UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

MASSIVELY BROADBAND LLC Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD. AND SAMSUNG ELECTRONICS AMERICA, INC., Defendants.	Case No. 2:25-cv-00608-JRG

SAMSUNG'S P.R. 3-3 AND 3-4 INVALIDITY CONTENTIONS

I. INTRODUCTION

Defendants Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively "Samsung" or "Defendant") provide these Invalidity Contentions to Plaintiff Massively Broadband LLC ("MBB" or "Plaintiff") for the following patents (collectively, "Asserted Patents") and claims (collectively, "Asserted Claims"), which were identified as asserted in Plaintiff's Preliminary Infringement Contentions served on September 16, 2025 ("Infringement Contentions"):

U.S. Patent No.	Asserted Claims
7,676,194 ("'194 patent")	Claims 1, 4, 7, 8, 9, 12, 13, 14, 17, 20, 22, and 23
8,923,754 ("'754 patent")	Claims 1, 2, 3, 14, 23, 24, and 25
9,667,337 ("'337 patent")	Claims 1, 2, 3, 6, 8, 9, 11, 17, 26, 29, 30, 32, 33, 35, 48, and 49
10,224,999 ("'999 patent")	Claims 1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28, 31, 32, and 39
10,797,783 ("'783 patent")	Claims 1, 2, 3, 6, 13, 14, 15, and 16
8,350,763 ("'763 patent")	Claims 1, 3, 4, 6, 7, 10, 11, 13, 15, and 16
8,593,358 ("'358 patent")	Claims 1, 3, 4, 6, 7, 8, 9, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, and 24
11,063,625 ("'625 patent")	Claims 1, 2, 5, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, and 33

11,876,548 ("'548 patent")	Claims 1, 6, 7, and 12
8,224,794 ("'794 patent")	Claims 20, 22, 23, and 25
8,515,925 ("'925 patent")	Claims 1, 4, 6, 12, 14, 17, 18, and 22
8,725,700 ("'700 patent")	Claims 1, 3, 4, 5, 10, 12, and 13

II. RESERVATIONS AND EXPLANATIONS

These Invalidity Contentions and accompanying document productions are subject to further revision as follows. Nothing in these contentions constitutes an admission concerning the priority date, conception date, or date of reduction to practice of the Asserted Claims. Samsung reserves the right to modify or supplement these Invalidity Contentions, including in response to any positions taken or information disclosed regarding the priority date, conception date, or date of reduction to practice of the Asserted Claims.

This disclosure is directed to invalidity issues only and does not address other defenses or grounds, including but not limited to: claim construction, non-infringement, patent misuse, inequitable conduct, estoppel, waiver, acquiescence, patent exhaustion, unfair competition, unclean hands, express or implied license, or non-statutory defenses of any sort. Samsung reserves all rights with respect to such issues, including but not limited to their position that the Asserted Claims are to be construed in a particular manner and are not infringed.

For prior art patents and prior art publications identified in these Invalidity Contentions, Samsung reserves the right to rely on the public use, offer for sale, sale, and/or actual products embodying the methods and systems described therein uncovered during discovery. Samsung also reserves the right to rely on any related patents and patent applications, foreign patent counterparts and foreign patent applications of U.S. patents identified in these Invalidity Contentions, and U.S. counterparts of foreign patents and foreign patent applications identified in these Invalidity Contentions.

Samsung also contends that the Asserted Patents are invalid in view of public knowledge and uses and/or offers for sale or sales of products and services that are under 35 U.S.C. § 102(a) and/or 35 U.S.C. § 102(b) and/or prior inventions made in this country by other inventors who had not abandoned, suppressed, or concealed them under 35 U.S.C. § 102(g).

Samsung also reserves the right to rely on any system, public knowledge or use embodying or otherwise incorporating any of the prior art disclosed herein alone or in combination. Samsung further reserves the right to rely on any other documents or references describing any such system, knowledge, or use. Samsung also reserves the right to rely on physical exemplars of these prior art systems (and will make the same available for inspection).

Samsung's Invalidity Contentions are based in part on Samsung's present understanding of the Asserted Claims and Plaintiff's apparent interpretation of these claims as reflected in its Infringement Contentions. By including prior art that anticipates or renders obvious claims based on Plaintiff's apparent or explicit claim interpretations, Samsung is not agreeing that Plaintiff's claim interpretations are correct. Any invalidity analysis depends on claim construction, which is a question of law reserved for the Court. Samsung reserves the right to amend, supplement, or materially modify its Invalidity Contentions in response to any claim construction positions that Plaintiff may take in this case or any claim construction the Court may adopt in this case. Samsung also reserves the right to assert that a claim is indefinite, not enabled, or fails to meet the written description requirement, in response to any additional claim construction positions Plaintiff may take in this case or any further claim construction the Court may adopt in this case.

Samsung contends that Plaintiff appears to be pursuing overly broad constructions of the Asserted Claims in an effort to piece together an infringement claim where none exists and to accuse products that do not practice the claims as properly construed. At the same time, Plaintiff's

Infringement Contentions are in many respects too general and vague to discern exactly how Plaintiff contends the accused instrumentalities practice each element of the Asserted Claims. These Invalidity Contentions are not intended to be, and are not, an admission that the Asserted Claims are infringed by any of Samsung's products or technology, that any particular feature or aspect of the accused instrumentalities practices any element of the Asserted Claims, or that any of Plaintiff's proposed constructions are supportable or proper. To the extent that any of the prior art references disclose the same functionality or feature of any of the accused instrumentalities, Samsung reserves the right to argue that said feature or functionality does not practice the Asserted Claims, and to argue, in the alternative, that if said feature or functionality is found to practice the Asserted Claims, then the prior art reference demonstrates that that feature or functionality is not novel, is obvious, or is not patentable.

The accompanying invalidity claim charts provide examples of prior art that discloses, either expressly or inherently, every limitation of certain claims and/or teachings, suggestions and motivations through which a POSITA at the time of the alleged invention would have considered the limitations obvious in view of the state of the art at the time, the differences between the claimed invention and the state of the art, and the foreseeability from a technical perspective and/or marketing and/or natural and expected evolution of the art. Where Samsung cites to a particular figure in a reference, the citation should be understood to encompass the caption and description of the figure and any text relating to the figure. Conversely, where Samsung cites to particular text referring to a figure, the citation should be understood to include the figure as well. As discovery progresses and the scope and focus of the liability issues become clearer, Samsung may rely on uncited portions of the prior art.

Samsung reserves the right to revise its contentions concerning the invalidity of the Asserted Claims, which may change depending on discovery taken in the case, the Court's construction of the Asserted Claims, any findings as to the priority date of the Asserted Claims, and/or positions that Plaintiff or expert witness(es) may take concerning claim construction, infringement, and/or invalidity issues.

Samsung may rely on Plaintiff's or any inventor's admissions concerning the scope of prior art relevant to the Asserted Patents; the patent prosecution histories for the Asserted Patents; any deposition testimony of the named inventors on the Asserted Patents; and the papers filed and any evidence submitted by Plaintiff in connection with this litigation. For example, Samsung reserves the right to assert that the Asserted Claims are invalid under 35 U.S.C. § 102(f) in the event that Samsung obtains evidence that the named inventors did not invent (either alone or in conjunction with others) the subject matter claimed in the Asserted Patents. Should Samsung obtain such evidence, it will provide the name(s) of the person(s) from whom and the circumstances under which the claimed invention or any part of it was derived.

Prior art not included in this disclosure, whether known or not known to Samsung, may become relevant. In particular, Samsung is currently unaware of the extent, if any, to which Plaintiff will contend that limitations of the Asserted Patents are not disclosed in the prior art identified by Samsung. To the extent such an issue arises, Samsung reserves the right to identify other references that would render obvious the allegedly missing limitation(s) of the disclosed device or method. Further, because Samsung has not yet completed its search for or analysis of relevant prior art, Samsung reserves the right to revise, amend, and/or supplement the information provided herein, including identifying, charting, and relying on additional references, should Samsung's further search and analysis yield additional information or references, consistent with the Federal Rules of Civil Procedure. Plaintiff also has a duty to produce to Defendants all relevant documents from other proceedings involving the patents related to the Asserted Patents or their subject matter, including but not limited to all prior art invalidity contentions and expert reports on invalidity among other relevant items.

Additionally, because third-party discovery is not yet complete, Samsung reserves the right to present additional items of prior art under 35 U.S.C. §§ 102(a), (b), (e), and/or (g), and/or § 103, located during the course of such discovery or further investigation, and to assert invalidity under 35 U.S.C. §§ 102(c), (d), or (f), to the extent that such discovery or investigation yields information forming the basis for such invalidity. For example, Samsung has issued or plans to issue subpoenas to (and has received and expects to receive, voluntarily or subject to subpoenas, information from) third parties believed to have knowledge, documentation, and/or corroborating evidence concerning some of the prior art listed below and/or additional prior art. These third parties include, without limitation, the authors, inventors, vendors, or assignees of the references listed in these disclosures.

Samsung further reserves the right to modify or add additional contentions in the event that Plaintiff provides amended infringement contentions and to the extent the Court orders or allows Plaintiff to amend its infringement contentions.

Pursuant to the Scheduling Order, and in light of Plaintiff's Infringement Contentions and accompanying claim chart, Samsung lists in these Invalidity Contentions the prior art now known to it that it contends anticipates or renders obvious the Asserted Claims. Although Samsung has identified at least one disclosure of a limitation for each prior art reference, each and every disclosure of the same limitation in the same reference is not necessarily identified. In an effort to focus the issues, Samsung's citations are only to representative portions of an identified reference, even where a reference may contain additional support for a particular claim limitation. POSITAs generally read an item of prior art as a whole and in the context of other publications and literature. Thus, to understand and interpret any specific statement or disclosure within a prior art reference, such persons would rely on other information within the reference, along with other publications and their general scientific knowledge. Samsung may rely on uncited portions of the prior art references and on other publications and expert testimony to provide context, and as aids to understanding and interpreting the portions that are cited.

Samsung incorporates in these Invalidity Contentions, in full, all prior art references cited in the Asserted Patents and their prosecution histories.

Subject to Samsung's reservation of rights, Samsung identifies each item of prior art that anticipates and/or renders obvious the Asserted Claims. The patents/applications, publications, and systems identified are also relevant to show the state of the art and reasons and motivations for making improvements, additions, and combinations.

III. PRIORITY DATE OF THE ASSERTED PATENTS AND CLAIMS

Plaintiff asserts that each Asserted Claims is entitled to a priority date of "the earliest application date[]" and states that "certain documents…may support a priority date earlier than the earliest application dates identified." (Infringement Contentions, p. 8-9)

It is Plaintiff's burden to show entitlement to its asserted priority date, and Samsung asserts that Plaintiff has failed to meet that burden. *See Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1327 (Fed. Cir. 2008); *see also In re Magnum Oil Tools Int'l, Ltd*., 829 F.3d 1364, 1376 (Fed. Cir. 2016) ("[A] patentee bears the burden of establishing that its claimed invention is entitled to an earlier priority date than an asserted prior art reference."). For example, Plaintiff has failed to specifically identify a priority date for each Asserted Patent and failed to show that

Asserted Claims in divisional and continuation patents are supported by the parent applications to which they ultimately claim priority.

Nevertheless, except with respect to the ’625 and ’548 patents, Samsung has focused on prior art that predates the claimed earliest application dates. Samsung reserves the right to amend these Invalidity Contentions with additional prior art and/or with additional charts of the art if Plaintiff alleges earlier or later priority dates.

In addition, Plaintiff has not identified a date of conception or reduction to practice for any of the Asserted Patents. Samsung therefore also reserves its right to amend its Invalidity Contentions if Plaintiff is permitted to allege earlier dates of conception for the patents-in-suit, or if Plaintiff does not meet its burden to prove the priority dates it asserts.

With respect to the ’625 and ’548 patents specifically, both are identified on their faces as continuations-in-part of the ’358 patent. However, both the ’625 patent and ’548 patent are not entitled to claim priority to the ’358 patent or any earlier priority application because they claim subject matter that was newly added in the ’625 patent and was not disclosed in the ’358 patent or any earlier parent application. Accordingly, both the earliest priority date to which the ’625 patent and the ’548 patent are entitled is the filing date of the ’625 patent, August 14, 2013.

In particular, the disclosures in column 10 line 34 through column 14 line 52 of the ’625 patent, which also appear in column 10 line 35 through column 14 line 52 of the ’548 patent, comprise new matter that was first added in the ’625 patent and was not included in the specification of the ’358 patent or any earlier parent application. This new matter in the ’625 and ’548 specifications provides the only possible written description support under Section 112 for every claim of the ’625 and ’548 patents.

For example, every claim of the ’625 patent and ’548 patent recites sensors that detect the orientation of a wireless device relative to a user or structure and at least one steerable antenna configured to adjust its beam radiation pattern to steer or direct beams in directions where the user or structure are not located. None of these elements are disclosed in the ’358 patent or any earlier parent application. For example, the words “steer” and “steerable” do not even appear in the specification of the ’358 patent, nor does the specification of the ’358 patent disclose steerable or directional antennas in wireless devices, using sensors to detect a user or structure relative to the orientation of a wireless device and/or its antenna, or adjusting a beam radiation pattern to steer or direct a beam of radiation in certain directions based on the spatial detection. These limitations are disclosed only in the new matter first presented in the specification of the ’625 patent and repeated in the specification of the ’548 patent. *See, e.g.*, ’625 patent, 10:34-62 (steerable antennas), 10:63-11:26, 12:4-17 (use of sensors to detect user/structure relative to device), 11:27-12:3 (use of detection to steer/adjust beam pattern).

