

LGE 1022

3. Defendant LG Electronics USA, Inc. (“LGUSA”) is a Delaware corporation having a principal place of business at 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey 07632.

4. LG Electronics Alabama, Inc. (“LG Alabama”) is an Alabama corporation having a principal place of business at 201 James Record Road, Huntsville, Alabama, 35824.

5. LGUSA is a wholly owned subsidiary of LGE.

6. LG Alabama is a wholly owned subsidiary of LGUSA.

JURISDICTION AND VENUE

7. This action arises under the Patent Act, 35 U.S.C. § 1 *et seq.*

8. Subject matter jurisdiction is proper in this Court under 28 U.S.C. §§ 1331 and 1338(a).

9. Venue in this District is proper under 28 U.S.C. § 1391(c)(3) and 28 U.S.C. § 1400(b) with respect to LGE.

10. LGE is not a resident of the United States and may be sued in this District because suits against foreign entities are proper in any judicial district where they are subject to personal jurisdiction.

11. Defendant LGE and its subsidiaries have committed acts of patent infringement in this District.

12. Venue in this District is proper under 28 U.S.C. § 1400(b) with respect to LGUSA.

13. Venue in this District is proper under 28 U.S.C. § 1400(b) with respect to LGUSA because LGUSA has committed acts of infringement in this District and has a regular and established place of business in this District.

14. LGUSA supports LGE’s TV business in the United States with local logistics, local sales, repair, and technical support in the United States.

15. LGUSA conducts business in and is doing business in this District and elsewhere in the United States, including, without limitation, using, offering to sell, selling, and/or importing communications devices such as TVs that practice the patented technology, enabling third party distributors and resellers to sell and offer to sell such devices, and enabling end-user purchasers to use such devices in this District.

16. Specifically, LGUSA imports digital televisions with integrated receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points, into the United States and directs that such goods be delivered to a “Buyer-Notify Party” at a “NTX FORT WORTH WH.” *See* Exhibit 8.

17. Furthermore, LGUSA has a regular and established place of business in this District at the “NTX FORT WORTH WH” where it receives the Accused Products upon importing them into the United States from LGE for sale to those in the United States.

18. As the consignee of the goods being imported, LGUSA is the owner of such goods. *See* Exhibit 8.

19. As such, LGUSA’s ownership of the imported Accused Products and repeated direction to deliver such Accused Products, among other goods, to the “NTX FORT WORTH WH” demonstrates that such “NTX FORT WORTH WH” is a regular and established place of business of LGUSA.

20. There is an individual present to receive such goods at the “NTX FORT WORTH WH” either as an employee of LGUSA or as LGUSA’s agent conducting LGUSA’s business in this District.

21. The “NTX FORT WORTH WH” is an LG branded building located in this District at 14901 North Beach Street, Fort Worth, Texas, 76177. *See* Exhibit 9.

22. Accordingly, venue is proper in this District as to LGUSA under 28 U.S.C. § 1400(b).

23. Venue in this District is proper under 28 U.S.C. § 1400(b) with respect to LG Alabama.

24. Venue in this District is proper under 28 U.S.C. § 1400(b) with respect to LG Alabama because LG Alabama has committed acts of infringement in this District and has a regular and established place of business in this District at 2153 Eagle Parkway, Fort Worth, Texas 76177.

25. LG Alabama supports LGE’s TV business in the United States with local logistics, local sales, repair, and technical support in the United States.

26. LG Alabama conducts business in and is doing business in this District and elsewhere in the United States, including, without limitation, using, offering to sell, selling, and/or importing devices such as TVs that practice the patented technology, enabling third party distributors and resellers to sell and offer to sell such devices, and enabling end-user purchasers to use such devices in this District.

27. This Court has personal jurisdiction over LGE, LGUSA, and LG Alabama.

28. LGE and its subsidiaries, including LGUSA and LG Alabama, have conducted and do conduct business within the State of Texas.

29. LGE and its subsidiaries, directly or through their subsidiaries or intermediaries (including distributors, retailers, and others), ship, distribute, make, use, offer for sale, sell, import, repair and/or advertise (including by providing interactive web pages) products and/or services in the United States and the Eastern District of Texas and/or contribute to and actively induce

customers to ship, distribute, make, use, offer for sale, sell, import, repair and/or advertise (including the provision of interactive web pages) infringing products and/or services in the United States and the Eastern District of Texas.

30. LGE, LGUSA, and LG Alabama directly and through their subsidiaries or intermediaries (including distributors, retailers, and others), have purposefully and voluntarily placed one or more infringing products and/or services, as described below, into the stream of commerce with the expectation that those products will be purchased and used by customers and/or consumers in the Eastern District of Texas.

31. These infringing products and/or services have been and continue to be made, used, sold, offered for sale, purchased, and/or imported by customers and/or consumers in the Eastern District of Texas.

32. LGE and its subsidiaries have also placed the Accused Products into the stream of commerce by shipping Accused Products into the Eastern District of Texas, shipping Accused Products knowing that those products would be shipped into the Eastern District of Texas, and/or shipping Accused Products knowing that these Accused Products would be incorporated into other Accused Products that would be shipped into the Eastern District of Texas. *See, e.g., Progress Report Fall 2020, LG Electronics, ATSC, <https://www.atsc.org/atsc-progress/lg-electronics/>* (“Ushering in the NEXTGEN TV era, ATSC 3.0 co-developer LG Electronics has launched new OLED TV models equipped to receive new services with enhanced content, pictures and sound.”); *LG Introduces ATSC 3.0-Enabled OLED TVs In USA, Ushering In ‘NEXTGEN TV’ Era*, CISION PR Newswire (Jan. 8, 2020, 11:20 a.m.), <https://www.prnewswire.com/news-releases/lg-introduces-atsc-3-0-enabled-oled-tvs-in-usa-ushering-in-nextgen-tv-era-300983627.html>; Phil Kurtz, *LG Electronics to Rollout Six 3.0 TVs This Year in U.S.*, tvtech (Jan. 6, 2020),

<https://www.tvtechnology.com/atsc3/lg-electronics-to-rollout-six-3-0-tvs-this-year-in-u-s>; *LG USA Begins Rollout of 2021 OLED TV Lineup*, LG (Mar. 24, 2021), <https://www.lg.com/us/press-release/lg-usa-begins-rollout-of-2021-oled-tv-lineup> (“LG G1 and ZX OLED TVs are ushering in the NEXTGEN TV era as American broadcasters prepare to launch services this year in 20 more cities with signals reaching the majority of TV viewers in America. NEXTGEN TV, powered by the ATSC 3.0 standard.”).

JOINDER

33. Joinder of Defendants is proper under 35 U.S.C. § 299.

34. The allegations of patent infringement contained herein arise out of the same series of transactions or occurrences relating to the selling, or offering for sale within the United States, the same Accused Products, including receivers configured to utilize non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, unequally spaced constellations and/or the use of infringing methods for the reception of encoded data.

