at least one of: (i)
 28 allow the receiving device to operatively associate with the different beam downlink
 if determined that the receiving device should operatively associate with the
 different beam downlink; (ii) force the receiving device to operatively associate with
 the different beam downlink if determined that the receiving device should be
 operatively associated with the different beam downlink. For example, the
 SURFboard SBG7400AC2 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

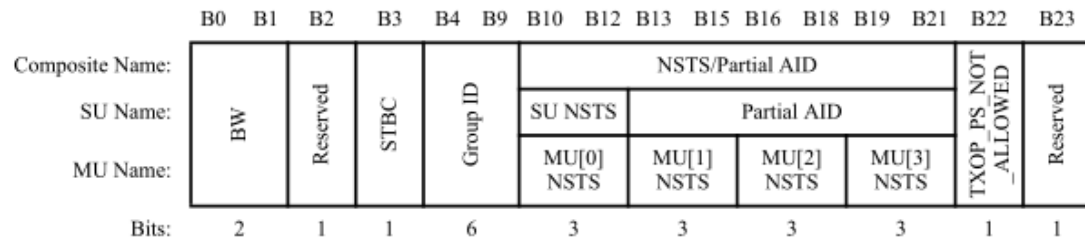
1 the receiving device should operatively associate with the different beam downlink;
2 (ii) force the receiving device to operatively associate with the different beam
3 downlink if determined that the receiving device should be operatively associated
4 with the different beam downlink. *See, e.g.*, 802.11ac Standard Clause 10.40 (“An
5 AP determines the possible combinations of STAs that can be addressed by a VHT
6 MU PPDU by assigning STAs to groups and to specific user positions within those
7 groups. Assignments or changes of user positions corresponding to one or more
8 Group IDs shall be performed using a Group ID Management frame defined in
9 8.5.23.3...A VHT MU PPDU shall be transmitted to a STA based on the content of
10 the Group ID Management frame most recently transmitted to the STA and for which
11 an acknowledgement was received.”); *id.* Clause 8.5.23.3 (“The Group ID
12 Management frame is an Action frame of category VHT. It is transmitted by the AP
13 to assign or change the user position of a STA for one or more group IDs. The Action
14 field of a Group ID Management frame contains the information shown in Table 8-
15 281aj”); *id.* Clause 8.4.1.51 (“The Membership Status Array field is used in the
16 Group ID Management frame (see 8.5.23.3). The length of the field is 8 octets. An
17 8 octet Membership Status Array field (indexed by the group ID) consists of a 1-bit
18 Membership Status subfield for each of the 64 group IDs, as shown in Figure 8-80f.
19 * * * Within the 8 octet Membership Status Array field, the 1-bit Membership Status
20 subfield for each group ID is set as follows: — Set to 0 if the STA is not a member
21 of the group — Set to 1 if STA is a member of the group The Membership Status
22 subfields for group ID 0 (transmissions to AP) and group ID 63 (downlink SU
23 transmissions) are reserved.”); *id.* Clause 8.4.1.52 (“The User Position Array field
24 is used in the Group ID Management frame (see 8.5.23.3). The length of the field is
25 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists
26 of a 2-bit User Position subfield for each of the 64 group IDs, as shown in Figure 8-
27 80g. * * * If the Membership Status subfield for a particular group ID is 1, then the
28 corresponding User Position subfield is encoded as shown in Table 8-53l.”); *id.*

1 Table 8-53l:

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

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

3
4
5
6
7 *Id.* Clause 22.3.8.3.3 (“The VHT-SIG-A field carries information required to
8 interpret VHT PPDU. The structure of the VHT-SIG-A field for the first part (VHT-
9 SIG-A1) is shown in Figure 22-18 and for the second part (VHT-SIG-A2) is shown
10 in Figure 22-19.”); *id.* Figure 22-18:



12
13
14
15 **Figure 22-18—VHT-SIG-A1 structure**

16 *Id.* Clause 22.3.11.4:

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

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

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

1 mechanism is used where the VHT beamformee directly measures the channel from
2 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 NDP
7 Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer
8 shall include in the VHT NDP Announcement frame one STA Info field for each
9 VHT beamformee that is expected to prepare VHT Compressed Beamforming
10 feedback and shall identify the VHT beamformee by including the VHT
11 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 transmit
14 its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming
15 Report Poll with RA matching its MAC address and a non-bandwidth signaling TA
16 obtained from the TA field matching the MAC address of the VHT beamformer.”);
17 *id.* Clauses 8.5.23.2, 8.4.1.48, 8.4.1.49; *id.* Clauses 22.3.4.6(d), 22.3.4.7(e),
18 22.3.4.8(l), 22.3.4.9.1(m), 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply
19 the Q matrix as described in 22.3.10.11.1.”); *id.* Clauses 22.3.10.11.1, 22.3.11.2;
20 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, and
25 gather signal parameter information from uplink transmittable messages received
26 from the receiving device through the phased array antenna. For example, the
27 SURFboard SBG7400AC2 is configured to actively probe the receiving device by
28 generating a signal to initiate that the phased array antenna transmit a signal, e.g. a

1 VHT null data packet announcement frame over the beam downlinks, and to gather
2 signal parameter information from uplink transmittable messages received from the
3 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.”); *id.*
12 (“A non-AP VHT beamformee that receives a VHT NDP Announcement frame...
13 shall transmit its VHT Compressed Beamforming feedback a SIFS after receiving a
14 Beamforming Report Poll with RA matching its MAC address and a non-bandwidth
15 signaling TA obtained from the TA field matching the MAC address of the VHT
16 beamformer.”); *id.* Clause 8.4.1.24; IEEE 802.11-2012 Clause 20.3.12.3.6; 802.11ac
17 Standard Clause 8.5.23.2 (defining format and subfields within the VHT
18 Compressed Beamforming frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-
19 (h)) (“Each SNR value per tone in stream i (before being averaged) corresponds to
20 the SNR associated with the column i of the beamforming feedback matrix V
21 determined at the beamformee”); *id.* Clause 8.4.1.49 (including Table 8-53i – MU
22 Exclusive Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1,
23 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 customers
28 who use, sell, or offer for sale the Accused Products).

1 38. By at least the filing and service of the complaint in the case *XR*
2 *Communications, LLC d/b/a Vivato Technologies v. ARRIS International plc, et al.*,
3 No. 8:18-cv-00192-AG(JDEx) (C.D. Cal.), Defendant had, at least as early as
4 February 5, 2018, knowledge of the '728 Patent, and that its actions resulted in a
5 direct infringement of the '728 Patent. As explained below, Defendant likely had
6 knowledge of the '728 Patent at least as early as December 1, 2017, or May 3, 2017.
7 Defendant also knew or was willfully blind that its actions would induce direct
8 infringement by others and intended that its actions would induce direct
9 infringement by others.

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

28 ///

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

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

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

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

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

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

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

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

1 47. Each of the Accused Products comprises an apparatus for use in a
2 wireless routing network. For example, the SURFboard SBG7400AC2 is an
3 apparatus for use in a wireless routing network.

4 48. Each of the Accused Products comprises an adaptive antenna. For
5 example, the SURFboard SBG7400AC2 has at least one adaptive antenna. *See, e.g.:*
6 802.11ac Standard Clause 8.4.2.58.6, Table 8-128:

7 **8.4.2.58.6 Transmit Beamforming Capabilities**

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

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

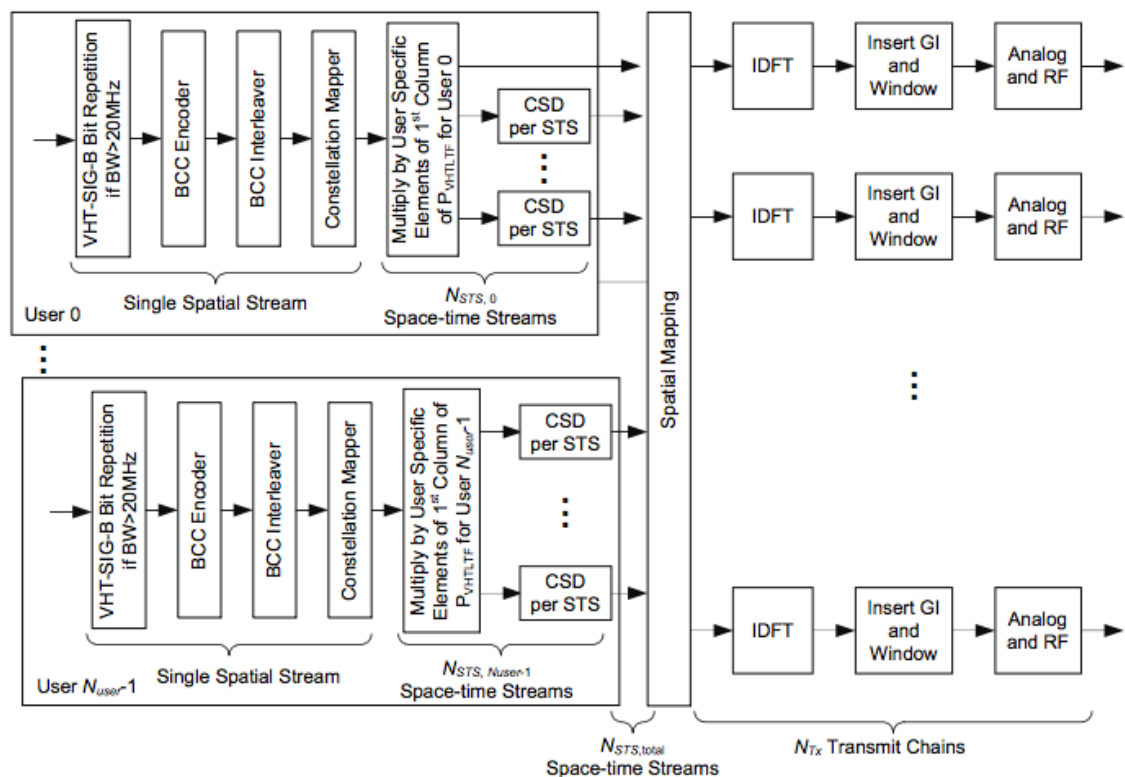
Subfield	Definition	Encoding
CSI Number of Beamformer Antennas Supported	Indicates the maximum number of beamformer antennas the HT beamformee can support when CSI feedback is required	Set to 0 for single Tx antenna sounding Set to 1 for 2 Tx antenna sounding Set to 2 for 3 Tx antenna sounding Set to 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

10
11
12
13
14
15
16
17
18
19
20
21 90

Copyright © 2013 IEEE. All rights reserved.

22 49. Each of the Accused Products comprises at least one transmitter
23 operatively coupled to said adaptive antenna and at least one receiver operatively
24 coupled to said adaptive antenna. For example, the SURFboard SBG7400AC2 has
25 a Wi-Fi radio operatively coupled to the adaptive antenna. *See, e.g.,* 802.11ac
26 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),
27 22.3.4.9.2(q), 22.3.4.10.4(e) (“Analog and RF: Up-convert the resulting complex
28 baseband waveform associated with each transmit chain to an RF signal according

1 to the center frequency of the desired channel and transmit.”); *id.* Clauses 22.3.7.4,
 2 22.3.8; *id.* Clause 22.3.3 and Figure 22-7:



3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

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 SURFboard SBG7400AC2 is configured to output at least one transmission signal to said adaptive antenna. For a further example, the SURFboard SBG7400AC2 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

1 routing information. *See, e.g.*, 802.11ac Standard Clause 9.31.5.1 (“Transmit
 2 beamforming and DL-MU-MIMO require knowledge of the channel state to
 3 compute a steering matrix that is applied to the transmitted signal to optimize
 4 reception at one or more receivers. The STA transmitting using the steering matrix
 5 is called the VHT beamformer and a STA for which reception is optimized is called
 6 a VHT beamformee. An explicit feedback mechanism is used where the VHT
 7 beamformee directly measures the channel from the training symbols transmitted by
 8 the VHT beamformer and sends back a transformed estimate of the channel state to
 9 the VHT beamformer. The VHT beamformer then uses this estimate, perhaps
 10 combining estimates from multiple VHT beamformees, to derive the steering
 11 matrix.”); *id.* Clauses 22.3.4.6(d), 22.3.4.7(e), 22.3.4.8(l), 22.3.4.9.1(m),
 12 22.3.4.9.2(m), 22.3.4.10.4(a) (“Spatial mapping: Apply the Q matrix as described in
 13 22.3.10.11.1.”); *id.* Clause 22.3.10.11.1; IEEE 802.11-2012 Standard Clause
 14 20.3.12.3.6; 802.11ac Standard Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.* Clause
 15 22.3.11.1:

16
 17 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
 18 beamformer using the beamforming feedback matrices for subcarrier k from beamformee u , $V_{k,u}$, and SNR
 19 information for subcarrier k from beamformee u , $SNR_{k,u}$, where $u = 0, 1, \dots, N_{user} - 1$. The steering matrix
 20 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).