Accordingly, the earliest priority date all claims of the ’625 and ’548 patents are entitled to is the filing date of the ’625 patent, August 14, 2013. Because these claims are subject to the AIA, Plaintiff may also not claim the benefit of an earlier priority date based on alleged earlier conception or reduction to practice.

IV. PRIOR ART REFERENCES

Samsung identifies the following prior art now known to Samsung to anticipate or render obvious the Asserted Claims under at least pre-AIA 35 U.S.C. §§ 102(a), (b), (e), and/or (g) and/or post-AIA 35 U.S.C. §§ 102(a)(1) and/or (a)(2), either expressly or inherently as understood by a POSITA, and/or render obvious under 35 U.S.C. § 103, either alone or in combination. At this time, Samsung contends that the prior art references described below anticipate or render obvious, either alone or in combination, one or more of the Asserted Claims. These prior art references also provide a description of the level of skill in the art and provide background information showing the knowledge of a person of skill in the art. Samsung reserves the right to rely on these references for those purposes.

Samsung additionally incorporates by reference all prior art references cited on the face of the Asserted Patents, each related patent, and each foreign counterpart. Samsung further incorporates by reference all prior art references identified in the file histories of the same. Samsung reserves the right to rely upon foreign counterparts of the U.S. Patents identified in these Invalidity Contentions; U.S. counterparts of foreign patents and foreign patent applications identified in these Invalidity Contentions; U.S. and foreign patents and patent applications corresponding to articles and publications identified in these Invalidity Contentions; and any systems, products, or prior inventions related to any references identified in these Invalidity Contentions. Samsung also incorporates by reference, without limitation, disclosures in previous or related litigation, in copending *inter partes* review petitions filed on the Asserted Patents, in United States Patent & Trademark Office ("USPTO") proceedings, by Plaintiff, by any other parties accused of patent infringement by Plaintiff, or by the named inventors or any individuals associated with the prosecution and/or any form of post-grant review or reexamination of the Asserted Patents.[1]

In these Invalidity Contentions, including the exhibits, any citation to a printed publication or other reference describing a prior art system should also be construed to include a reference to the prior art system itself.

[1] *See, e.g,* IPR2025-01563, IPR2025-01564, IPR2025-01565, IPR2025-01587, IPR2025-01594, IPR2025-01595, IPR2025-01605, IPR2026-00032, IPR2026-00033, IPR2026-00035, IPR2026-00086, IPR2026-00103.

Each Asserted Patent has asserted claims with limitations that are substantially similar to limitations of other asserted claims of that Asserted Patent. Each Asserted Patent also has asserted claims with limitations that are substantially similar to limitations of asserted claims on other Asserted Patents. Samsung reserves the right to rely on references and obviousness arguments charted for a limitation of one asserted claim when invalidating another asserted claim with a similar limitation.

Similarly, these Invalidity Contentions, including the exhibits, may contain citations to certain embodiments disclosed in a prior art reference but not to all embodiments disclosed in that reference. Samsung reserves the right to rely on variant embodiments in cited prior art references even if those variant embodiments are not otherwise specifically cited.

A. Prior Art Patents and Publications

Prior Art	Effective Filing Date	Publication / Issue Date	Country of Origin
US Provisional Appl. 60/496913			US
US Provisional Appl. 60/498324			US
US Provisional Appl. 60/774406	Feb. 17, 2006		US
US Provisional Appl. 60/971175	Sep. 10, 2007		US
US Provisional Appl. 60/977582	Oct. 4, 2007		US
US Provisional Appl. 61/028261	Feb. 13, 2008		US
US20010045914A1	Feb. 23, 2001	Nov. 29, 2001	US
US20020028655A1	Dec. 22, 2000	Mar. 7, 2002	US
US20020035698A1	May 15, 2001	Mar. 21, 2002	US
US20020046084A1	Oct. 8, 1999	Apr. 18, 2002	US
US20020073235A1	Dec. 11, 2000	Jun. 13, 2002	US

Prior Art	Effective Filing Date	Publication / Issue Date	Country of Origin
US20020077944A1	Nov. 14, 2001	Jun. 20, 2002	US
US20020086657A1	Dec. 21, 2001	Jul. 4, 2002	US
US20020161633A1	Apr. 27, 2001	Oct. 31, 2002	US
US20020164946A1	Dec. 1, 2001	Nov. 7, 2002	US
US20020165773A1	May 30, 2001	Nov. 7, 2002	US
US20020174051A1	May 15, 2001	Nov. 21, 2002	US
US20020187769A1	Sept. 14, 2001	Dec. 12, 2002	US
US20030002456A1	Mar. 7, 2002	Jan. 2, 2003	US
US20030003933A1	Jun. 27, 2001	Jan. 2, 2003	US
US20030072273A1	Sep. 9, 2002	Apr. 17, 2003	US
US20030120809A1	Dec. 20, 2001	Jun. 26, 2003	US
US20030125044A1	Mar. 7, 2002	Jul. 3, 2003	US
US20030154399A1	Feb. 8, 2002	Aug. 14, 2003	US
US20030164794A1	Mar. 4, 2002	Sep. 4, 2003	US
US20030216953A1	May 15, 2002	Nov. 20, 2003	US
US20040002871A1	Jun. 27, 2003	Jan. 1, 2004	US
US20040021605A1	Jan. 2, 2002	Feb. 5, 2004	US
US20040048574A1	Feb. 20, 2023	Mar. 11, 2004	US
US20040095280A1	Nov. 18, 2002	May 20, 2004	US
US20040097260A1	Jul. 30, 2003	May 20, 2004	US
US20040125027A1	Dec. 27, 2002	Jul. 1, 2004	US

Prior Art	Effective Filing Date	Publication / Issue Date	Country of Origin
US20040132434A1	Feb. 7, 2002	Jul. 8, 2004	US
US20040136373A1	Jun. 13, 2003	Jul. 15, 2004	US
US20040160928A1	May 9, 2003	Aug. 19, 2004	US
US20040185859A1	Jan. 29, 2004	Sept. 23, 2004	US
US20040235484A1	Aug. 22, 2001	Nov. 25, 2004	US
US20050022010A1	Jun. 6, 2003	Jan. 27, 2005	US
US20050201326A1	Dec. 6, 2001	Sep. 15, 2005	US
US20050233709A1	Apr. 5, 2004	Oct. 20, 2005	US
US20060097918A1	Nov 10, 2003	May 11, 2006	US
US20060253453A1	Mar. 31, 2005	Nov. 9, 2006	US
US20070111748A1	Nov. 14, 2005	May 17, 2007	US
US20070173237A1	Feb. 7, 2007	Jul. 26, 2007	US
US20070178911A1	May 31, 2005	Aug. 2, 2007	US
US20070207800A1	Feb. 20, 2007	Sep. 6, 2007	US
US20070213925A1	Mar. 13, 2006	Sep. 13, 2007	US
US20080030411A1	Aug. 14, 2007	Feb. 7, 2008	US
US20080091815A1	Oct. 12, 2007	Apr. 17, 2008	US
US20080103935A1	Aug. 7, 2007	May 1, 2008	US
US20080186882A1	May 3, 2007	Aug. 7, 2008	US
US20080262897A1	Apr. 17, 2007	Oct. 23, 2008	US
US20080305747A1	Jun. 7, 2007	Dec. 11, 2008	US

Prior Art	**Effective Filing Date**	**Publication / Issue Date**	**Country of Origin**
US20090076906A1	Sept. 14, 2007	Mar. 19, 2009	US
US20090295648A1	Jun. 3, 2088	Dec. 3, 2099	US
US20100112997A1	Aug. 16, 2007	May 6, 2010	US
US20100130179A1	Nov. 26, 2008	May 27, 2010	US
US20110182174A1	Oct. 29, 2010	Jul 28, 2011	US
US20110250928A1	Apr. 3, 2010	Oct. 13, 2011	US
US20130237272A1	Sep. 16, 2011	Sep. 12, 2013	US
US4056780A	Jun. 25, 1975	Nov. 1, 1977	US
US4394775	May 22, 1981	Jul. 19, 1983	US
US5794145A	Jun. 7, 1996	Aug. 11, 1998	US
US5905859A	Jan. 9, 1997	May 18, 1999	US
US5926751A	Feb. 19, 1997	Jul. 20, 1999	US
US5948061	Oct. 29, 1996	Sept. 7, 1999	US
US5983115	Aug. 13, 1996	Nov. 9, 1999	US
US6188496B1	Nov. 25, 1997	Feb. 13, 2001	US
US6332127B1	Jan. 28, 1999	Dec. 18, 2001	US
US6497656B1	May 16, 2000	Dec. 24, 2002	US
US6456234B1	Jun. 7, 2000	Sept. 24, 2002	US
US6505032B1	Oct. 10, 2000	Jan. 7, 2003	US
US6545596B1	Jun. 30, 2000	Apr. 8, 2003	US
US6584080B1	Jun. 14, 1999	Jun. 24, 2003	US

Prior Art	Effective Filing Date	Publication / Issue Date	Country of Origin
US6664922B1	Aug. 2, 1999	Dec. 16, 2003	US
US6779042B1	Apr. 28, 2000	Aug. 17, 2004	US
US6807558B1	Jun. 2, 1998	Oct. 19, 2004	US
US6978138B1	Oct. 28, 2002	Dec. 20, 2005	US
US7076244B2	Jul. 23, 2002	Jul. 11, 2006	US
US7089194B1	Jun. 17, 1999	Aug. 8, 2006	US
US7088997B1	Sept. 12, 2001	Aug. 8, 2006	US
US7110749B2	Dec. 19, 2000	Sep. 19, 2006	US
US7184703B1	Jun. 6, 2003	Feb. 27, 2007	US
US7209523B1	Feb. 17, 1999	Apr. 24, 2007	US
US7295556B2	Feb. 28, 2003	Nov. 13, 2007	US
US7308285B2	May. 7, 2003	Dec. 11, 2007	US
US7373246B3	May 27, 2005	May 13, 2008	US
US7489914B2	Apr. 25, 2005	Feb. 10, 2009	US
US7529208B2	Sep. 20, 2005	May 5, 2009	US
US7786819B2	Aug. 31, 2007	Aug. 31, 2010	US
US7990904B2	Dec. 16, 2003	Aug. 2, 2011	US
US8125940B2	Jul. 14, 2003	Feb. 28, 2012	US
US8165146B1	Jan. 16, 2003	Apr. 24, 2012	US
US8458286B2	Feb. 28, 2001	Jun. 4, 2013	US
US8583065B2	Jun. 7, 2007	Nov. 12, 2013	US

Prior Art	**Effective Filing Date**	**Publication / Issue Date**	**Country of Origin**
US8593358B2	Dec. 13, 2012	Nov. 26, 2013	US
US8666821B2	Aug. 28, 2006	Mar. 4, 2014	US
US9245040B2	Mar. 27, 2008	Jan. 26, 2016	US
US9362994B2	May 10, 2013	Jun. 7, 2016	US
EP1162852A1	Jun 9, 2000	Dec. 12, 2001	EP
EP1624710B1	Aug. 6, 2004	June 25, 2008	EP
EP1670270A1	Feb. 17, 2005	Jun. 14, 2006	EP
EP1914835A1	Oct. 20, 2006	Apr. 23, 2008	EP
WO1999059283A2	May 8, 1998	Nov. 18, 1999	US
WO2000043933A1	Jan. 26, 1999	Jul. 27, 2000	PCT
WO2000077978A2	Jun. 13, 2000	Dec. 21, 2000	PCT
WO2001011507A1	Aug. 11, 2000	Feb. 15, 2001	PCT
WO2001022669A1	Sep. 25, 2000	Mar. 29, 2001	PCT
WO2001061559A1	Feb. 16, 2001	Aug. 23, 2001	PCT
WO 2005029720A1	Sep. 6, 2004	Mar. 31, 2005	PCT
WO 2014194455A1	June 3, 2013	Dec 11, 2014	PCT
WO2003058850A2	Jan. 6, 2003	Jul. 17, 2003	PCT
WO2004030393A1	May 23, 2003	Apr. 8, 2004	PCT
KR20060028515A	Sept. 24, 2004	Mar. 30, 2006	KR
KR20060077402A	Dec. 30, 2004	Jul. 5, 2006	KR