35. Examples of these products include, but are not limited to, the LG OLED77G1PUA, OLED65G1PUA, OLED55G1PUA, OLED77ZXP UA, and OLED88ZXP UA television models, which are or have been manufactured with infringing receivers, which are imported, sold, offered for sale, and/or used in this District.

BACKGROUND OF PATENTED TECHNOLOGY

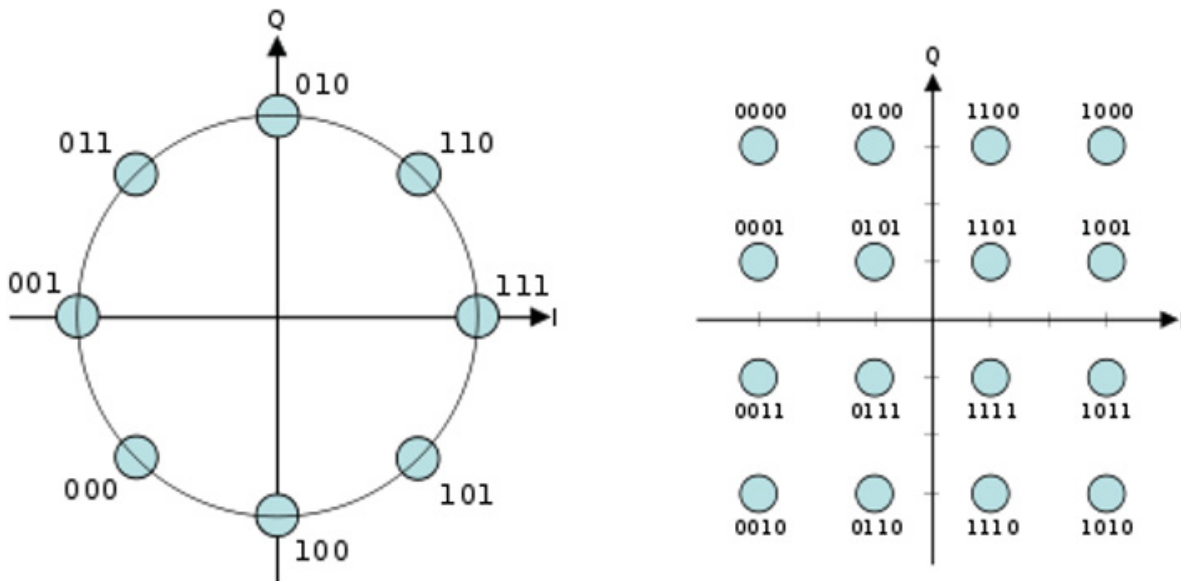
36. Constellation Designs’ breakthrough patented technology improves digital communication systems, allowing efficient over-the-air digital transmission and reception of high-quality audio and video.

37. Constellation Designs’ technology overcomes inherent issues and constraints in previous wireless communication systems, allowing for lower-power and more efficient transmissions.

38. As described in the Asserted Patents, the term “constellation” is used to describe the possible symbols that can be transmitted by a typical digital communication system. *See, e.g.*, U.S. Patent No. 8,842,761 (“the ’761 Patent”) at 1:29–31.

39. Historically, communication systems used traditional “uniform” constellations that maximize the minimum distance between constellation points, because the “most likely to occur” error event will be established by the closest neighbors in a constellation.

40. Uniform constellations that maximize d_{min} are depicted below:



Traditional Uniform Constellations

41. In 2007, while at NASA’s Jet Propulsion Laboratory (“JPL”), inventors Maged Barsoum, Ph.D. and Christopher Jones, Ph.D. developed a technique for achieving “shaping gains” by selecting the location and labelling of the points of any constellation based upon a measure of

mutual information known as Bit-Interleaved Coded Modulation (“BICM”) capacity or “Parallel Decode capacity.”

42. The resulting constellations have non-uniformly spaced points at low SNRs and are therefore often referred to as non-uniform constellations (“NUCs”), e.g., NU-QAM (non-uniform quadrature amplitude modulations).

43. That same year, Drs. Barsoum and Jones filed a provisional patent application, U.S. Appl. No. 60/933,319, to which the Asserted Patents claim priority.

44. Shortly thereafter, the International Institute of Electrical Engineers (“IEEE”) published Drs. Barsoum and Jones’ work in a paper entitled “Constellation Design via Capacity Maximization.” M. F. Barsoum, C. Jones and M. Fitz, “Constellation Design via Capacity Maximization,” *2007 IEEE International Symposium on Information Theory*, pp. 1821–1825 (2007) (attached as Exhibit 10).

45. Drs. Barsoum and Jones’ invention was groundbreaking but counterintuitive as the error rate on the pair of nearest neighbors in a non-uniform constellation will be higher than the error rate on the pair of nearest neighbors in a constellation that maximizes minimum distance.

46. However, a key insight of Drs. Barsoum and Jones was that optimizing constellations for their inherent channel capacity (in particular, their parallel decode, or BICM, capacity), rather than d_{min} , would enable higher overall throughput in a coded system.

47. This is true although some neighboring pairs of points in the proposed Barsoum/Jones constellations would have higher error rates as compared to constellations where d_{min} is optimized, and hence, uniform constellations.

48. This seminal work of Drs. Barsoum and Jones has been recognized as groundbreaking.

49. For example, Constellation Designs' technology has allowed broadcasting companies and consumer electronic device companies to usher in the "NextGen TV" broadcast standard by the Advanced Television Systems Committee ("ATSC"), known as ATSC 3.0.

50. The ATSC approved the ATSC 3.0 physical layer as a Candidate Standard on September 29, 2015. *ATSC 3.0 Physical Layer Elevated to Candidate Standard*, ATSC (Sept. 29, 2015), <https://www.atsc.org/news/atsc-3-0-physical-layer-elevated-to-candidate-standard/>.

51. Samsung described the development of ATSC 3.0 as "the next-generation terrestrial television broadcasting system, which will be the world's first all-Internet Protocol broadcast TV system" which is "intended for use in the United States, South Korea, Canada, Mexico, and any other countries that choose to adopt it." *See ATSC 3.0 Physical Layer Candidate Standard Approved*, Samsung Newsroom U.S. (September 29, 2015), <https://news.samsung.com/us/atsc-3-0-physical-layer-candidate-standard-approved/>.

52. In addition, Samsung highlighted "[t]wo important components" of ATSC 3.0: "low-density parity-check (LDPC)," and "**non-uniform constellation (NUC)**, **a key component** for generating the modulated symbols and optimizing the transmission capacity for all reception conditions." *Id.* (emphasis added).