21 ///

22 ///

23 ///

24 ///

25 ///

26 ///

27 ///

28 ///

1 *Id.* Clause 22.3.11.2:

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

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

8 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
 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
 10 between participating beamformees. The method used by the beamformer to calculate the steering matrix Q_k
 is implementation specific.

11 51. Each of the Accused Products comprises search receiver logic
 12 operatively coupled to said control logic and said at least one receiver and configured
 13 to update said routing information based at least in part on cross-correlated signal
 14 information that is received by said receiver using said adaptive antenna. For
 15 example, the SURFboard SBG7400AC2 updates the routing information based at
 16 least in part on cross-correlated signal information received in a VHT Compressed
 17 Beamforming frame. *See, e.g.*, 802.11ac Standard Clause 9.31.5.2 (“A VHT
 18 beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP
 19 Announcement frame followed by a VHT NDP after a SIFS. The VHT beamformer
 20 shall include in the VHT NDP Announcement frame one STA Info field for each
 21 VHT beamformee that is expected to prepare VHT Compressed Beamforming
 22 feedback and shall identify the VHT beamformee by including the VHT
 23 beamformee’s AID in the AID subfield of the STA Info field. The VHT NDP
 24 Announcement frame shall include at least one STA Info field.”); *id.* (“A non-AP
 25 VHT beamformee that receives a VHT NDP Announcement frame... shall transmit
 26 its VHT Compressed Beamforming feedback a SIFS after receiving a Beamforming
 27 Report Poll with RA matching its MAC address and a non-bandwidth signaling TA
 28 obtained from the TA field matching the MAC address of the VHT beamformer.”);

1 *id.* Clause 8.5.23.2 (defining format and subfields within the VHT Compressed
 2 Beamforming frame); *id.* Clause 8.4.1.48 (including Tables 8-53(d)-(h)) (“Each
 3 SNR value per tone in stream i (before being averaged) corresponds to the SNR
 4 associated with the column i of the beamforming feedback matrix V determined at
 5 the beamformee”); *id.* Clause 8.4.1.49 (including Table 8-53i – MU Exclusive
 6 Beamforming Report information); *id.* Clauses 8.4.1.24, 9.31.5.1, 9.31.5.2; *id.*
 7 Clause 22.3.8.3.5; *id.* Clause 22.3.11.2:

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

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

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

24 52. Defendant has been and is now indirectly infringing at least one claim
 25 of the '231 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 customers
 28 who use, sell, or offer for sale the Accused Products).

 53. By at least the filing and service of the complaint in the case *XR*
Communications, LLC d/b/a Vivato Technologies v. ARRIS International plc, et al.,
 No. 8:18-cv-00192-AG(JDEx) (C.D. Cal.), Defendant had, at least as early as
 February 5, 2018, knowledge of the '231 Patent, and that its actions resulted in a
 direct infringement of the '231 Patent. As explained below, Defendant likely had
 knowledge of the '231 Patent at least as early as December 1, 2017, or May 3, 2017.
 Defendant also knew or was willfully blind that its actions would induce direct

1 infringement by others and intended that its actions would induce direct
2 infringement by others.

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

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

27 ///

28 ///

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

4 57. The '231 Patent is valid and enforceable.

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

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

10 **VII. WILLFUL INFRINGEMENT**

11 60. By at least the filing and service of the complaint in the case *XR*
12 *Communications, LLC d/b/a Vivato Technologies v. ARRIS International plc, et al.*,
13 No. 8:18-cv-00192-AG(JDEx) (C.D. Cal.), Defendant had, at least as early as
14 February 5, 2018, knowledge of the '296 Patent, and that its actions resulted in a
15 direct infringement of the '296 Patent. Alternatively, Defendant has knowledge of
16 the patents-in-suit at least as early as December 1, 2017, through the acquisition, and
17 related due diligence activities, of Ruckus Wireless, Inc. ("Ruckus") by Arris's
18 parent company, Arris International plc. ("AIP").