Prior Art	Author	Pub. Date	Publisher
3GPP TX 23.003 Technical Specification, v7.1.0		Sep. 2006	3GPP
Antenna Theory: Analysis and Design,2nd Ed.	Balanis	1997	Wiley
Beamforming: a versatile approach to spatial filtering	Van Veen and Buckley	Apr. 1998	IEEE
Wireless Communication Networks and Systems	Beard and Stallings	2016	Pearson
Active Tuning and Miniaturization of Microstrip Antennas	Bhuiyan et al.	2002	IEEE
Bitfone Solutions, Bitfone, available at https://web.archive.org/web/20061022001229/http:/www.bitfone.com/usa/enter.shtml		2006	
Using gravity to estimate accelerometer orientation	Mizell	2003	IEEE
Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification (3GPP TS 03.03 version 7.8.0 Release 1998)		2003	ETSI
FCC ASR Registration Form 854		Jan. 2006	FCC
FCC ASR Search Screenshot			FCC
Fryer's TowerSource Acquired by Biby Publishing https://wirelessestimator.com/content/articles/?pagename=wireless+tower+news		Dec. 2005	
GSM Networks: Protocols, Terminology, and Implementation	Heine	1999	Artech House
The first Palm-Microsoft smart phone debuts, available at https://www.nbcnews.com/id/wbna10698983	Krakow	Jan. 2006	NBC News
GSM Goes to Market, GSM Association	Sinclair	Mar. 2007	ETSI
IEEE 100: The Authoritative Dictionary of IEEE Standards Terms, 7th ed.		2000	IEEE
IEEE Standard 145-2013 - IEEE Standard for Definitions of Terms for Antennas		2013	IEEE
Mobile Communications	Schiller	2003	Addison-Wiley
Array Signal Processing: Concepts and Techniques	Johnson and Dudgeon	1993	PTR Prentice Hall
Which Way Am I Facing: Inferring Horizontal Device Orientation from an Accelerometer Signal	Kunze et al.	2009	IEEE
GpsOne: a New Solution to Vehicle Navigation	Wang et al.	2004	IEEE

Prior Art	**Author**	**Pub. Date**	**Publisher**
Modern Digital and Analog Communication Systems	Lathi	1983	HRW
A review of antennas and propagation for MIMO wireless communications	Jenson and Wallace	2004	IEEE
802.11 Wireless Networks – The Definitive Guide	Gast	2002	O'Reilly
Vertical handoffs in wireless overlay networks, Mobile Networks and Applications	Stemm and Katz	1998	Baltzer Science
Multiband Integrated Antennas for 4G Terminals	David A. Sanchez-Hernandez (Ed.)	2008	Artech House
Beamforming on Mobile Devices: A First Study	Yu Zhong et al.	2011	ACM
Integrated Planar Multiband Antennas for Personal Communication Handsets	Marinez-Vazquez Marta, et al.	Feb. 2006	IEEE
Masters Thesis, Internal Control of a Beamforming Antenna Array for Use in Cellular Phones	Schmidt	May 18, 2010	
Masters Thesis, Directional Antenna Diversity for Mobile Devices: Characterizations and Solutions	Sani	April 2011	
Wireless Communications 2nd Ed.	Molisch	2011	Wiley
MySpace, Facebook and Other Social Networking Sites: Hot Today, Gone Tomorrow?, available at https://knowledge.wharton.upenn.edu/podcast/knowledge-at-whartonpodcast/myspace-facebook-and-other-social-networking-sites-hottoday-gone-tomorrow/		May 3, 2006	Wharton Pod Cast
How Palm’s Treo Capitalized On BlackBerry’s Patent Fracas, available at https://www.wsj.com/articles/SB114308086956305949	Tam	Mar. 23, 2006	Wall Street Journal
The Evolution of UWB and IEEE 802.15.3a for Very High Data Rate WPAN	Mandke et al.	2003	UWB Group
Wireless Communications Principles and Practice 2nd Ed.	Rappaport	2002	Prentice Hall
IEEE Std 802.11b-1999		1999	IEEE
IEEE Specifications – Part 3: Media Access Control (MAC) Bridges 802-15-3a		December 12, 2002	IEEE
IEEE 802.15-03/099r1		March 2003	IEEE

Prior Art	Author	Pub. Date	Publisher
Recent Applications of Ultra Wideband Radar and Communications Systems	Fontana	January 2002	Ultra-Wideband, Short-Pulse Electromagnetics 5
The Evolution of Ultra Wide Band Radio for Wireless Personal Area Networks	Mandke et al.	2003	High Frequency Electronics
Invisible Wires	Pickert	Sep. 2004	New York
MapInfo, Marconi announce availability of deciBel Planner 2.5 and UMTS module, available at https://www.wirelessnetworksonline.com/doc/mapinfo-marconiannounce-availability-of-deci-0001		Jun. 2001	
MapInfo 2000 Annual Report		2001	MapInfo
NIST, Information Security, Electronic Authentication Guideline, Special Publication 800-63		Jun. 2004	NIST
Cisco, Cisco Wi-Fi Becomes Available To Tenants As Part Of Their Commercial Lease		Jun. 2003	Cisco
LightReading, Marconi Teams With ComOpt - Software integration to provide complete wireless planning and automatic optimization solution (Dec. 12, 2002)		Dec. 2002	
IEEE P802.15.3a		2003	IEEE
Universal Manager: Seamless Management of Enterprise Mobile and Non-mobile Devices	Adwankar, Mohan, Vasudevan	2004	IEEE
A Remote Personal Device Management Framework Based on SyncML DM Specifications	Mei, Lukkien	2005	ACM

Samsung additionally identifies and relies on patent or publication references that describe or are otherwise related to the prior art systems identified below, including any patents or publications cited in the claim charts for these systems or elsewhere in these Invalidity Contentions, including Sections V and VI, below. Samsung's investigation into prior art patent and publication references is ongoing, and Samsung reserves the right to identify and rely on additional patent or publication references that are identified through further investigation or discovery. Samsung reserves the right to supplement as further prior art is identified through investigation or discovery.

B. Prior Art Systems and Products

Samsung also contends that the Asserted Claims are invalid based on public knowledge and uses and/or offers for sale or sales of products and services that are prior art under pre-AIA 35 U.S.C. § 102(a) and/or (b) and/or post-AIA 35 U.S.C. §102(a)(1); and/or prior inventions made in the United States by other inventors who had not abandoned, suppressed, or concealed them under pre-AIA 35 U.S.C. § 102(g), and that anticipate or render obvious under 35 U.S.C. § 103 the Asserted Claims.

Prior Art	Date of Public Use, Sale, Offer, or Availability	Offering Entity
Qualcomm QCP-2700	September 9, 1997	Qualcomm
Motorola Timeport	February, 1999	Motorola
Skyworks CX74017	August 20, 2002	Skyworks
Philips UAA3537/87/88	November, 2002	Philips
Infineon PMB7860	March, 2005	Infineon Technologies
Nokia N95	September 26, 2006	Nokia
AirPort Extreme 802.11n	January 9, 2007	Apple
iPhone (Gen. 1)	January 9, 2007	Apple
Blackberry 8320 Curve	May 3, 2007	Blackberry
Trinity Chipset (*e.g.*, XSI 141, XSI 122, XSI 112, XSI 102)	June 24, 2002	XtremeSpectrum
D-Link SmartBeam	January, 2011	D-Link
Ruckus BeamFlex Smart Antenna System	November, 2005	Ruckus Networks
Samsung 5G mmWave Mobile Technology[2]	May, 2013	Samsung
Linksys WRT600 series (*e.g.*, -600N, -610N)	2007-2009	Linksys
Motorola Razr V3, V3i, V3xx	2004-2006	Motorola
Sierra Aircard 500 and 800 series (*e.g.*, Sierra Wireless AirCard 875)	2006-2008	Sierra
WNDR3300 RangeMax Dual Band Wireless-N	2008	NETGEAR

[2] *See* "Samsung Announces World's First 5G mmWave Mobile Technology," (May 13, 2013) available at https://news.samsung.com/global/samsung-announces-worlds-first-5g-mmwave-mobile-technology.

Prior Art	Date of Public Use, Sale, Offer, or Availability	Offering Entity
Bitfone	2004	Hewlett-Packard
Wandering WiFi Wireless Network Management	2006	Omnissa
Wandering WiFi HotSpot Solutions	2003	Omnissa
Microsoft System Center Configuration Manager	2007	Microsoft
SOTI MobiControl	December 13, 2004	SOTI
Blackberry Enterprise Server	2000	Blackberry
Good Mobile Intranet	2006	Blackberry
Good Mobile Mobile Defense	2006	Blackberry
Good Mobile Mobile Messaging	2006	Blackberry
Open Mobile Alliance Device Management	2004	Open Mobile Alliance
Loopt	2007	Green Dot Corp.
Smaato	2007	Verve Group
Digital Envoy	2005	Digital Envoy

Samsung intends to take discovery of third parties, but the process of identifying and engaging with entities that may have prior art from over a decade ago is ongoing. Samsung reserves the right to conduct such discovery and supplement these Invalidity Contentions to include any prior art systems and products that render the asserted claims invalid, if necessary. Samsung may use documentation and publications, physical samples, executable software, or source code as evidence of the relevant functionality of these prior art products or services. Samsung will make available for inspection any physical samples of products, systems, or software listed above, and/or any source code therefor, that it has in its possession or that becomes available during discovery.

V. BACKGROUND: STATE OF THE ART AT TIME OF ALLEGED INVENTION

1. Intelligent Wireless Broadband Relay Patents

The Intelligent Wireless Broadband Relay Patents relate generally to wireless communication systems, specifically broadband network repeaters, ultrawideband (UWB) technologies, and network management functions.

By the claimed priority date of the Intelligent Wireless Broadband Relay patents, August 2003, the demand for high-speed wireless data transmission was rapidly increasing, driving significant research and development in wireless local area networks (WLANs) and personal area networks (WPANs). *See, e.g.*, IEEE 802.11g-2003, "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Amendment 4: Further Higher-Speed Physical Layer Extension in the 2.4 GHz Band," June 2003. The technologies described below were well-understood, publicly documented, and formed the fundamental building blocks available to a person of ordinary skill in the art seeking to design and implement such wireless systems.

2. Smart Antenna Patents

Smart Antenna Patents relate generally to multiband antennas, including antennas that operate in mmWave frequency bands. In particular, the ’763 and ’358 patents relate to multiband antennas or antenna arrays that are tuned using active elements, or passive elements selected by a controller; and the ’625 and ’548 patents relate to steerable multiband antennas or antennas arrays that can be used to direct beams in specific directions to avoid irradiating a user or other structure. These technologies were well-understood and publicly documented by the respective priority dates of the patents.

3. Network Monitoring Patents

The Asserted Claims of the Network Monitoring Patents relate generally to collecting and providing information about the performance and characteristics of wireless devices. By the claimed priority date of these patents, these technologies were well-understood and publicly documented.

The specifications of the Network Monitoring Patents disclose that before the alleged inventions, intermediaries would help make a market between real property owners and telecommunications carriers desirous of placing infrastructure on that property. ’925 Patent at

1:25-2:47. They describe that a variety of information and analytics were used when identifying opportunities and negotiating a deal. *Id*. They also describe the existence of online marketplaces and software tools to facilitate such transactions. *Id*. at 2:35-63. After asserting there was no "public clearinghouse" where carriers could explore information about "tower sites or available real estate or land available to their business needs" (3:24-28, 2:64-3:35), the Patents allege that that business and technical trends, including developments in wireless connectivity (3:37-4:30), will contribute to the demand for an online marketplace specific to telecommunications infrastructure, replacing the existing manual markets (4:31-5:62).

However, such "clearinghouses" were well-known long before the claimed priority date of September 10, 2007. For example, U.S. Pat. App. Pub. 2007/0207800 ("Daley") describes a system for managing and monitoring mobile devices and the mobile networks to which they connect. Daley at Abstract, [0031], [0032], [0038], [0047]-[0056]. Daley provides a client software that configures, updates, and monitors the mobile device, including diagnostics, tracing, debugging, and network performance information. *Id.* at [0035]-[0044]. Such information is uploaded to a server and stored in a database to be made available (via a web page) to a network operator or mobile device user. *See, e.g. id.* at [0044], [0059], [0072], [0072], [0202], [0215], [0242], [249], [252], [0273] [0274], Fig. 14-18. Similarly, U.S. Pat. App. Pub. 2008/0186882 ("Scherzer") describes a system for collecting service quality information for wireless access points into a database that is then shared with devices to facilitate those devices connecting to access points based on the collected measurements. Scherzer at Abstract. Client devices such as cellphones communicate with a server to update and query a database containing measurements of quality and the geographic location of wireless access points. Scherzer at [0068], Fig. 1.

4. Network Repeaters and Relays

The concept of a network repeater (also known as a relay) was a fundamental and elementary building block of network design, long preceding 2003. At its most basic, a repeater is a network device, operating at the physical layer (OSI Layer 1) or data-link layer (OSI Layer 2), that receives a signal and retransmits it to extend the operational range of a network. *See, e.g.*, A. Tanenbaum, *Computer Networks*, 4th Ed., Prentice Hall, 2003, at 264-266.

This concept was ubiquitous. Ethernet hubs were a common form of repeater in wired networks. (Id.). In the wireless domain, cellular networks were inherently designed using repeaters to extend coverage, and "range extenders" or "wireless repeaters" for 802.11 Wi-Fi networks were common commercial products by 2003. The function of such a device—to receive, regenerate, and retransmit a wireless signal to overcome distance or obstructions—was well-understood.

5. Traffic Monitoring, Identification, and Network Security

As networks became more complex, the tools to manage them were likewise mature.

Device Identification and Traffic Monitoring: It was a standard practice to identify devices on a network. At Layer 2, this was accomplished via the unique, hard-coded MAC (Media Access Control) address of a network interface. *See, e.g.*, IEEE Std 802-2001, "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture," 2001. Network administrators routinely used "packet sniffing" software (such as Ethereal, publicly released in 1998) to capture and analyze all traffic on a network segment for troubleshooting and monitoring. Protocols like SNMP (Simple Network Management Protocol), first standardized in 1988 (RFC 1067), were also a long-standing industry standard for managing and monitoring network devices.