53. Samsung stated that "[b]oth LDPC and **NUC** will strengthen ATSC 3.0's ability to deliver Ultra High Definition (UHD) and High Dynamic Range (HDR) programming as well as other new broadcast services." *Id.* (emphasis added).

54. Samsung's article quotes Mark Aitken, Vice President of Advanced Technology for Sinclair Broadcast Group, as stating that "ATSC 3.0's adoption of OFDM and cutting-edge enhancements in the physical layer **such as NUC**, combined with the flexibility and extensibility afforded by the previously approved Bootstrap system, means broadcasters are at the forefront of

delivering local content, advertising, and other services that our viewers and partners demand.” *Id.* (emphasis added).

55. In March 2016, Senior Members of IEEE, including engineer Jinwoo Kim of LGE, wrote an article entitled “Non-Uniform Constellations for ATSC 3.0,” in which they state that “ATSC 3.0 will be the first major broadcasting standard, which completely uses **NUCs** due to their **outstanding properties**.” IEEE Transactions on Broadcasting, Vol. 62, No. 1 at 197 (March 2016) (emphasis added) (Attached as Exhibit 11).

56. In that article, the authors describe the history of “[c]onstellation shaping techniques” and acknowledge that “[t]he optimization of constellations in the 1-dimensional space with respect to BICM capacity was **first described** in [] “M. F. Barsoum, C. Jones, and M. Fitz, ‘Constellation Design via Capacity Maximization,’ in *Proc. IEEE Int. Symp. Inf. Theory*, Nice, France, Jun. 2007, pp. 1821–1825.” *Id.* at 197 (emphasis added), 202.

57. According to the article, author and LGE engineer Jinwoo Kim received his B.S.E.E. and M.S.E.E. degrees in Korea, and “[s]ince 2003, he has been with LG Electronics[.]” *Id.* at 203. The article further states that “[h]is research interests include digital communications and signal processing.” *Id.*

58. LG engineer Mr. Kim’s article also states that ATSC constellations are optimized to maximize BICM capacity, as taught by Constellation Designs’ patents. *See, e.g., id.* at 199 (“When optimizing NUCs of a given constellation size m for a transmission system using a BICM chain, we need to maximize the BICM capacity C_B .”).

59. With respect to Fig. 9 (reproduced below), LG engineer Mr. Kim’s article compares the use of the NUC results over traditional uniform constellations (and demonstrates that 50%

more power (1.5x) is required to communicate with a traditional constellation as compared to a capacity optimized NU-QAM).

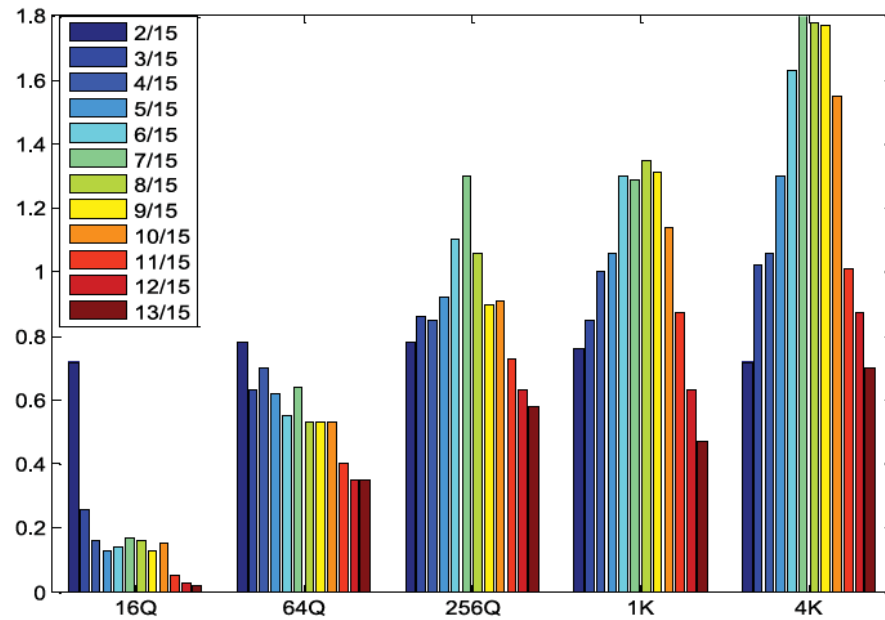


Fig. 9. Performance gains in dB of ATSC3.0 NUCs versus uniform constellations over AWGN channel.

Id. at 202.

60. Also in 2016, ETRI, Huawei, HiSilicon, and Sony proposed adoption of BICM optimized NU-QAM constellations for 5G in 3GPP in separate proposals and encouraged further investigation into non-uniform constellations. *See Exhibits 12–13.*

61. In June 2017, BICM-optimized NU-QAMs were adopted with the finalized ATSC 3.0 A/322 Physical Layer Protocol. *See Exhibit 14.*

62. And in September 2017, the IEEE Task Group AY voted to adopt a capacity optimized NU 64-QAM into IEEE 802.11ay. *See Exhibit 15.*

THE ASSERTED PATENTS

63. Constellation Designs owns all rights, title, and interest to U.S. Patent Nos. 10,567,980, 8,842,761, 10,693,700, 11,019,509, 11,018,922, 9,743,290, and 11,039,324 (collectively, the “Asserted Patents”).

64. The Asserted Patents are each valid and enforceable.

65. Furthermore, when analyzed under the two-step framework set forth in *Alice*, the Asserted Patents are directed to patent-eligible subject matter. *See Alice Corp. Pty. v. CLS Bank Int’l*, 134 S. Ct. 2347, 2354 (2014); *Cf., Mad Dogg Athletics, Inc. v. Peloton Interactive, Inc.*, No. 2:20-CV-00382-JRG, 2021 WL 4206175, at *7 (E.D. Tex. Sept. 15, 2021).

66. The Asserted Patents are directed to improvements in digital communication systems, including the implementation and use of non-uniform constellations, including parallel decode capacity optimized and multi-dimensional constellations, allowing efficient over-the-air digital transmission and reception of high-quality audio and video.

67. Accordingly, the Asserted Patents are not directed to an abstract idea.

68. Moreover, the Asserted Patents contain an inventive concept and the inventions contained therein are not well-understood routine, or conventional.

69. The Asserted Patents describe the fundamental technological shift away from the conventional wisdom of using theoretically optimal uniform constellations that maximize the minimum distance between constellation points to instead focusing on non-uniform spacing of constellation points to increase the amount of information that can be correctly decoded in real-world receivers.

70. This breakthrough technology was invented by Drs. Barsoum and Jones, embraced by the ATSC 3.0 standard, and endorsed by LG engineers themselves.

71. Accordingly, the Asserted Patents are directed to patent-eligible subject matter and

are valid and enforceable.