19 61. Specifically, on April 19, 2017, Vivato filed a lawsuit against Ruckus
20 Wireless: *XR Communications, LLC d/b/a Vivato Technologies v. Ruckus Wireless,*
21 *Inc.*, No. 2:17-cv-02961-AG(JDEx) (C.D. Cal.) (the "Ruckus lawsuit"). Ruckus was
22 served with the lawsuit on May 3, 2017. The patents asserted in the Ruckus lawsuit
23 are the same three patents asserted in this complaint. Further, the Ruckus lawsuit
24 alleges infringement by Ruckus's Wi-Fi access-point products, which have many
25 similar features and capabilities as Arris's infringing Wi-Fi access-point products
26 identified in this complaint. In February 2017, AIP announced its intention to acquire
27 Ruckus from its parent company, Brocade Communications Systems, Inc.
28 ("Brocade"). On December 1, 2017, AIP finalized its acquisition of Ruckus.

1 62. Accordingly, a reasonable inference is that Defendant had knowledge
2 of the patents-in-suit, and its issued claims, by at least as early as December 1, 2017,
3 and likely at least as early as May 3, 2017, the service of the Ruckus complaint,
4 because AIP and Arris, through conducting their due diligence for the Ruckus
5 acquisition, had likely obtained knowledge of the Ruckus lawsuit and the patents-
6 in-suit. Similarly, Defendant likely also obtained knowledge of the patents-in-suit
7 because Brocade and Ruckus had an obligation to notify AIP and Arris of any
8 pending lawsuits, and they likely notified AIP and Arris of the Ruckus lawsuit on or
9 about May 3, 2017.

10 63. Therefore, Defendant knew, or should have known, about Plaintiff's
11 '231, '296 and '728 Patents, at least as early as December 1, 2017, and likely at least
12 as early as May 3, 2017.

13 64. Despite such knowledge, Defendant infringed and continues to infringe
14 the patents-in-suit with full and complete knowledge of their applicability to
15 Defendant's MU-MIMO products without taking a license and without a good faith
16 belief that the patents-in-suit are invalid and not infringed. Defendant's infringement
17 of the patents-in-suit occurred, and continues to occur, with knowledge of
18 infringement and/or objective recklessness. Defendant's infringement was, and
19 continues to be, willful and deliberate. For example, Defendant sold, and continues
20 to sell its Accused Products (e.g., its SURFboard SBG7400AC2 on Amazon.com)
21 to customers despite Defendant's knowledge of the patents-in-suit. Defendant also
22 manufactured and imported into the United States, and continues to do so, the
23 Accused Products for sale and distribution to its customers, despite its knowledge of
24 the patents-in-suit.

25 65. Defendant also actively induced, and continues to induce, its customers
26 to infringe the patents-in-suit by, among other things, providing user manuals and
27 other instruction material for its Accused Products that induce its customers to use
28 the Accused Products in their normal and customary way to infringe the patents-in-

1 suit. For example, Defendant's website provided, and continues to provide,
2 instructions for using the Accused Products on wireless communication systems, and
3 to utilize their beamforming and MU-MIMO functionalities. Through its continued
4 manufacture, importation, and sales of its Accused Products, Defendant specifically
5 intended, and continues to intend, for its customers to infringe claims of the patents-
6 in-suit, despite Defendant's knowledge of the patents-in-suit.

7 66. Defendant's infringement of the patents-in-suit is egregious because
8 despite its knowledge of the patents-in-suit, Defendant deliberately copied the
9 innovation claimed in the patents-in-suit and implemented that patented innovation
10 in its Accused Products. Further, despite Defendant's knowledge of the patents-in-
11 suit, Defendant sold, offered for sale, manufactured, and imported, the Accused
12 Products—and continues to do so—without investigating the scope of the patents-
13 in-suit and without forming a good-faith belief that its Accused Products do not
14 infringe or that the patents-in-suit are invalid. Defendant has not taken any steps to
15 remedy its infringement of the patents-in-suit (e.g., by removing the Accused
16 Products from its sales channels); but instead, continues to sell its Accused Products
17 to customers, such as its continued sale of its SURFboard SBG7400AC2 on
18 Amazon.com. Defendant's behavior is egregious because it engaged in misconduct
19 beyond that of typical infringement. For example, in a typical infringement, an
20 infringer would investigate the scope of the asserted patents and develop a good-
21 faith belief that it does not infringe the asserted patents or that the asserted patents
22 are invalid before selling (or continuing to sell) its accused products. An infringer
23 would also remove its accused products from its sales channels and discontinue
24 further sales.

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

28 ///

Attorneys for Plaintiff
XR COMMUNICATIONS, LLC,
dba VIVATO TECHNOLOGIES

RUSS, AUGUST & KABAT

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28