Network Security: Security was a critical and well-known concern for all wireless networks, as their broadcast nature made them susceptible to eavesdropping and unauthorized access. The original 802.11 security protocol, WEP (Wired Equivalent Privacy), was known to be critically flawed by 2001. *See, e.g.*, S. Fluhrer, I. Mantin, and A. Shamir, "Weaknesses in the Key Scheduling Algorithm of RC4," Aug. 2001. In response, the Wi-Fi Alliance promulgated WPA (Wi-Fi Protected Access) in April 2003 as an intermediate solution. *See, e.g.,* Wi-Fi Alliance, "Wi-Fi Protected Access: Security for Wireless LANs," Apr. 2003. This history demonstrates that by 2003, concepts of wireless access control, authentication (e.g., via 802.1X), and packet encryption were fundamental design considerations for any new wireless system.

6. Ultrawideband (UWB) Technologies

Ultrawideband was a known wireless technology that utilized very wide channel bandwidths, such as those using 100 MHz or more of spectrum. Unlike traditional "narrowband" systems that transmit on a specific carrier frequency, UWB systems spread energy across this vast bandwidth, often as a series of very short-duration pulses ("impulse radio").

This approach was known to provide several potential advantages, including high data rates at short ranges, low power consumption, and resilience to multipath interference. (See, e.g., J. Foerster et al., "Ultra-Wideband Technology for Short-Range Wireless Communications," *Intel Technology Journal*, Q2 2001). It was also known for its potential in high-resolution radar and precision location-tracking applications. FCC 02-48, *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, at 3, released Feb. 14, 2002.

A seminal event in this field occurred on February 14, 2002, when the U.S. Federal Communications Commission (FCC) issued its *First Report and Order* authorizing the unlicensed commercial use of UWB technology. (*Id.* at 2). This ruling, which defined UWB as systems having a bandwidth greater than 500 MHz or more than 20% of the center frequency, authorized UWB operation in the 3.1 to 10.6 GHz frequency band. This 2002 ruling immediately spurred significant public and commercial research and development to create UWB-based products, and standardization efforts were already underway by 2003, most notably in the IEEE 802.15.3a task group for high-rate WPANs. *See, e.g.*, IEEE 802.15.3a, Call for Proposals, Jan. 2003. However, contrary to the FCC defining ultrawideband as larger than 500 MHz,[3] the patents define "ultrawideband" as "any type of electromagnetic signals that have an instantaneous or overall occupied bandwidth of 100 MHz or more and that are used to communicate or to position-locate between 2 or more devices. Such wide bandwidths … generally implies a proportionally higher noise floor power level, which requires UWB devices generally to be physically closer in distant to each other in order to obtain a sufficiently strong signal to noise ratio (SNR)…. Thus, repeaters will become necessary to connect devices over greater distances than the range of a single UWB device." '194 Patent at 3:57-4:7.

7. OFDM and MIMO Systems

Alongside UWB, other advanced techniques for achieving high-throughput wireless communication were mature and widely adopted at least by 2003.

Orthogonal Frequency-Division Multiplexing (OFDM) was a well-understood and heavily implemented digital modulation scheme. It worked by splitting a single high-speed data stream into many lower-speed sub-streams, which were then transmitted in parallel on closely spaced, orthogonal sub-carrier frequencies. This technique was known to be highly effective at mitigating multipath interference, a common problem in indoor wireless environments. (*See, e.g.*, R. van Nee & R. Prasad, *OFDM for Wireless Multimedia Communications*, Artech House, 2000). By 2003, OFDM was already the established foundation for mainstream standards like IEEE 802.11a (1999), IEEE 802.11g (ratified June 2003), and ADSL. Its application to UWB systems (as Multi-Band OFDM, or "MB-OFDM") was a prominent and publicly debated proposal in

[3] FCC, First Report and Order 02-48. February 2002. The FCC published this formal definition in April 2002, prior to the earliest priority date of the patents.

standardization bodies by 2003. *See, e.g.*, A. Batra et al., "Multi-band OFDM: a new approach for UWB," *IEEE 802.15.3a presentation*, July 2003.

Multiple-Input, Multiple-Output (MIMO) was another advanced transmission technique known at the time. MIMO systems used multiple antennas at both the transmitter and receiver to exploit the spatial dimension, thereby increasing data throughput (spectral efficiency) and link reliability. The fundamental principles of MIMO were well-established in the art. *See*, *e.g.*, G. J. Foschini, "Layered space-time architecture for wireless communication in a fading environment when using multi-element antennas," *Bell Labs Technical Journal*, Autumn 1996). By 2003, it was widely recognized as the next major evolution for high-speed systems like Wi-Fi (eventually standardized as 802.11n). Furthermore**,** the paper “A review of antennas and propagation for MIMO wireless communications” (2004) presented a review of the application of antennas in MIMO wireless communications, acknowledging that MIMO systems were well known and had already “demonstrated the potential for increased capacity in rich multipath environments [].” The same paper referenced another “notable study where several different array types were explored for both the base station and the mobile unit in an outdoor environment [].” *Id.*

8. Multiband Antennas

Since Tesla and Marconi first successfully demonstrated the transmission of wireless signals in the late nineteenth century using electromagnetic waves at specific frequencies, wireless communications have evolved tremendously. While other types of waves can be used to carry information, the utilization of radio waves for the purposes of transmitting signals is the predominant modality in modern wireless devices due to energy efficiency, propagation speed, transmission distance, and available bandwidth. Wireless devices utilize an antenna to generate the electric and magnetic fields (signals) at a given frequency, and these signals then travel (propagate) out in space to eventually arrive at a receiving antenna that is used to detect the signals and the information those waves are carrying.

Antennas are necessary to facilitate energy-efficient communication. At the transmit device, antennas convert the electrical signals encoded with data/information into electromagnetic waves that are intended to be received by a desired/target device or devices (receivers). Likewise, at the receiving device, an antenna is necessary to detect efficiently the propagating electromagnetic signals and convert them to electric signals and process them to determine the encoded data. The antenna's energy conversion efficiency (electric to electromagnetic) is related to various physical characteristics, and it will be more and less efficient at various frequencies (bands) across the spectrum. Therefore, it is important to match the antenna's resonances (range of frequencies where it most efficiently couples the electric to electromagnetic energy) to the frequency bands used to transmit and receive the signals. If the transmitter and receiver are not using the same frequency band, then the signals will not be detected, and the data will not be communicated/sent between the devices. These fundamental characteristics of antennas were well known before the priority dates of the Smart Antenna Patents, including in textbooks such as *Antenna Theory: Analysis and Design* (Balanis 1997) and *Modern Digital and Analog Communication Systems* (Lathi 1983).

The same context is true for various wireless communication protocols used by devices such as LTE (700 MHz–2.5 GHz), 5G NR (410 MHz–52 GHz), Wi-Fi (2.4, 5, and 6 GHz), NFC (13.56 MHz), UWB (3.1–10.6 GHz), Bluetooth/Bluetooth Low Energy (2.4 GHz ISM band), etc. The table below, reproduced from *Multiband Integrated Antennas for 4G Terminals* (2008), identifies some of the bands associated with technologies that were in use as of 2008, before the priority dates of the Smart Antenna Patents:

Table 1.1 Wireless Communications Bands and Their Frequency Designations

Band Designation	*Alternate Description(s)*	*Transmit Frequency (Uplink) (MHz)*	*Receive Frequency (Downlink) (MHz)*
GSM 800 or GSM 850	AMPS DAMPS	824–849	869–894
P-GSM 900	Primary GSM 900	890–915	935–960
E-GSM 900	Extended GSM 900	880–915	925–960
GSM-R 900	Railways GSM 900	876–915	921–960
T-GSM 900	TETRA GSM 900	870.4–915	915.4–921
GPS		N/A	1,565.42–1,585.42
GSM 1800	DCS 1800	1,710–1785	1,805–1880
GSM 1900	PCS 1900	1,850–1910	1,930–1990
UMTS		1,885–2,025 1,710–1,755 (US)	2,110–2,200 2,110–2,155 (US)
802.11 b/g/n	Wi-Fi; ISM	2.4 – 2.4835 GHz ISM	
802.11 a/h/j	Wi-Fi; UNII	5.15–5.35 GHz (UNII) 5.47–5.725 GHz 5.725–5.825 GHz (ISM/UNII) 4.9–5 GHz (Japan) 5.03–5.091 GHz (Japan)	
802.15.4	Zigbee	898 MHz 915 MHz 2.4-GHz ISM	
802.15.1 1a	Bluetooth	2.4–2.4835-GHz ISM	
802.15.3	UWB	Typically > 500 MHz bands within the 3.1 – 10.6-GHz spectrum	
802.16	Wi-Max	Various bands within the 2–11-GHz spectrum. Mobile Networks: 2–6 GHz Fixed Network: < 11 GHz	

Given the operational frequency band associated with a specific protocol, very early antennas were designed and developed to operate efficiently at that band only, but not at other bands. Thus, very early devices wishing to support communication using multiple wireless protocols, at the various frequency bands, required multiple antennas—one dedicated for each band/protocol. Years before the Smart Antenna Patents, the need for a single antenna with the capability to support multiple frequency bands was already well known in the art prior. For example, over a decade before the Smart Antenna Patents, U.S. Patent No. 5,794,145 ("Milan") recognized that "[i]n some environments, it is necessary that the mobile device communicate with two or more cellular communication systems and another radio communication system," and disclosed a multiband antenna capable of such operation. In particular, the need to provide mobile devices subject to size constraints was a driving force to overcome the technical challenges associated with developing multiband antennas, as using multiple antennas to communicate on different frequency bands necessarily increased the footprint of a mobile device. From the mid-to-late 1990s through early 2000s, devices continued to miniaturize and researchers continued to refine both design and manufacturing processes. For example, in "Integrated Planar Multiband Antennas for Personal Communication Handsets" (2006), the author recognized that "[t]he constant evolution of the mobile phone market determines more stringent constraints for terminal antenna design, as the size of the terminals shrinks rapidly, while the functionalities of the handsets are ever increased," which led to "[m]ultiband operation" becoming "almost a common standard." Indeed, the author acknowledged that there was already a "preferred antenna solution to deal with multistandard" by using "radiating patches with multiple resonances covering different bands, which are easily adapted to the shape of the handset, and can therefore be integrated within the back cover."

9. Multiband Transceivers

Like multiband antennas, multiband transceivers were well known and in use before the Smart Antenna Patents. For example, the '763 patent itself acknowledges that "it is possible to purchase multi-band transceiver chips for popular wireless standards." This is confirmed by other contemporaneous materials. As a further example, WO 2005/029720 ("Leenaerts") disclosed that "multi-band transceivers and accordingly multi-band receivers and multi-band transmitters" were in use and available, and offered the advantage of being able to "work with signals situated in different bands and being adapted to different communication protocols."

10. Antenna Tuning

In order to optimize energy coupling to free space propagation, the antenna should optimally possess a resonance at the frequency associated with the radio waves being transmitted. This is true regardless of the antenna size, but small antennas for mobile devices in particular must mitigate a "high VSWR [Voltage Standing Wave Ratio] and mismatch loss by first tuning the antenna to resonance and then impedance matching the antenna to the desired characteristic impedance. *Multiband Integrated Antennas for 4G Terminals* (2008). It was well known in the prior art to use active and passive techniques to modify antenna resonance frequencies and the bandwidth at those resonance frequencies. For example, years before the Smart Antenna Patents, "Active Tuning and Miniaturization of Microstrip Antennas" (2002) described using "varactor diodes … as capacitive loads for the antenna" to provide "an added feature of tunability" by "varying the biasing voltage of the varactors," allowing "resonant frequency [to] be varied over a wide range."

Antenna tuners were also well known and widely used to tune antenna to a desired resonant frequency and impedance match the antenna to a desired characteristic impedance. For example, U.S. Pat. No. 8,583,065 ("Ben-Bassat") disclosed that "antenna tuning circuits are in widespread use today" and used to "allow[] [an antenna] to operate over a wide range of frequencies" and adjust the impedance of the antenna to "minimize[] the SWR [standing wave ratio] and maximize[] power transfer through the antenna system."

11. Steerable Antennas and Beamforming/Beamsteering

At the same time that multiband antennas were being developed to support multiple frequency bands for different communication technologies, the field of mobile communications was being expanded to use higher frequency bands to accommodate an ever-increasing demand and an ever-increasing number of devices competing for bandwidth. These efforts extended radio communications into the mmWave range for every day use. For example, in 2012, Samsung inventors wrote that because "demands for traffic have accelerated due to increased demands for smartphones and tablet Personal Computers (PCs) and the resulting rapid growth of applications requiring a large amount of traffic, it is difficult to satisfy the soaring demands for wireless data simply by increasing spectral efficiency." *See* U.S. Patent No. 9,362,994 ("Seol"); Korean Pat. App. 10-2012-0094630. These inventors noted that "[t]o avert the problem, recent interest has focused on a millimeter-wave wireless communication system." *Id.* However, "wireless communication … provided in a millimeter-wave frequency band" also had well-known challenges, namely, that "propagation loss, such as path loss and reflection loss, is increased in view of the spectral nature of the millimeter-wave frequency band and the resulting shortened propagation distance reduces service coverage." *Id*.

Conveniently, for decades those in the field had developed and refined beamforming and beamsteering technologies, which was a well-understood and obvious solution for "mitigating the path loss of waves ... [and] thus increasing the propagation distance of the waves" in the millimeter-wave frequency band. *Id*. Beamforming (also known as spatial filtering) was an active topic of research and application since the late 19th century. An early version of a beamformer was the Perrin array (designed by and named after Sergeant Jean Perrin) deployed during WWI. The early days of beamforming were dominated by acoustic (in air and underwater) applications primarily until the mid-20th century when radio antennas came on to the scene during WWII.