I. The '980 Patent

72. United States Patent No. 10,567,980 (“the ’980 Patent”), entitled “Methodology and Method and Apparatus for Signaling with Capacity Optimized Constellations,” issued on February 18, 2020, to inventors Maged F. Barsoum and Christopher R. Jones.

73. The ’980 Patent issued from U.S. Patent App. Ser. No. 16/206,991 filed on November 30, 2018.

74. The ’980 Patent claims the benefit of priority to Provisional Application No. 60/933,319 filed June 5, 2007.

75. The ’980 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 050986 / 0586).

76. A copy of the ’980 Patent is attached to this Complaint as Exhibit 1.

II. The '761 Patent

77. United States Patent No. 8,842,761 (“the ’761 Patent”), entitled “Methodology and Method and Apparatus for Signaling with Capacity Optimized Constellations,” issued on September 23, 2014, to inventors Maged F. Barsoum and Christopher R. Jones.

78. The ’761 Patent issued from U.S. Patent App. Ser. No. 13/618,630 filed on September 14, 2012.

79. The ’761 Patent claims the benefit of priority to Provisional Application No. 60/933,319 filed June 5, 2007.

80. The ’761 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 050986 / 0586).

81. A copy of the ’761 Patent is attached to this Complaint as Exhibit 2.

III. The '700 Patent

82. United States Patent No. 10,693,700 (“the ’700 Patent”), entitled “Receivers Incorporating Non-Uniform Multidimensional Constellations and Code Rate Pairs,” issued on June 23, 2020 to inventors Maged F. Barsoum and Christopher R. Jones.

83. The ’700 Patent issued from U.S. Patent App. Ser. No. 16/726,037 filed on December 23, 2019.

84. The ’700 Patent claims the benefit of priority to Provisional Application No. 60/933,319 filed June 5, 2007.

85. The ’700 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 051390 / 0026).

86. A copy of the ’700 Patent is attached to this Complaint as Exhibit 3.

IV. The '509 Patent

87. United States Patent No. 11,019,509 (“the ’509 Patent”), entitled “Receivers Incorporating Non-Uniform Constellations with Overlapping Constellation Point Locations,” issued on May 25, 2021 to inventors Maged F. Barsoum and Christopher R. Jones.

88. The ’509 Patent issued from U.S. Patent App. Ser. No. 16/728,384 filed on December 27, 2019.

89. The ’509 Patent claims the benefit of priority to Provisional Application No. 60/933,319 filed June 5, 2007.

90. The ’509 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 051390 / 0026).

91. A copy of the ’509 Patent is attached to this Complaint as Exhibit 4.

V. The '922 Patent

92. United States Patent No. 11,018,922 (“the ’922 Patent”), entitled “Methods and Apparatuses for Signaling with Geometric Constellations,” issued on May 25, 2021 to inventors Maged F. Barsoum and Christopher R. Jones.

93. The ’922 Patent issued from U.S. Patent App. Ser. No. 16/734,261 filed on January 3, 2020.

94. The ’922 Patent claims the benefit of priority to Provisional Application No. 61/141,662 filed on December 30, 2008 and Provisional Application No. 61/141,935 filed on December 31, 2008.

95. The ’922 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 052458 / 0043).

96. A copy of the ’922 Patent is attached to this Complaint as Exhibit 5.

VI. The '290 Patent

97. United States Patent No. 9,743,290 (“the ’290 Patent”), entitled “Methods and Apparatuses for Signaling with Geometric Constellations in a Raleigh Fading Channel,” issued on August 22, 2017 to inventors Maged F. Barsoum and Christopher R. Jones.

98. The ’290 Patent issued from U.S. Patent App. Ser. No. 14/943,003 filed on November 16, 2015.

99. The ’290 Patent claims the benefit of priority to Provisional Application No. 61/362,649 filed July 8, 2010.

100. The ’290 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 050986 / 0586).

101. A copy of the ’290 Patent is attached to this Complaint as Exhibit 6.

VII. The '324 Patent

102. United States Patent No. 11,039,324 (“the ’324 Patent”), entitled “Methods and Apparatuses for Signaling with Geometric Constellations in Rayleigh Fading Channel,” issued on May 26, 2021 to inventors Maged F. Barsoum and Christopher R. Jones.

103. The ’324 Patent issued from U.S. Patent App. Ser. No. 16/752,332, filed on January 24, 2020.

104. The ’324 Patent claims the benefit of priority to Provisional Application No. 61/362,649 filed July 8, 2010.

105. The ’324 Patent is assigned to Constellation Designs, LLC (*see* Reel Frame No. 052458 / 0101).

106. A copy of the ’324 Patent is attached to this Complaint as Exhibit 7.

ALLEGATIONS OF PATENT INFRINGEMENT

107. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

108. As set forth below, the Accused Products incorporate, without any license from Constellation Designs, receiver technology protected by patents owned by Constellation Designs. Constellation Designs respectfully seeks relief from this Court for Defendants’ infringement.

109. LG Defendants have and continue to make, have made, use, sell, offer for sale, import, have imported, test, design, and/or market in the United States televisions with receivers that comply with the A/322 Physical Layer Protocol of the ATSC 3.0 Standard.

110. The Asserted Patents are directed to technology practiced under the A/322 Physical Layer Protocol of the ATSC 3.0 Standard.

111. LG Defendants have and continue to make, have made, use, sell, offer for sale, import, have imported, test, design, and/or market in the United States televisions with receivers that infringe the Asserted Patents.

112. LG Defendants have directly infringed, and continue to directly infringe, the Asserted Patents under 35 U.S.C. § 271(a) by making, using, selling and/or offering to sell, in this District and elsewhere in the United States, and/or importing into this District and elsewhere in the United States, certain infringing receivers or televisions outfitted with receivers which infringe the Asserted Patents, as further described in detail in Counts I–VII *infra* (collectively, “Accused Products”).

113. LG Defendants have also indirectly infringed, and continue to indirectly infringe, the Asserted Patents under 35 U.S.C. § 271(b) and (c).

114. LG Defendants knew and intended to induce the infringement of the Asserted Patents by customers and/or other third parties.

115. The Accused Products have no substantial non-infringing use.

116. The Accused Products include, but are not limited to, all LG G1 and ZX OLED televisions, and any televisions incorporating a ATSC 3.0-compatible transceiver, receiver, or processor that the LG Defendants have made, used, sold, offered for sale, or imported or indirectly caused or induced another to do any of the same.

117. Plaintiff Constellation Designs reserves the right to accuse any LG products in the disclosure of infringement contentions in this action, and to accuse any forthcoming LG technology not yet commercially available.

118. LG Defendants' acts of infringement have caused damage to Plaintiff. Plaintiff is entitled to recover from LG Defendants the damages incurred by Plaintiff as a result of LG Defendants' wrongful acts.