As explained in *Array Signal Processing: Concepts and Techniques* (1993), the term "beamforming" refers to "a wide variety of array processing algorithms that, by some means, focus the array's signal-capturing abilities in a given direction." "Based on the analogy of a flashlight, the mainlobe of an array's directivity pattern is called a beam[]. Just as one might point a telescope or a radar dish, a beamforming algorithm 'points' the array's spatial filter toward desired directions but algorithmically rather than physically…the signal processing algorithms developed for these conventional beamforming algorithms date from the early days of array processing and are well understood." *Id.*

Beamsteering and beamforming were typically implemented using antenna arrays comprising multiple antenna elements, including for decades before the priority dates of the Smart Antenna Patents. These techniques were applied to many areas of technology. A number of different well-known techniques using antenna arrays were described in "Beamforming: a versatile approach to spatial filtering" as early as 1998. Figure 2.1 from that publication, reproduced below, displays two beamforming receiver structures; the latter is a broadband configuration; Figure 3.1 from the same publication, reproduced below, shows the 3D sensing of a planar array; and Table 1.1 from the publication, also reproduced below, presents some common areas of application of arrays at the time.

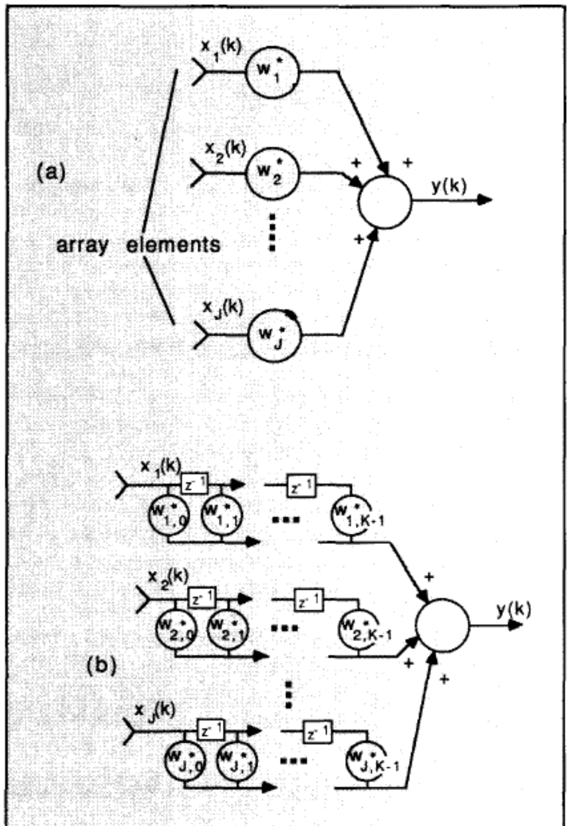

Figure 2.1 A beamformer forms a linear combination of the sensor outputs. In (a), sensor outputs are each multiplied by a complex weight and then summed (for notational convenience it is conventional to apply conjugates of the defined weights). This beamformer is typically used with narrowband signals. A common broadband beamformer is illustrated in (b).

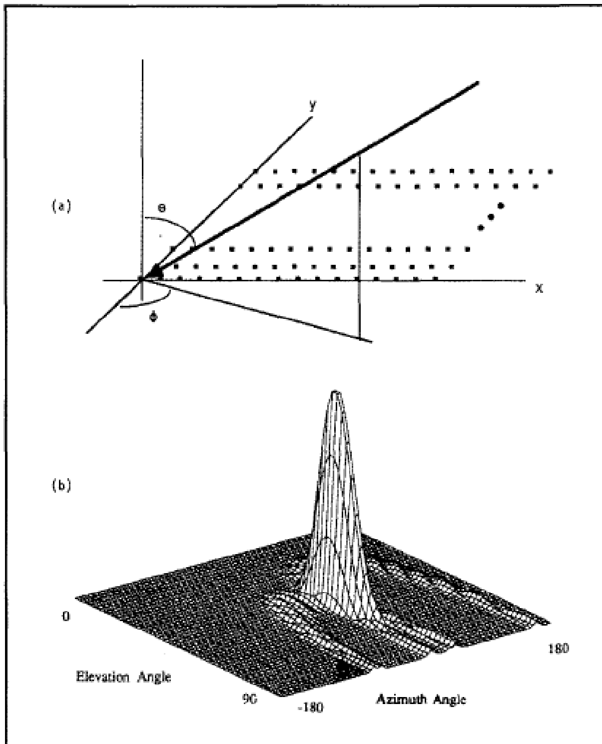

Figure 3.1 Part (a) depicts the array configuration and defines azimuth angle Φ and elevation angle Θ for a 16 by 16 rectangular planar array of sensors. The sensors are spaced at one-half wavelength along the x and y axes. The narrowband magnitude squared response is illustrated in (b) as a function of azimuth and elevation angles. The array is phase shift steered to $\Phi = 30°$ and $\Theta = 45°$. The weights applied to each sensor channel are the product of x axis and y axis Dolph-Chebyshev taper weights.

TABLE 1.1

ARRAYS AND BEAMFORMERS PROVIDE AN EFFECTIVE AND VERSATILE MEANS OF SPATIAL FILTERING. THIS TABLE LISTS A NUMBER OF APPLICATIONS OF SPATIAL FILTERING, GIVES EXAMPLES OF ARRAYS AND BEAMFORMERS, AND PROVIDES A FEW KEY REFERENCES.

Application	Description	References
RADAR	phased-array RADAR; air traffic control; synthetic aperture RADAR	Brookner [1985]; Haykin [1985]; Munson et al. [1983]
SONAR	source localization and classification	Knight et al. [1981]; Owsley [1985]
Communications	directional transmission and reception; sector broadcast in satellite communications	Mayhan [1976]; Compton [1978]; Adams et al. [1980]
Imaging	ultrasonic; optical; tomographic	Macovski [1983]; Pratt [1978]; Kak [1985]
Geophysical Exploration	earth crust mapping; oil exploration	Justice [1985]
Astrophysical Exploration	high resolution imaging of the universe	Readhead [1982]; Yen [1985
Biomedical	fetal heart monitoring; tissue hyperthermia; hearing aids	Widrow et al. [1975]; Gee et al. [1984]; Peterson et al. [1987]

The fundamental concepts of using multiple antenna elements (acoustic or RF) to form an array and spatially focus the transmit signal (transmit beam) or spatially filter the received signal (receive beam) have not changed significantly over the years because it was the well-understood physics that permitted the original construction of the arrays. In the 1960s, adaptive beamforming became an active area of research, development, and application and provided algorithms to automatically update weights for the elements of a given array to permit it to either optimize transmit/receive operations and/or track signals of interest. As commercial wireless devices became more ubiquitous through the 1970s – 1990s, along with the continued advancement of signal processing platforms, such as digital signal processers (DSPs), the well-known beamforming techniques could be transitioned beyond resource-rich environments (such as base stations) to smaller, more resource constrained platforms (such as mobile devices).

Given the maturity of beamforming for several decades before the Smart Antenna Patents, engineers and standards bodies, such as IEEE, were already integrating and proposing the implementation of beam steering in mobile wireless devices. For example, in the paper "Beamforming on Mobile Devices: A First Study" (2011), the authors demonstrated that "beamforming is already feasible on mobile devices in terms of form factor, device mobility and power efficiency." In an even earlier patent, U.S. Patent No. 7,308,285, phase shifts were used to shape signals generated by phase antenna arrays to create radiation patterns that targeted certain directions while avoiding others. A phased array is a system comprising many small radiating elements whose signals are combined with electronically controlled phase shifts to form a steerable beam, without physically steering the array itself. By adjusting the relative phase of each element, all the elements work together to form one composite radiation pattern with increased power radiating in a desired direction while reducing it in other directions (e.g., through destructive interference).

12. Sensor-based Detection for Beamforming

To complement the use of beamforming and beamsteering, researchers had long recognized that steering algorithms should be informed by the external environment (i.e., an understanding of what objects or structures the beam should be steered around). Related work beginning in the late to early 2000s investigated various sensors associated with mobile devices explored the application of sensing the device's orientation and/or the orientation of the user with respect to the device and the local environment. A common sensor used for orientation sensing is an accelerometer which provides 3D acceleration information. For example, in "Using gravity to estimate accelerometer orientation" (2003), the author explored how to determine device orientation when you do not know where on the body the mobile device may be carried, as illustrated in Figure 1 from that paper (reproduced below).

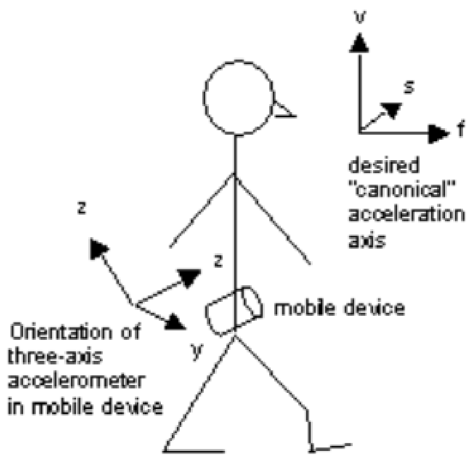

Fig. 1. Relevant coordinate systems

Similarly, in "Which Way Am I Facing: Inferring Horizontal Device Orientation from an Accelerometer Signal" (2009), the authors presented "a method to infer the orientation of a mobile device carried in a pocket from the acceleration signal acquired when the user is walking," as illustrated in Figure 2 from that paper (reproduced below).

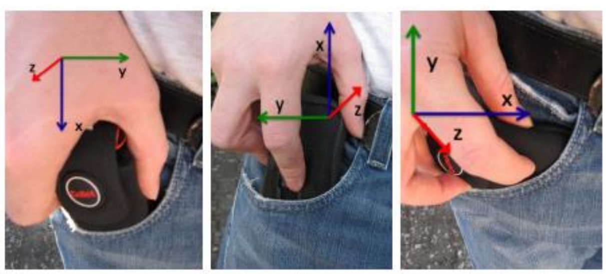

Figure 2. The Mtx motion sensor in the phone casing placed in the pocket depicted with the different axis orientations.

The integration of additional sensors and multiple antennas in mobile devices throughout the early 2000s into the early 2010s led to predictable research efforts in combining sensor-based detection to continue to improve wireless communication link performance and mitigation of human effects, including in combination with beamsteering. For example, in 2011, a masters student at Rice University conducted a beamsteering experiment using an array of passive directional antennas, and to obtain device orientation information "collect[ed] accelerometer and compass readings along with network usage information" from smartphones in order to "estimate the orientation and rotation of the smartphones during wireless usage." *See* "Masters Thesis: Directional Antenna Diversity for Mobile Devices: Characterizations and Solutions (2011). Similarly, in 2010, a masters student at Oregon State University presented a solution that used "accelerometer sensor inputs" and "return[ed] the progressive phase shifts required to direct the radio beam in an optimal direction." *See* "Internail Control of a Beamforming Antenna Array for Use in Cellular Phones (2010).

VI. INVALIDITY UNDER 35 U.S.C. §102 AND §103

A. Anticipation

Samsung contends that the Asserted Claims are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references charted in Exhibits 194-A01-A12 ("194 Invalidity Charts"), 754-A01-A12 ("754 Invalidity Charts"), 337-A01-A12 ("337 Invalidity Charts"), 999-A01-A12 ("999 Invalidity Charts"), 783-A01-A12 ("783 Invalidity Charts"), 763-A01-A16 ("763 Invalidity Charts"), 358-A01-A16 ("358 Invalidity Charts"), 625-A01-A16 ("625 Invalidity Charts"), 548-A01-A16 ("548 Invalidity Charts"), 794-A01-A10 ("794 Invalidity Charts"), 925-A01-A10 ("925 Invalidity Charts"), and 700-A01-A10 ("700 Invalidity Charts") (collectively, "Invalidity Charts"):

'194 Exhibit No.	**Prior Art**
194-A01	U.S. Pat. No. 6,584,080 ("Ganz '080")
194-A02	U.S. Pat. Pub. No. 2002/0028655("Rosener '655")
194-A03	U.S. Pat. Pub. No. 2004/0160928 ("Perlman '928")
194-A04	U.S. Pat. No. 6,188,496 ("Krishna '496")
194-A05	U.S. Pat. No. 7,209,523 ("Larrick '523")
194-A06	U.S. Pat. No. 4,056,780 ("Faulkner '780")
194-A07	U.S. Pat. No. 6,497,656 ("Evans '656")
194-A08	U.S. Pat. Pub. No. 2003/0120809 ("Bellur '809")
194-A09	U.S. Pat. No. 8,125,940 ("Perlman '940")

194-A10	U.S. Pat. Pub. No. 2005/0201326 (“Lakkis ’326”)
194-A11	U.S. Pat. Pub. No. 2004/0048574 (“Walker ’574”)
194-A12	XtremeSpectrum Trinity Chipset