COUNT I
(Defendants' Infringement of the '980 Patent)

119. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

120. The Defendants have infringed and/or do willfully infringe the '980 Patent.

121. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '980 Patent. The '980 Patent is valid and enforceable.

122. Defendants have directly infringed, and continue to directly infringe, the '980 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '980 Patent including, but not limited to digital receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

123. The products that infringe one or more claims of the '980 Patent include, but are not limited to, at least the Accused Products.

124. Further discovery may reveal additional infringing products and/or models.

125. The Accused Products include all of the limitations of at least Claim 20 of the '980 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

126. Specifically, Claim 20 of the '980 Patent claims a digital communication system comprising: (i) a receiver capable of receiving signals via the communication channel, the receiver

comprising (ii) a demodulator capable of demodulating a signal received via the communication channel; (iii) a demapper capable of estimating likelihoods from the demodulated signal using a symbol constellation; (iv) a decoder that is capable of estimating decoded bits from the likelihoods generated by the demapper; and (v) wherein the symbol constellation is an unequally spaced symbol constellation that is characterizable by assignment of locations and labels of constellation points that maximize parallel decode capacity of the symbol constellation at a given signal-to-noise ratio so that the symbol constellation provides a given capacity at a reduced signal-to-noise ratio compared to a uniform symbol constellation that differs from the symbol constellation only in that the minimum distance, d_{min} , between constellation points of the uniform symbol constellation is maximized. *See* Exhibit 16.

127. Plaintiff Constellation Designs reserves the right to identify any other claims of the '980 Patent in the disclosure of infringement contentions in this action.

128. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

129. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See* Exhibit 17.

130. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See* Exhibit 18.

131. Accordingly, Defendants have had knowledge of the '980 Patent family since at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

132. At a minimum, Defendants' have had knowledge of the '980 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

133. As such, Defendants' infringement of the '980 Patent has been and is willful.

134. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

135. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O'Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech (May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0's Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

136. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

137. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

138. As such, Defendants indirectly infringe the '980 Patent by inducing infringement by others, such as broadcast networks.

139. Defendants also indirectly infringe the '980 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

140. Defendants took the above actions intending to cause infringing acts by others.

141. Defendants received actual notice of its infringement of the '980 Patent at least as early as the date of service of this Complaint.

142. Therefore, Defendants were or are now aware of the '980 Patent or has willfully blinded itself as to the existence of the '980 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '980 Patent at all times relevant to this suit.

143. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '980 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

144. Defendants therefore infringe the '980 Patent under 35 U.S.C. § 271(b).

145. Defendants indirectly infringe the '980 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '980 Patent, and that are used to practice one or more processes/methods covered by the claims of the '980 Patent.

146. Defendants' end-user customers directly infringe the '980 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including

receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

147. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '980 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

148. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the '980 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same. Defendants therefore infringe the '980 Patent under 35 U.S.C. § 271(c).

149. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '980 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

150. Defendants' continued infringement of the '980 Patent has damaged and will continue to damage Plaintiff.

151. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT II
(Defendants' Infringement of the '761 Patent)

152. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

153. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '761 Patent. The '761 Patent is valid and enforceable.

154. Defendants have directly infringed, and continue to directly infringe, the '761 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '761 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

155. The products that infringe one or more claims of the '761 Patent include, but are not limited to, at least the Accused Products.

156. Further discovery may reveal additional infringing products and/or models.

157. The Accused Products include all of the limitations of at least Claim 17 of the '761 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

158. Specifically, the '761 Patent claims a digital communication system, comprising: (i) a receiver configured to receive signals transmitted via a communication channel using a QAM symbol constellation; wherein the receiver, comprises: (ii) a demodulator configured to demodulate the signal received via the communication channel; (iii) a demapper configured to estimate likelihoods of symbols in a QAM symbol constellation from the demodulated signal; (iv) a decoder that is configured to estimate decoded bits from the likelihoods generated by the demapper using an LDPC code; and wherein (v) the QAM symbol constellation is a geometrically spaced symbol constellation optimized for capacity using parallel decode capacity that provides a

given capacity at a reduced signal-to-noise ratio compared to a QAM signal constellation that maximizes $d_{\min}$. *See* Exhibit 19.

159. Plaintiff Constellation Designs reserves the right to identify any other claims of the '761 Patent in the disclosure of infringement contentions in this action.

160. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

161. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See* Exhibit 17.

162. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See* Exhibit 18.

163. Accordingly, Defendants have had knowledge of the '761 Patent at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

164. At a minimum, Defendants' have had knowledge of the '761 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

165. As such, Defendants' infringement of the '761 Patent has been and is willful.

166. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

167. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC

3.0 functionality for Federal Communications Commission Commissioner Michael O’Rielly in the United States in May 2018. See Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech (May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0’s Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

168. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

169. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

170. As such, Defendants indirectly infringe the ’761 Patent by inducing infringement by others, such as broadcast networks.

171. Defendants also indirectly infringe the ’761 patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

172. Defendants took the above actions intending to cause infringing acts by others.

173. Defendants received actual notice of its infringement of the ’761 Patent at least as early as the date of service of this Complaint.

174. Therefore, Defendants were or are now aware of the ’761 Patent or has willfully blinded itself as to the existence of the ’761 Patent and made, used, sold, offered to sell, imported

and/or encouraged the making, using, selling, offering to sell, or importing of the Accused Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '761 Patent at all times relevant to this suit.

175. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '761 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

176. Defendants therefore infringe the '761 Patent under 35 U.S.C. § 271(b).

177. Defendants indirectly infringe the '761 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '761 Patent, and that are used to practice one or more processes/methods covered by the claims of the '761 Patent.

178. Defendants' end-user customers directly infringe the '761 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

179. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '761 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

180. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the

'761 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same. Defendants therefore infringe the '761 Patent under 35 U.S.C. § 271(c).

181. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '761 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

182. Defendants' continued infringement of the '761 Patent has damaged and will continue to damage Plaintiff.

183. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT III
(Defendants' Infringement of the '700 Patent)

184. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

185. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '700 Patent. The '700 Patent is valid and enforceable.

186. Defendants have directly infringed, and continue to directly infringe, the '700 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '700 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

187. The products that infringe one or more claims of the '700 Patent include, but are not limited to, at least the Accused Products.

188. Further discovery may reveal additional infringing products and/or models.

189. The Accused Products include all of the limitations of at least Claim 1 of the '700 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

190. Specifically, the '700 Patent claims a communication system, comprising, (i) a receiver capable of receiving signals via a communication channel having a channel signal-to-noise ratio (SNR), wherein the receiver comprises: (ii) a demodulator capable of demodulating a received signal into a demodulated signal; (iii) a demapper, coupled to the demodulator, capable of determining likelihoods using the demodulated signal and a multidimensional symbol constellation selected from a plurality of multidimensional symbol constellations; and (iv) a decoder, coupled to the demapper, capable of using the likelihoods determined by the demapper to provide a sequence of received bits based upon a low density parity check (LDPC) code; (v) wherein the plurality of multidimensional symbol constellations comprises a plurality of different non-uniform multidimensional symbol constellations having the same number of constellation points, where the constellation points are non-uniformly spaced in each degree of freedom available to the multidimensional symbol constellations; and (vi) wherein the receiver is capable of selecting an LDPC code rate and multidimensional symbol constellation pair from a plurality of predetermined LDPC code rate and multidimensional symbol constellation pairs, where each of the plurality of different non-uniform multidimensional symbol constellations is only included in one of the plurality of predetermined LDPC code rate and multidimensional symbol constellation pairs. *See Exhibit 20.*

191. Plaintiff Constellation Designs reserves the right to identify any other claims of the '700 Patent in the disclosure of infringement contentions in this action.

192. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

193. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See* Exhibit 17.

194. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See* Exhibit 18.

195. Accordingly, Defendants have had knowledge of the '700 Patent family since at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

196. At a minimum, Defendants' have had knowledge of the '700 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

197. As such, Defendants' infringement of the '700 Patent has been and is willful.

198. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

199. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O'Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech

(May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0's Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

200. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

201. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

202. As such, Defendants indirectly infringe the '700 Patent by inducing infringement by others, such as broadcast networks.

203. Defendants also indirectly infringe the '700 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

204. Defendants took the above actions intending to cause infringing acts by others.

205. Defendants received actual notice of its infringement of the '700 Patent at least as early as the date of service of this Complaint.

206. Therefore, Defendants were or are now aware of the '700 Patent or has willfully blinded itself as to the existence of the '700 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused

Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '700 Patent at all times relevant to this suit.

207. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '700 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

208. Defendants therefore infringe the '700 Patent under 35 U.S.C. § 271(b).

209. Defendants indirectly infringe the '700 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '700 Patent, and that are used to practice one or more processes/methods covered by the claims of the '700 Patent.

210. Defendants' end-user customers directly infringe the '700 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

211. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '700 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

212. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the

'700 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

213. Defendants therefore infringe the '700 Patent under 35 U.S.C. § 271(c).

214. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '700 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

215. Defendants' continued infringement of the '700 Patent has damaged and will continue to damage Plaintiff.

216. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT IV
(Defendants' Infringement of the '509 Patent)

217. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

218. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '509 Patent.

219. The '509 Patent is valid and enforceable.

220. Defendants have directly infringed, and continue to directly infringe, the '509 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '509 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

221. The products that infringe one or more claims of the '509 Patent include, but are not limited to, at least the Accused Products.

222. Further discovery may reveal additional infringing products and/or models.

223. The Accused Products include all of the limitations of at least Claim 1 of the '509 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

224. Specifically, the '509 Patent claims a communication system, comprising, (i) a receiver capable of receiving signals via a communication channel having a channel signal-to-noise ratio (SNR), wherein the receiver comprises: (ii) a demodulator capable of demodulating a received signal into a demodulated signal; (iii) a demapper, coupled to the demodulator, capable of determining likelihoods using the demodulated signal and a symbol constellation that includes constellation points at a plurality of unique point locations, where: (iv) the plurality of unique point locations are unequally spaced; (v) the constellation points each have a location and a different label; and (vi) the locations of at least two of the constellation points are the same; and (vii) a decoder, coupled to the demapper, capable of using the likelihoods determined by the demapper to provide a sequence of received bits based upon a low density parity check (LDPC) code. *See* Exhibit 21.

225. Plaintiff Constellation Designs reserves the right to identify any other claims of the '509 Patent in the disclosure of infringement contentions in this action.

226. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

227. LG Representative Wayne Luplow responded that LG had “ZERO/NO interest” in partnering with Constellation Designs. *See* Exhibit 17.

228. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones’ innovations. *See* Exhibit 18.

229. Accordingly, Defendants have had knowledge of the ’509 Patent family at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

230. At a minimum, Defendants’ have had knowledge of the ’509 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

231. As such, Defendants’ infringement of the ’509 Patent has been and is willful.

232. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

233. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O’Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech (May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0’s Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

234. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

235. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

236. As such, Defendants indirectly infringe the '509 Patent by inducing infringement by others, such as broadcast networks.

237. Defendants also indirectly infringe the '509 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

238. Defendants took the above actions intending to cause infringing acts by others.

239. Defendants received actual notice of its infringement of the '509 Patent at least as early as the date of service of this Complaint.

240. Therefore, Defendants were or are now aware of the '509 Patent or has willfully blinded itself as to the existence of the '509 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '509 Patent at all times relevant to this suit.

241. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '509 patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

242. Defendants therefore infringe the '509 Patent under 35 U.S.C. § 271(b).

243. Defendants indirectly infringe the '509 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '509 Patent, and that are used to practice one or more processes/methods covered by the claims of the '509 Patent. Defendants' end-user customers directly infringe the '509 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

244. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '509 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

245. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the '509 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

246. Defendants therefore infringe the '509 Patent under 35 U.S.C. § 271(c).

247. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '509 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

248. Defendants' continued infringement of the '509 Patent has damaged and will continue to damage Plaintiff.

249. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT V
(Defendants' Infringement of the '922 Patent)

250. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

251. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '922 Patent. The '922 Patent is valid and enforceable.

252. Defendants have directly infringed, and continue to directly infringe, the '922 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '922 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

253. The products that infringe one or more claims of the '922 Patent include, but are not limited to, at least the Accused Products.

254. Further discovery may reveal additional infringing products and/or models.

255. The Accused Products include all of the limitations of at least Claim 24 of the '922 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

256. Specifically, the '922 Patent claims a communication system, comprising, (i) a receiver capable of receiving signals via a communication channel having a channel signal-to-noise ratio (SNR), wherein the receiver comprises: (ii) a demodulator capable of demodulating a received signal into a demodulated signal; (iii) a demapper, coupled to the demodulator, capable

of determining likelihoods using the demodulated signal and a non-uniform quadrature amplitude modulation 1024-point symbol constellation (NU-QAM 1024); and (iv) a decoder, coupled to the demapper, capable of using likelihoods determined by the demapper to provide a sequence of received bits based upon a Low Density Parity Check (LDPC) code; (v) wherein the NU-QAM 1024 constellation comprises an in-phase component and a quadrature component, where each component comprises 32 levels of amplitude such that the amplitudes scaled by a scaling factor are within 0.55 from the following set of amplitudes: -38.424, -31.907, -24.169, -26.796, 38.425, 31.908, -20.038, -19.169, -7.759, -7.759, -11.460, -11.460, -4.850, -4.850, -15.014, -15.205, 20.038, 19.170, 15.206, 15.015, 24.170, 26.797, 11.460, 11.460, 1.326, 1.326, 4.849, 4.849, -1.328, -1.328, 7.759, and 7.759. *See Exhibit 22.*

257. Plaintiff Constellation Designs reserves the right to identify any other claims of the '922 Patent in the disclosure of infringement contentions in this action.

258. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

259. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See Exhibit 17.*

260. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See Exhibit 18.*

261. Accordingly, Defendants have had knowledge of the '922 Patent family since at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

262. At a minimum, Defendants' have had knowledge of the '922 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

263. As such, Defendants' infringement of the '922 patent family has been and is willful.

264. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

265. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O'Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech (May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0's Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

266. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

267. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

268. As such, Defendants indirectly infringe the '922 Patent by inducing infringement by others, such as broadcast networks.

269. Defendants also indirectly infringe the '922 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

270. Defendants took the above actions intending to cause infringing acts by others.

271. Defendants received actual notice of its infringement of the '922 Patent at least as early as the date of service of this Complaint.

272. Therefore, Defendants were or are now aware of the '922 Patent or has willfully blinded itself as to the existence of the '922 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '922 Patent at all times relevant to this suit.

273. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '922 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

274. Defendants therefore infringe the '922 Patent under 35 U.S.C. § 271(b).

275. Defendants indirectly infringe the '922 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '922 Patent, and that are used to practice one or more processes/methods covered by the claims of the '922 Patent. Defendants' end-user customers directly infringe the '922 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized

constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

276. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '922 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

277. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the '922 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

278. Defendants therefore infringe the '922 Patent under 35 U.S.C. § 271(c).

279. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '922 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

280. Defendants' continued infringement of the '922 Patent has damaged and will continue to damage Plaintiff.

281. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT VI
(Defendants' Infringement of the '290 Patent)

282. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

283. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '290 Patent. The '290 Patent is valid and enforceable.

284. Defendants have directly infringed, and continue to directly infringe, the '290 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '290 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

285. The products that infringe one or more claims of the '290 Patent include, but are not limited to, at least the Accused Products.

286. Further discovery may reveal additional infringing products and/or models.

287. The Accused Products include all of the limitations of at least Claim 65 of the '290 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

288. Specifically, the '290 Patent claims a digital communication system, comprising, (i) a receiver via a communication channel transmitted signals via a communication channel, wherein the receiver, comprises: (ii) a demodulator configured to demodulate the received signal via the communication channel; (iii) a demapper configured to estimate likelihoods from the a demodulated signal and a symbol constellation; and (iv) a decoder that is configured to estimate decoded bits from the likelihoods generated by the demapper; (v) wherein the symbol constellation is a non-uniform QAM constellation formed by orthogonalizing a first PAM-32 symbol constellation and a second PAM-32 symbol constellation, wherein the first PAM-32 symbol constellation achieves at least 50% of the gain in parallel decode capacity at a given SNR achieved by a non-uniform PAM-32 symbol constellation optimized for parallel decode capacity at the given SNR relative to a uniform PAM-32 symbol constellation. *See Exhibit 23.*

289. Plaintiff Constellation Designs reserves the right to identify any other claims of the '290 Patent in the disclosure of infringement contentions in this action.

290. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

291. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See* Exhibit 17.

292. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See* Exhibit 18.

293. Accordingly, Defendants have had knowledge of the '290 Patent since at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

294. At a minimum, Defendants' have had knowledge of the '290 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

295. As such, Defendants' infringement of the '290 Patent has been and is willful.

296. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

297. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O'Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech

(May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0's Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge (Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

298. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

299. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

300. As such, Defendants indirectly infringe the '290 Patent by inducing infringement by others, such as broadcast networks.

301. Defendants also indirectly infringe the '290 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

302. Defendants took the above actions intending to cause infringing acts by others.

303. Defendants received actual notice of its infringement of the '290 Patent at least as early as the date of service of this Complaint.

304. Therefore, Defendants were or are now aware of the '290 Patent or has willfully blinded itself as to the existence of the '290 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused

Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '290 Patent at all times relevant to this suit.

305. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '290 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others. Defendants therefore infringe the '290 Patent under 35 U.S.C. § 271(b).

306. Defendants indirectly infringe the '290 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '290 Patent, and that are used to practice one or more processes/methods covered by the claims of the '290 Patent.

307. Defendants' end-user customers directly infringe the '290 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

308. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '290 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

309. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the

'290 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

310. Defendants therefore infringe the '290 Patent under 35 U.S.C. § 271(c).

311. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '290 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

312. Defendants' continued infringement of the '290 Patent has damaged and will continue to damage Plaintiff.

313. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

COUNT VII
(Defendants' Infringement of the '324 Patent)

314. Plaintiff incorporates the allegations of all of the foregoing paragraphs as if fully restated herein.

315. Plaintiff is the assignee and lawful owner of all right, title and interest in and to the '324 Patent. The '324 Patent is valid and enforceable.

316. Defendants have directly infringed, and continue to directly infringe, the '324 Patent by making, using, selling, offering for sale, or importing into the United States products that infringe the '324 Patent including, but not limited to, receivers or televisions incorporating receivers capable of: (1) receiving and processing signals using non-uniform parallel decode capacity optimized constellations; and/or (2) operating under different channel conditions by utilizing different non-uniform multidimensional constellation and code rate pairs, where some of the unequally spaced constellations have overlapping constellation points.

317. The products that infringe one or more claims of the '324 Patent include, but are not limited to, at least the Accused Products.

318. Further discovery may reveal additional infringing products and/or models.

319. The Accused Products include all of the limitations of at least Claim 47 of the '324 Patent, either literally or under the doctrine of equivalents, and either directly or indirectly.

320. Specifically, the '324 Patent claims a communication system, comprising, (i) a receiver capable of receiving signals via a communication channel having a channel signal-to-noise ratio (SNR), wherein the receiver comprises: (ii) a demodulator capable of demodulating a received signal into a demodulated signal; (iii) a demapper, coupled to the demodulator, capable of determining likelihoods using the NU-QAM 1024; and (iv) a decoder, coupled to the demapper, capable of using likelihoods determined by the demapper to provide a sequence of received bits based upon the LDPC code; and (v) wherein the NU-QAM 1024 comprises an in-phase component and a quadrature component, where each component comprises 32 levels of amplitude such that the amplitudes scaled by a scaling factor are within 1.012 from the following set of amplitudes: -39.1811, -32.19, -26.6863, -24.2565, -19.4031, -18.8423, -15.3045, -15.3045, -10.1865, -10.1865, -8.2773, -8.2708, -3.5662, -3.5662, -2.652, -2.6518, 2.651, 2.6514, 3.5662, 3.5662, 8.2697, 8.2746, 10.816, 10.816, 15.3039, 15.3039, 18.8439, 19.4019, 24.2575, 26.686, 32.1917, and 39.1856. *See Exhibit 24.*

321. Plaintiff Constellation Designs reserves the right to identify any other claims of the '324 Patent in the disclosure of infringement contentions in this action.