’754 Exhibit No.	**Prior Art**
754-A01	U.S. Pat. No. 6,584,080 (“Ganz ’080”)
754-A02	U.S. Pat. Pub. No. 2002/0028655(“Rosener ’655”)
754-A03	U.S. Pat. Pub. No. 2004/0160928 (“Perlman ’928”)
754-A04	U.S. Pat. No. 6,188,496 (“Krishna ’496”)
754-A05	U.S. Pat. No. 7,209,523 (“Larrick ’523”)
754-A06	U.S. Pat. No. 4,056,780 (“Faulkner ’780”)
754-A07	U.S. Pat. No. 6,497,656 (“Evans ’656”)
754-A08	U.S. Pat. Pub. No. 2003/0120809 (“Bellur ’809”)
754-A09	U.S. Pat. No. 8,125,940 (“Perlman ’940”)
754-A10	U.S. Pat. Pub. No. 2005/0201326 (“Lakkis ’326”)
754-A11	U.S. Pat. Pub. No. 2004/0048574 (“Walker ’574”)
754-A12	XtremeSpectrum Trinity Chipset

’337 Exhibit No.	**Prior Art**
337-A01	U.S. Pat. No. 6,584,080 (“Ganz ’080”)
337-A02	U.S. Pat. Pub. No. 2002/0028655(“Rosener ’655”)
337-A03	U.S. Pat. Pub. No. 2004/0160928 (“Perlman ’928”)
337-A04	U.S. Pat. No. 6,188,496 (“Krishna ’496”)
337-A05	U.S. Pat. No. 7,209,523 (“Larrick ’523”)
337-A06	U.S. Pat. No. 4,056,780 (“Faulkner ’780”)
337-A07	U.S. Pat. No. 6,497,656 (“Evans ’656”)
337-A08	U.S. Pat. Pub. No. 2003/0120809 (“Bellur ’809”)
337-A09	U.S. Pat. No. 8,125,940 (“Perlman ’940”)
337-A10	U.S. Pat. Pub. No. 2005/0201326 (“Lakkis ’326”)
337-A11	U.S. Pat. Pub. No. 2004/0048574 (“Walker ’574”)
337-A12	XtremeSpectrum Trinity Chipset

’999 Exhibit No.	**Prior Art**
999-A01	U.S. Pat. No. 6,584,080 (“Ganz ’080”)
999-A02	U.S. Pat. Pub. No. 2002/0028655(“Rosener ’655”)
999-A03	U.S. Pat. Pub. No. 2004/0160928 (“Perlman ’928”)
999-A04	U.S. Pat. No. 6,188,496 (“Krishna ’496”)
999-A05	U.S. Pat. No. 7,209,523 (“Larrick ’523”)
999-A06	U.S. Pat. No. 4,056,780 (“Faulkner ’780”)
999-A07	U.S. Pat. No. 6,497,656 (“Evans ’656”)
999-A08	U.S. Pat. Pub. No. 2003/0120809 (“Bellur ’809”)
999-A09	U.S. Pat. No. 8,125,940 (“Perlman ’940”)
999-A10	U.S. Pat. Pub. No. 2005/0201326 (“Lakkis ’326”)
999-A11	U.S. Pat. Pub. No. 2004/0048574 (“Walker ’574”)
999-A12	XtremeSpectrum Trinity Chipset

’783 Exhibit No.	Prior Art
783-A01	U.S. Pat. No. 6,584,080 (“Ganz ’080”)
783-A02	U.S. Pat. Pub. No. 2002/0028655(“Rosener ’655”)
783-A03	U.S. Pat. Pub. No. 2004/0160928 (“Perlman ’928”)
783-A04	U.S. Pat. No. 6,188,496 (“Krishna ’496”)
783-A05	U.S. Pat. No. 7,209,523 (“Larrick ’523”)
783-A06	U.S. Pat. No. 4,056,780 (“Faulkner ’780”)
783-A07	U.S. Pat. No. 6,497,656 (“Evans ’656”)
783-A08	U.S. Pat. Pub. No. 2003/0120809 (“Bellur ’809”)
783-A09	U.S. Pat. No. 8,125,940 (“Perlman ’940”)
783-A10	U.S. Pat. Pub. No. 2005/0201326 (“Lakkis ’326”)
783-A11	U.S. Pat. Pub. No. 2004/0048574 (“Walker ’574”)
783-A12	XtremeSpectrum Trinity Chipset

’763 Exhibit No.	Prior Art
763-A01	European Pat. App. No. 1,914,835 (“Wen ’835”)
763-A02	U.S. Pat. Pub. No. 2008/0030411 (“Wen ’411”)
763-A03	U.S. Pat. Pub. No. 2004/0125027 (“Rubinshteyn ’027”)
763-A04	U.S. Pat. Pub. No. 2008/0233888 (“Saliga ’888”)
763-A05	U.S. Pat. No. 5,926,751 (“Vlahos ’751”)
763-A06	U.S. Pat. No. 7,489,914 (“Govind ’914”)
763-A07	U.S. Patent No. 7,786,819 (“Ella ’819”)
763-A08	U.S. Pat. Pub. No. 2006/0281423 (“Caimi ’423”)
763-A09	U.S. Pat. Pub. No. 2005/0007291 (“Fabrega-Sanchez ’291”)
763-A09	U.S. Pat. Pub. No. 2005/0007291 (“Fabrega-Sanchez ’291”)
763-A10	U.S. Pat. Pub. No. 2004/0095280 (“Poilasne”)
763-A11	U.S. Pat. Pub. No. 2009/0284416 (“Quinn”)
763-A12	Nokia N95
763-A13	Apple AirPort Extreme 802.11n
763-A14	Linksys WRT600 series (e.g., -600N, -610N)
763-A15	Sierra Aircard 800 series (e.g., Sierra Wireless AirCard 875)
763-A16	NETGEAR WNDR3300 RangeMax Dual Band Wireless-N

’358 Exhibit No.	Prior Art
358-A01	European Pat. App. No. 1,914,835 (“Wen ’835”)
358-A02	U.S. Pat. Pub. No. 2008/0030411 (“Wen ’411”)
358-A03	U.S. Pat. Pub. No. 2004/0125027 (“Rubinshteyn ’027”)
358-A04	U.S. Pat. Pub. No. 2008/0233888 (“Saliga ’888”)
358-A05	U.S. Pat. No. 5,926,751 (“Vlahos ’751”)
358-A06	U.S. Pat. No. 7,489,914 (“Govind ’914”)
358-A07	U.S. Patent No. 7,786,819 (“Ella ’819”)
358-A08	U.S. Pat. Pub. No. 2006/0281423 (“Caimi ’423”)
358-A09	U.S. Pat. Pub. No. 2005/0007291 (“Fabrega-Sanchez ’291”)

358-A10	U.S. Pat. Pub. No. 2004/0095280 ("Poilasne")
358-A11	U.S. Pat. Pub. No. 2009/0284416 ("Quinn")
358-A12	Nokia N95
358-A13	Apple AirPort Extreme 802.11n
358-A14	Linksys WRT600 series (e.g., -600N, -610N)
358-A15	Sierra Aircard 800 series (e.g., Sierra Wireless AirCard 875)
358-A16	NETGEAR WNDR3300 RangeMax Dual Band Wireless-N

'625 Exhibit No.	**Prior Art**
625-A01	U.S. Pat. Pub. No. 2011/0250928 ("Schlub '928")
625-A02	WIPO Pub. No. WO 2012/176217 ("Prasad '217")
625-A03	WIPO Pub. No. WO 2013/0237272 ("Prasad '272")
625-A04	U.S. Pat. No. 8,744,418 ("Novet '418")
625-A05	WIPO Pub. No. WO 2014/194455 ("Yin '455")
625-A06	U.S. Pat. Pub. No. 2003/0193446 ("Chen '446")
625-A07	U.S. Pat. No. 9,362,994 ("Seol '994")
625-A08	U.S. Pat. No. 7,308,285 ("Nelson '285")
625-A09	U.S. Pat. Pub. No. 2013/0217450 ("Kanj '450")
625-A10	U.S. Pat. Pub. No. 2009/0295648 ("Dorsey '648")
625-A11	U.S. Pat. Pub. No. 2006/0097918 ("Oshiyama '625")
625-A12	U.S. Pat. No. 8,462,002 ("Hyde '002")
625-A13	Inertial Control of a Beamforming Antenna Array for Use in Cellular Phones ("Schmidt")
625-A14	BeamFlex
625-A15	ClientLink
625-A16	SmartBeam

'548 Exhibit No.	**Prior Art**
548-A01	U.S. Pat. Pub. No. 2011/0250928 ("Schlub '928")
548-A02	WIPO Pub. No. WO 2012/176217 ("Prasad '217")
548-A03	WIPO Pub. No. WO 2013/0237272 ("Prasad '272")
548-A04	U.S. Pat. No. 8,744,418 ("Novet '418")
548-A05	WIPO Pub. No. WO 2014/194455 ("Yin '455")
548-A06	U.S. Pat. Pub. No. 2003/0193446 ("Chen '446")
548-A07	U.S. Pat. No. 8,462,002 ("Hyde '002")
548-A08	U.S. Pat. Pub. No. 2013/0217450 ("Kanj '450")
548-A09	U.S. Pat. Pub. No. 2009/0295648 ("Dorsey '648")
548-A10	U.S. Pat. No. 9,362,994 ("Seol '994")
548-A11	U.S. Pat. No. 7,308,285 ("Nelson '285")
548-A12	U.S. Pat. Pub. No. 2006/0097918 ("Oshiyama '625")
548-A13	Inertial Control of a Beamforming Antenna Array for Use in Cellular Phones ("Schmidt")
548-A14	BeamFlex
548-A15	ClientLink

548-A16	SmartBeam

’794 Exhibit No.	Prior Art
794-A01	U.S. Pat. Pub. No. 2007/0207800 (“Daley ’800”)
794-A02	U.S. Pat. Pub. No. 2008/0186882 (“Scherzer ’882”)
794-A03	U.S. Pat. Pub. No. 2008/0305747 (“Aaron ’747”)
794-A04	U.S. Pat. Pub. No. 2003/0216953 (“Dawson ’953”)
794-A05	U.S. Pat. Pub. No. 2007/0178911 (“Baumeister ’911”)
794-A06	U.S. Pat. Pub. No. 2007/0111748 (“Risbood ’748”)
794-A07	U.S. Pat. Pub. No. 20070173237A1 (“Roundtree ’237”)
794-A08	Bitfone
794-A09	SOTI
794-A10	Blackberry Enterprise Server

’925 Exhibit No.	Prior Art
925-A01	U.S. Pat. Pub. No. 2007/0207800 (“Daley ’800”)
925-A02	U.S. Pat. Pub. No. 2008/0186882 (“Scherzer ’882”)
925-A03	U.S. Pat. Pub. No. 2008/0305747 (“Aaron ’747”)
925-A04	U.S. Pat. Pub. No. 2003/0216953 (“Dawson ’953”)
925-A05	U.S. Pat. Pub. No. 2007/0178911 (“Baumeister ’911”)
925-A06	U.S. Pat. Pub. No. 2007/0111748 (“Risbood ’748”)
925-A07	U.S. Pat. Pub. No. 20070173237A1 (“Roundtree ’237”)
925-A08	Bitfone
925-A09	SOTI
925-A10	Blackberry Enterprise Server

’700 Exhibit No.	Prior Art
700-A01	U.S. Pat. Pub. No. 2007/0207800 (“Daley ’800”)
700-A02	U.S. Pat. Pub. No. 2008/0186882 (“Scherzer ’882”)
700-A03	U.S. Pat. Pub. No. 2008/0305747 (“Aaron ’747”)
700-A04	U.S. Pat. Pub. No. 2003/0216953 (“Dawson ’953”)
700-A05	U.S. Pat. Pub. No. 2007/0178911 (“Baumeister ’911”)
700-A06	U.S. Pat. Pub. No. 2007/0111748 (“Risbood ’748”)
700-A07	U.S. Pat. Pub. No. 20070173237A1 (“Roundtree ’237”)
700-A08	Bitfone
700-A09	SOTI
700-A10	Blackberry Enterprise Server

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an Asserted Claim, Samsung reserves the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent to the art or obvious to a person of ordinary skill in the art.

Additional prior art has not been charted, but is still relevant to the anticipation of the Asserted Patents, including without limitation as evidence of the state of the art at the alleged time of invention, defining the relevant POSITA, and demonstrating how a POSITA would understand the charted prior art. This includes, for example, prior art identified in Sections IV, V, and VI of these cover pleadings and in the accompanying exhibits. For example, each of the above-identified charts further incorporates by the descriptions of prior art technologies referenced in the above-identified prior art. *See* Exhibits 194-B, 754-B, 337-B, 999-B, 783-B, 763-B, 358-B, 625-B, 548-B, 794-B, 925-B, and 700-B (collectively, "Obviousness Charts").

Samsung reserves the right to amend these Invalidity Contentions to assert these references depending on the infringement positions Plaintiff may take as the case proceeds and/or on Samsung's ongoing investigation.

B. Obviousness

Each anticipatory prior art reference disclosed in the preceding section as invalidating an Asserted Claim also renders that claim obvious, either alone or in combination with other prior art, as demonstrated in the claim charts appended as Exhibits 194-A01-A12, 754-A01-A12, 337-A01-A12, 999-A01-A12, 783-A01-A12, 763-A01-A16, 358-A01-A16, 625-A01-A16, 548-A01-A16, 794-A01-A10, 925-A01-A10, and 700-A01-A10. To the extent any limitation is deemed not to be exactly met by an item of prior art listed above and in the appended Exhibits, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. The item of prior art would, therefore, render the relevant claims invalid for obviousness under 35 U.S.C. § 103.