322. When Drs. Barsoum and Jones' patented inventions were adopted as part of the ATSC 3.0 standard, representatives of Constellation Designs' patents reached out to LG

Representative Wayne Luplow and LG Representative Nandhu Nandhakumar in an endeavor to partner with LG in licensing Constellation Designs' seminal technology.

323. LG Representative Wayne Luplow responded that LG had "ZERO/NO interest" in partnering with Constellation Designs. *See* Exhibit 17.

324. Nandhu Nandhakumar stopped communicating with Constellation Designs after suggesting a phone call to discuss Drs. Barsoum and Jones' innovations. *See* Exhibit 18.

325. Accordingly, Defendants have had knowledge of the '324 Patent family since at least as of receiving the email dated December 13, 2017, and as of participating in LinkedIn conversations about the Constellation Designs ATSC 3.0 innovations in January of 2018.

326. At a minimum, Defendants' have had knowledge of the '324 Patent at least as of the filing and/or service of this lawsuit and have continued their infringing activities.

327. As such, Defendants' infringement of the '324 Patent has been and is willful.

328. Defendants provide LG receivers to others for ATSC 3.0 testing within the United States and encourage broadcast networks, like TEGNA, Inc., to transmit signals to LG receivers in compliance with the ATSC 3.0 standard.

329. LG NextGen TVs were used for the first live over-the-air broadcast of ATSC 3.0 next-generation television in Korea in October 2016 and were used to test and demonstrate ATSC 3.0 functionality for Federal Communications Commission Commissioner Michael O'Rielly in the United States in May 2018. *See* Phil Kurtz, *ATSC Meeting Explores 3.0 Developments*, tvtech (May 24, 2018), <https://www.tvtechnology.com/atsc3/atsc-meeting-explores-3-0-deployments>; Glen Dickson, *NewsFlash: ATSC 3.0's Potential to be Tested in Phoenix, Dallas*, ATSC (May 1, 2018), <https://www.atsc.org/news/newsflash-atsc-3-0s-potential-to-be-tested-in-phoenix-dallas/>; *Korea Broadcaster SBS and LG Test ATSC 3.0*, The Broadcast and Playout Transmission Bridge

(Oct. 1, 2015, 3:00pm), <https://www.thebroadcastbridge.com/content/entry/3989/korea-broadcaster-and-lg-test-atsc-3.0>.

330. Defendants have continued to provide LG NextGen TVs for over-the-air broadcast testing in the United States and encouraged others to engage in such testing by infringing means.

331. Defendants took the above actions intending to cause infringing acts by such broadcast networks.

332. As such, Defendants indirectly infringe the '324 Patent by inducing infringement by others, such as broadcast networks.

333. Defendants also indirectly infringe the '324 Patent by inducing infringement by others, such as end-user customers, by, for example, encouraging its users to take advantage of ATSC 3.0 features within the United States and by implementing the standardized features in its televisions.

334. Defendants took the above actions intending to cause infringing acts by others.

335. Defendants received actual notice of its infringement of the '324 Patent at least as early as the date of service of this Complaint.

336. Therefore, Defendants were or are now aware of the '324 Patent or has willfully blinded itself as to the existence of the '324 Patent and made, used, sold, offered to sell, imported and/or encouraged the making, using, selling, offering to sell, or importing of the Accused Products despite knowing of an objectively high likelihood that its actions constituted infringement of the '324 Patent at all times relevant to this suit.

337. Alternatively, Defendants subjectively believed there was a high probability that others would infringe the '324 Patent but took deliberate steps to avoid confirming that it was actively inducing infringement by others.

338. Defendants therefore infringe the '324 Patent under 35 U.S.C. § 271(b).

339. Defendants indirectly infringe the '324 Patent by contributing to infringement by others, such as end-user customers by offering to sell and selling within the United States components (that is, the Accused Instrumentalities) that constitute a material part of the inventions claimed in the '324 Patent, and that are used to practice one or more processes/methods covered by the claims of the '324 Patent.

340. Defendants' end-user customers directly infringe the '324 Patent by, for example, using the ATSC 3.0 compliant features of Defendants' Accused Instrumentalities, including receiving and processing signals using non-uniform parallel decode capacity optimized constellations, non-uniform multidimensional constellation and code rate pairs, and/or unequally spaced constellations during video reception.

341. In offering to sell and selling the components specified above, Defendants knew these components to be especially made or especially adapted for use in an infringement of the '324 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use.

342. Alternatively, Defendants subjectively believed there was a high probability that these components to be especially made or especially adapted for use in an infringement of the '324 Patent and that these components are not a staple article or commodity of commerce suitable for substantial non-infringing use but took deliberate steps to avoid confirming the same.

343. Defendants therefore infringe the '324 Patent under 35 U.S.C. § 271(c).

344. To the extent that Defendants release any new version of Defendants' Accused Instrumentalities, such instrumentalities will meet the claims of the '324 Patent and infringe under 35 U.S.C. § 271(a)–(c) in ways analogous to Defendants' current infringement described above.

345. Defendants' continued infringement of the '324 Patent has damaged and will continue to damage Plaintiff.

346. Plaintiff is entitled to recover damages adequate to compensate it for Defendants' infringement or at minimum a reasonable royalty.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests the following relief:

- a. a judgment in favor of Plaintiff that Defendants have infringed, either literally and/or under the doctrine of equivalents, the Asserted Patents;
- b. a judgment that Defendants' infringement has been and is willful;
- c. a judgment and order requiring Defendants to pay Plaintiff its damages, costs, expenses, and any enhanced damages to which Plaintiff is entitled for Defendant's infringement;
- d. a judgment and order requiring Defendants to provide an accounting and to pay supplemental damages to Plaintiff, including without limitation, pre-judgment and post-judgment interest;
- e. a judgment and order requiring Defendants to pay ongoing royalties;
- f. a judgment pursuant to 35 U.S.C. § 283 permanently enjoining Defendants and any of its officers, directors, agents, servants, subsidiaries, affiliates, divisions, branches, parents, and/or those in association with them from further infringing the Asserted Patents;
- g. a judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding Plaintiff its reasonable attorney fees against Defendants; and
- h. any and all other relief as the Court may deem appropriate and just under the

circumstances.

DEMAND FOR JURY TRIAL

Pursuant to Fed. R. Civ. P. 38, Plaintiff hereby demands trial by jury on all claims and issues so triable.

DATED: December 9, 2021

Respectfully submitted,

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