In addition, the references identified above render one or more asserted claims of the Asserted Claims obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. To the extent any of the references in any of the Invalidity Charts is deemed to lack a particular claim limitation, that reference can be combined with the disclosure identified for that limitation in the corresponding Obviousness Chart to render that limitation and the claim as a whole obvious. Samsung may also show that such an allegedly lacking limitation is rendered obvious by the disclosure of any of the other references identified for that limitation in Exhibits 194-A01-A12, 754-A01-A12, 337-A01-A12, 999-A01-A12, 783-A01-A12, 763-A01-A16, 358-A01-A16, 625-A01-A16, 548-A01-A16, 794-A01-A10, 925-A01-A10, and 700-A01-A10.

Additional prior art, including material referenced herein or produced in conjunction with these Invalidity Contentions, that has not been charted is nonetheless relevant to the obviousness of the Asserted Patents, including without limitation as evidence of the state of the art at the alleged time of invention, defining the relevant POSITA, and demonstrating how a POSITA would understand the charted prior art. This includes prior art identified in Sections IV and V of these cover pleadings and in the accompanying exhibits.

Samsung also reserves the right to amend or supplement these contentions regarding anticipation or the obviousness of the Asserted Claims in view of further information from Plaintiff, or information discovered during discovery. Plaintiff has not identified what elements or combinations it alleges were not known to one of ordinary skill in the art at the time. Therefore, for any claim limitation that Plaintiff alleges is not disclosed in a particular prior art reference, Samsung reserves the right to assert that any such limitation is either inherent in the disclosed reference or obvious to one of ordinary skill in the art at the time in light of the same, or that the limitation is disclosed in another of the references disclosed above and in combination would have rendered the asserted claim obvious.

C. Motivation to Combine

Samsung intends to present expert evidence demonstrating the motivation to combine of one of ordinary skill in the art. Such facts and evidence are expert testimony and will be presented in the experts' reports according to the schedule of the Court. Samsung incorporates by reference its forthcoming expert reports and any testimony of its experts presented according to the Court's schedule. The motivation to combine or modify the above items of prior art are present, for example, in the references themselves, the Asserted Patents, references cited on the face of the Asserted Patents, the knowledge, skill, or creativity of one of ordinary skill in the art, the prior art as a whole, and/or the nature of the problems allegedly addressed by the Asserted Patents. The law requires no showing of a specific motivation to combine or modify prior art references disclosed herein and in the Invalidity Charts, as each combination or modification of art would have no unexpected results and at most would simply represent a known alternative to one of skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 127 S.Ct. 1727, 1739-40 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach). Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases, a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*. at 1742. Thus, to a person of ordinary skill in the art, the Asserted Claims represent solutions that would have been obvious to try, with predictable results.

Nevertheless, should additional evidence of motivation to combine or modify be required to render the Asserted Claims obvious, Samsung contends that there was a motivation to combine the references identified above. That motivation was provided in the nature of the problem allegedly solved by the Asserted Patents, the teachings of the cited prior art itself, and/or the knowledge of a person of ordinary skill in the art. For example, the combinations identified above would have been combined or modified using: known methods to yield predictable results; common sense; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining or modifying the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. In addition, the combination of the prior art references would have been obvious because the combination represents known potential options with a reasonable expectation of success.

Additional evidence that there would have been a motivation to combine or modify the prior art references above includes the interrelated teachings of multiple prior art references; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge, skill, or creativity that would have been possessed by a person having ordinary skill in the art. Samsung may rely on uncited portions of the prior art references cited and produced, other publications and testimony, and the testimony of experts to establish that a person of ordinary skill in the art would have been motivated to modify or combine certain of the cited references so as to render the claims obvious.

For example, where multiple publications describe the same system, describe devices that are intended to be used together, or are from the same author, publisher, or manufacturer, one of ordinary skill would be motivated and find it obvious to read those publications together and combine their disclosure. As another example, where a product was available in another country, the availability of such a product would motivate a person of ordinary skill to arrive at the same or similar product in the United States. As yet another example, where the prior art identifies the desirability of or plans for future enhancements of a system, a person of ordinary would be motivated to incorporate such enhancements even if the original developer or author was unable to complete those enhancements.

1. Intelligent Wireless Broadband Relay Patents

A person of ordinary skill in the art would have been motivated to combine any of the references in the 194-Obviousness Chart, 754-Obviousness Chart, 337-Obviousness Chart, 999-Obviousness Chart or 783-Obviousness Chart because they are all directed to the same technological subject matter, repeaters and/or ultrawideband technology. *See, e.g.*, '194 Pat., Title ("Broadband Repeater With Security For Ultrawideband Technologies"), '194 Pat., Abstract ("An ultrawideband radio transceiver/repeater provides a low cost infrastructure Solution that merges wireless and wired network devices while providing connection to the plant, flexible repeater capabilities, network security, traffic monitoring and provisioning, and traffic flow control for wired and wireless connectivity of devices or networks. The ultrawide band radio transceiver/repeater can be implemented in discrete, integrated, distributed or embedded forms.").

a. Network Repeaters and Relays

As discussed in Section V (incorporated herein by reference), the Intelligent Wireless Broadband Relay Patents claim the use of network repeaters and relays. As addressed in the "Background" section above and the accompanying claim charts, use of network repeaters and relays was well known in the art and frequently combined with wireless network systems and methods of network management. Thus, a POSITA would have recognized this market trend towards and documented benefit of integrating network repeaters and relays into a wireless network and been motivated to incorporate the same into other products and systems.

Moreover, incorporating networking repeaters and relays would achieve the known benefits of extending the coverage area of a wireless network, reducing network interference, and improving the quality of service of applications available to users.

Finally, a POSITA would have had a reasonable expectation of success, including as evidenced by the fact that network repeaters and relays were already being incorporated into various consumer products before the priority date of the Intelligent Wireless Broadband Relay Patents.

b. Ultrawideband (UWB) Technology

As discussed in Section V (incorporated herein by reference), the Intelligent Wireless Broadband Relay Patents claim the use of ultrawideband (UWB) technology. As addressed in the "Background" section above and the accompanying claim charts, use of UWB technology was well known in the art and frequently combined with wireless network systems and methods of network management. Thus, a POSITA would have recognized this market trend towards and documented benefit of integrating UWB technology into a wireless network and been motivated to incorporate the same into other products and systems. For example, a POSITA would have been motivated to add UWB technology, as taught by Larrick, Aiello, or McCorkle, to a wireless network repeater or relay, as taught by Ganz, Faulkner, or Perlman, and would reasonably have expected the combination to succeed.

There were known advantages to employing UWB technologies in a wireless network repeater, specifically to enhance modulation capabilities in an existing repeater. For example, Larrick teaches a "waveform-adaptive" approach that provides precise control over UWB signal characteristics through an "impulse-gated oscillator" that allows "precise control of radiated frequency" governed by "the choice of oscillator which has a known stable frequency." Larrick, 5:62-65. Further, UWB technology allows for advanced modulation including phase modulation where "oscillator phase may also be controlled to generate an additional phase modulation." Larrick, 5:67-6:1. Additionally, UWB technology enables "frequency agility on a pulse-by-pulse basis allowing frequency hopping if desired" (Larrick, Abstract), which would enhance the frequency hopping capabilities already present in repeater systems. Larrick, 7:21-23. Larrick also teaches a "time-gated oscillator" approach using high-speed switches to create "a sub-nanosecond microwave burst" with controllable bandwidth. Larrick, 15:1-9. These advanced modulation capabilities enabled by UWB technology (Larrick, Aiello, McCorkle) would pair effectively with wireless network protocols used by wireless network repeaters or relays (Ganz, Faulkner, Perlman).

Additionally, A POSITA would have appreciated that employing UWB technology would allow for multi-user capability and spectral efficiency in an existing wireless network repeater. For example, Ganz identifies inefficient spectrum utilization in conventional systems due to "polling" which leads to "time slots [going] unused when a polled radio has no data to transfer." Ganz, 1:58-60. Combining this with UWB technology would result in an ability to control "center frequency and bandwidth" (Larrick, 6:14-15) on a "pulse-by-pulse basis" (Larrick, 5:52) to create an advanced multiple access scheme where different users could be assigned different UWB center frequencies, enhancing a wireless network repeater's ability to support "multiple segments to be installed in a common geographical area without interfering with each other." Ganz, 8:17-18. Further, the network could dynamically allocate bandwidth based on user requirements, and segment networks where data bandwidth can be increased for higher transfer rate.

A POSITA would also have known that combining UWB technologies with existing wireless network repeaters would yield better link quality assessment and power efficiency. Existing wireless network repeaters may implement sophisticated link testing where "control packets" with "sequence numbers" allow the system to "know whether packets were lost either on the way to the destination, or on the way back to the source node." Ganz, 12:28-31. This capability would pair effectively adaptable UWB parameters to create a system that could dynamically adjust transmission parameters based on link quality. Additionally, Larrick's "gated power amplifier" with "the unique feature of high power efficiency as the power amplifier is only turned on for approximately the duration of the UWB pulse" (Larrick, 6:42-45) would be particularly valuable in a repeater network, especially for remote installations.

Finally, at the time of the Intelligent Wireless Broadband Relay Patents, a significant industry trend was toward higher data rates in wireless communication systems. For example, Ganz' system specifically aims to overcome the "reduction of throughput by a factor of two" that occurs in half-duplex systems (Ganz, 1:19-20) and discusses achieving "information throughput in each segment is preferably at least 1.5 Mb/s, equal to a full dedicated T-1 line rate." (Ganz, 8:24-26.) However, Ganz acknowledges bandwidth limitations within specific frequency bands, noting that "with an 11-bit modulation sequence, a transmission is spread over a 20 MHz bandwidth." (Ganz, 8:26-27). UWB technology taught by Larrick, McCorkle, and Aiello directly addresses these limitations by providing technology that enables "data rates in the hundreds of megabits per second or more" (Larrick, Abstract). These significant improvements in data rate capabilities – from Ganz' 1.5 Mb/s to Larrick's "hundreds of megabits per second" – represent precisely the kind of technological advancement that would motivate a POSITA to combine these references. The substantially increased bandwidth of Larrick's UWB system (400 MHz and greater compared to Ganz' 20 MHz) would directly enable these higher data rates. Similarly, a POSITA would have been motivated to combine any reference disclosed UWB technology into a network system for the same reasons.

A POSITA could have combined any network repeaters with UWB technology with a reasonable expectation of success. As noted above in the "Background" section, UWB technology was well-known and commercially available at the time of the

c. OFDM and MIMO Systems

As discussed in Section V (incorporated herein by reference), the Intelligent Wireless Broadband Relay Patents claim the use of OFDM and MIMO technology. As addressed in the "Background" section above and the accompanying claim charts, use of OFDM and MIMO technology was well known in the art and frequently combined with wireless network systems and methods of network management. Thus, a POSITA would have recognized this market trend towards and documented benefit of integrating OFDM and MIMO technology into a wireless network and been motivated to incorporate the same into other products and systems. As a specific illustrative example, the wireless network system described in prior art reference Ganz is discussed in combination with OFDM and MIMO reference Engels, below, but the benefits discussed would apply to any combination of a wireless network system with OFDM and MIMO technology.

Engels teaches various conventional antenna technologies that were well-known, including MIMO, beamforming, adaptable, and directional antennas.

A POSITA would have been motivated to incorporate the teachings of Engels to improve the Ganz system because of the utility of MIMO, beamforming, adaptable, and directional antennas. Such technologies were conventional and well-known by the time of the Intelligent Wireless Broadband Relay Patents, and a POSITA would have known and been motivated by their utility. It was known that MIMO could minimize errors, optimize data speed, and improve bandwidth and capacity by allowing data to travel over multiple signals at the same time. In particular, MIMO would transmit multiple signals along multiple paths, allowing better SNR performance in challenging conditions.

Beamforming is a signal processing technique used in wireless communications (Wi-Fi, 5G, radar, sonar, etc.) that focuses a signal in a specific direction instead of broadcasting it equally in all directions. Beamforming uses adaptable and steerable antennas. A POSITA would have been motivated to use beamforming as it allows for improved signal strength by directing energy to an intended receiver. This increases range and reduces dead zones, as well as allowing for higher data rates and reduction in interference. Moreover, beamforming allows multiple users to share the same frequency band simultaneously by steering beams in different directions (multi-user MIMO in 5G and Wi-Fi 6/7). Beamforming also increases energy efficiency by concentrating power where it's needed reduces overall wasted transmission energy.

A POSITA would have had a reasonable expectation of success combining any network system with MIMO and beamforming technologies. MIMO and beamforming were well-known and conventional technologies. A POSITA would have been well aware of such methods and the conventional ways of implementing such standard technologies. Implementation would have been well-within the skill of an ordinary artisan.

2. Smart Antenna Patents

a. '763 and '358 Patents

A person of ordinary skill in the art would have been motivated to combine any of the references in the 763-Obviousness Chart or 358-Obviousness chart because they are all directed to the same technological subject matter, multiband antenna(s) and related components for wireless devices. *See, e.g.*, '763 Pat., Abstract (describing "wireless devices" that "use a single physical structure (e.g., an antenna) for transmission and reception of many different bands"); '358 Pat, Abstract ("wireless devices" with antennas "for transmission and reception of many different bands"); Wen '835, Abstract (describing a "mobile wireless communications device" with "a common antenna" and "a plurality of wireless radio frequency (RF) transceivers … coupled to … the common antenna" with "respective different operating frequency"); Govind '914, 1:23-27 (invention relates to "RF single-band and multi-band transceivers … for use in radio frequency (RF) applications"); Ella '819, 1:10-13 ("invention" relates to "a portable radio telephone"), 4:15-29 (describing the tuning "apparatus" in the context of a "mobile cellular phone" with an "antenna arrangement"); Vlahos, '751, Abstract ("A method and apparatus enables a communication device … to operate in multiple bands."); Rubinshteyn '027, [0016] (describing a "tunable antenna" in a "wireless communication device" that "can operate at multiple frequencies"); Poilasne '280, [0038] ("a configurable antenna … that is able to cover multiple frequency bands"); Quinn '416, [0002]; Saliga '888, [0001]; Fabrega-Sanchez '291, [0005]; Caimi '423, [0002].

Multiband antenna design and modification typically rely on well-known methods and a finite set of known, modular components, where those methods and components are combined to iteratively optimize antenna performance. Given the limited number of combinations and the plug-and-play nature of most RF components, modifications yield predictable improvements and would be obvious to try. The same is true for multiband antenna arrays. A POSITA would understand that known techniques for each individual antenna are applicable to an antenna array (either with respect to each constituent antenna or the array as a whole) and may be incorporated in a predictable manner.

A POSITA would have been motivated to include a tuner and controller, to the extent absent in a wireless device with a multiband antenna or antenna array. For example, a POSITA would have been motivated to add a tuner and controller, as taught by, *e.g.*, Ella '819 or Caimi '423, to a wireless device with a multiband antenna or antenna array, such as those in Wen '835, Wen '411, Rubinshteyn '027, and Saliga '888, as well as system art, *e.g.*, Linksys WRT600 series (e.g., -600N, -610N) and AirPort Extreme 802.11n, and would have reasonably expected the combination to succeed.

Tuners were well known in the art and were commercially available prior to August 2008. For example, U.S. Pat. No. 8,583,065 ("Ben-Bassat '065"), filed in June 2007, discloses that "antenna tuning circuits are in widespread use today" and used to "allow[] [an antenna] to operate over a wide range of frequencies" and adjust the impedance of the antenna to "minimize[] the SWR [standing wave ratio] and maximize[] power transfer through the antenna system." Ben-Bassat '065, 1:51-2:9. A POSITA would have known that tuners are frequently used in RF systems to match the impedance at the antenna to the impedance of a transmitter, receiver, or transmitter in order to achieve well-known benefits, such as improving power transfer, minimizing distortion, and preventing overheating.

There were known advantages to employing a tuner and associated controller in a multiband antenna or antenna array. Ella '819, 1:51-2:9, 7:30-33. For example, Ella teaches a tuner and associated controller for multiband antenna which "provide[] adaptive tuning of an antenna element" by compensating for changes in impedance in the antenna. *Id.*, 7:21-29. Ella '819's adaptative tuning "result[s] in the device operating more efficiently (since the electrical energy supplied to the antenna element will be maximized) and effectively (the signal strength of the antenna element may be improved)." *Id.*, 7:21-29. A POSITA would have thus been particularly motivated to use a tuner and controller as taught by Ella '819 or Caimi '423 with the multiband antenna in Wen '835, Wen '411 or Rubinshteyn '027 to optimize performance in the plurality of frequency bands used by the antenna.

And, a POSITA would have reasonably expected the combination to succeed. As noted above, tuners were well known and commercially available prior to the '763 patent and '358 patent. Adding tuners associated with the transceivers in Wen '835 or Wen '411, or the transmitter and receiver in Rubinshteyn '027 or Saliga '888, would have entailed nothing more than the use of a known technique (*i.e.*, tuners for impedance matching) to improve similar devices in the same way. A POSITA would have been capable of adding a tuner and controller for impedance matching to a multiband antenna or antenna array using routine engineering to achieve predictable results.

A POSITA would have been motivated to include isolation means, to the extent absent in a wireless device with a multiband antenna or antenna array. For example, a POSITA would have been motivated to include filters and other RF isolation components, as taught by, *e.g.*, Vlahos '751, to a wireless device with a multiband antenna or multiband antenna arrays, such as those in, *e.g.*, Wen '411, Wen '835, Rubinshteyn '027, Poilasne '280, and Saliga '888, as well as system art, *e.g.*, Linksys WRT600 series (e.g., -600N, -610N) and AirPort Extreme 802.11n, and would have reasonably expected the combination to succeed.

The need for RF isolation in multi-band wireless communication systems would have been well understood by a POSITA. Absent such filtering and isolation, the transmitter energy and other spurious frequencies may interfere with proper operation of a receiver, and that filtering and isolation circuitry is particularly important in a multiband system due to the increased the risk of interference. A POSITA would be motivated to incorporate filtering and isolating circuitry known in the art, *i.e.*, that taught by Vlahos '751. Vlahos '751 discloses using filters and other isolation circuitry to "provide isolation … from transmitter energy and other spurious frequencies," which would otherwise interfere with a receiver, particularly in a multiband system. *Id.*, 2:59-65.

RF isolation and filtering for transmitters and receivers in wireless devices long predates the '763 patent and '358 patent, as evidenced at least by its disclosure in Vlahos '751 over a decade earlier. Indeed, the '763 patent acknowledges that the "key to proper operation" of a transceiver is to "provide sufficient RF isolation," and notes that "RF filtering and overload protection" is already available in "commercially available wireless transceivers in various popular bands." '763

Pat., 5:30-37. Accordingly, adding RF isolation and filtering circuitry to the wireless device in Wen or Rubinshteyn represents the use of a known technique with predictable results. A POSITA thus would have reasonably expected the combination to succeed.

A POSITA would have been motivated to include a plurality of single band transceivers (or transmitters or receivers) ***and/or one or more multiband transceivers*** (or transmitters or receivers) in a multiband antenna or antenna array, depending on market and design constraints.

Both single-band and multiband transceivers were well known in the art and were commercially available prior to August 2008. Leenaerts '720, 1:11-15 ("A vast majority of the transceivers are built for being used in only one band, the more the bands the more transceivers. Relatively recent, multi-band transceivers and accordingly multi-band receivers and multi-band transmitters have been considered."). A POSITA would have understood that single-band transmitters, receivers, or transceivers, and multi-band transmitters, receivers, and transceivers, are the two known alternatives available to a system designer in a multiband wireless system and selecting between multiband transceivers or a plurality of single-band transceivers in a multiband wireless device may depend on design constraints. '763 Pat., 4:60-5:2 (describing prior art devices using "different band transceivers"), 6:54-57 ("[I]t is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands.").

For example, a POSITA would have been motivated to add multiband transceivers, as taught by Govind '914 or Saliga '888, to the wireless device in Wen '411 or Wen '835, as well as system art, *e.g.*, Linksys WRT600 series (e.g., -600N, -610N) and AirPort Extreme 802.11n, and would have reasonably expected the combination to succeed.

Multiband transceivers were well known in the art and were commercially available prior to August 2008. The ’763 patent acknowledges that “it is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands.” ’763 Pat., 6:54-57. Indeed, no later than March 2005, multiband transceivers were already in use. For example, a POSITA would have “considered” “multi-band transceivers and [] multi-band receivers and multi-band transmitters” due to their advantage of being able to “work with signals situated in different bands and being adapted to different communication protocols.” Leenaerts ’720, 1:11-15.

A POSITA would have been motivated to incorporate a multiband transceiver to the antenna in Wen ’411 or Wen ’835 (or an antenna array). For example, Wen ’835 describes the difficulty and need to reduce size while increasing performance—“the functionality of cellular communications devices continues to increase, so too does the demand for smaller devices which are easier and more convenient for users to carry” —the “challenge” in reducing device size is “the relatively limited amount of space available for the antenna,” particularly “where multi-frequency band operation is required.” Wen ’835, [0003]. Replacing the multiple single-band transceivers with a single multiband transceiver fits the need articulated in Wen ’835 or Wen ’411 via a simple substitution achievable using known methods.

Govind ’914 provides a similar express motivation to combine. For example, Govind ’914 discloses using multiband transceivers in systems with “a multi-band antenna … for receiving signals in various frequency ranges.” EX1008, 17:17-31. In particular, the multiband transceivers in Govind ’914 “can be reused at different frequency ranges, thereby reducing the number of components required.” *Id.*, 2:8-13. This approach allows for “optimization of space and power requirements,” “reduced power consumption,” and “lower costs,” among other advantages. *Id.*, 17:17-31, 2:8-13, 21:48-57. A POSITA would have understood that these improvements are particularly beneficial for mobile devices, where size, power consumption (*i.e.*, battery life), and cost are all important design factors.

And, Saliga '888 too teaches the benefits and use of a multiband receiver ("Dual-band radio Rx") and a multiband transceiver. EX1006, [0008], Fig. 10. Saliga describes the need for, *e.g.*, "a dual band antenna" to enable devices to "operate simultaneously, one in the 2.4 GHz band and one in the 5 GHz band." *Id*. [0002]-[0003]. The dual-band transceiver enables "a low profile, dual band, diversity antenna that is very easy to deploy at a low cost." EX1006, [0040], [0002], [0003].

A POSITA would have reasonably expected the combination to succeed. Replacing the plurality of transceivers connected to the multiband antenna in Wen '835 or Wen '411 (or an antenna array, *e.g.*, Wen '411 and Poilasne '280) with one or more multiband transceivers would have been a simple substitution of known elements with predictable results. As noted above, multiband transceivers were well known and commercially available prior to the '763 patent. Leenaerts '720, 1:11-15; '763 Pat., 6:54-57. A POSITA would have been capable of replacing Wen's plurality of transceivers with one or more multiband transceivers using routine engineering because Wen's controller and antenna are already configured to operate using multiple frequency bands.

For further example, a POSITA would have been motivated to add multiple single-band transceivers, as taught by Wen '411 or Wen '835, to the wireless device in Rubinshteyn '027, and would have reasonably expected the combination to succeed. A POSITA would have understood that selecting between multiband transceivers or a plurality of single-band transceivers in a multiband wireless device may depend on design constraints.

Specifically, a POSA would understand that a plurality of transmitters, receivers or transceivers, was an alternate approach for certain circumstances—*e.g.*, where the need for significant and varied bandwidth coverage outweighs spatial constraints, such as in wireless stations. For example, multiband transceivers may present "difficulties in power consumption, compatibility, interference, and integration." Govind '914, 1:48-50. While a multi-band transceiver "may satisfy one or more of these issues," *id.*, 2:1-4, design constraints may nevertheless limit a particular device to use a plurality of single-band transceivers. Accordingly, a POSITA would have been motivated in certain circumstances to add multiple transceivers to the wireless device in Rubinshteyn, substituting the duplex, transmitter and receiver for, *e.g.*, three single-band transceivers. And, a POSITA would have reasonably expected the combination to succeed. Adding multiple transceivers into Rubinshteyn's wireless device represents a simple substitution of Rubinshteyn's individual multiband receiver and transmitter for a plurality of transmitters, receivers, or transceivers. *Id*.

A POSITA would be motivated to utilize antenna arrays in wireless devices. For example, a POSITA would have been motivated to modify a multiband antenna, *e.g.*, as taught in Wen '411, Wen '835 or Rubinshteyn '027, to incorporate an antenna array, as described by Quinn '416, Poilasne '280 or Saliga '888—and, system art to the extent an antenna array is not already incorporated. A POSITA would be aware that antenna arrays act to increase range and versality of such systems "for diversity operation" across multiple bands. Saliga '888, [0006], [0053]. For example, antenna arrays "improve the transmission quality of an antenna" through beam switching and steering (functionality typically unavailable for single antenna). Poilasne '280, [0060]-[0067].

Demand and design constraints would motivate a POSITA to employ an antenna array because, "new generations" of devices were "smaller and embedded with more and more applications" and required "new antenna designs … to provide solutions to inherent limitations of these devices." Poilasne '280, [0005]. In particular, "multi-band" antennas "need[ed] to take into account beam switching, beam steering, space or polarization antenna diversity, impedance matching, frequency switching, mode switching, etc., in order to reduce the size of devices and improve their performance." *Id.*, [0006], [0053]. A POSITA would understand that decreasing size for a multiband antenna may be done by (i) reducing the area occupied by antenna and/or (ii) reducing the area occupied by the electrical components supporting operation across bands, such as transmitters and receivers. A POSITA would further understand that modifying Wen to incorporate the antenna array in Quinn '416, Poilasne '280 or Saliga '888 would have the benefit of meeting both objectives—reducing the space occupied by the antenna by replacing the leg structure of Wen with a more compact array and also reducing electronic element count (specifically Wen's multiple transceivers).

Stated simply, a POSITA would have been motivated to implement antenna arrays in a multiband antenna system because arrays, like that in Poilasne '280, Quinn '416 or Saliga '888, provide performance improvements such as dynamic antenna reconfiguration and beam and null steering and other active real-time optimization. Indeed, many references provide explicit motivation to combine or include embodiments directed to antenna arrays. *See, e.g.*, Saliga '888, Claim 15; Wen '835, [0046] (disclosing a wireless device that includes "one or more antennas"), [0031], [0007]; Poilasne '280, [0043], [0067].

A POSITA could modify a multiband antenna to incorporate the antenna array design in Quinn '416, Poilasne '280 or Saliga '888 using known methods and with a reasonable expectation of success.

For example, a POSITA may configure Wen ’411 as an antenna array by, *i.e.*, first, by modifying the antenna in Wen ’411, to operate in an array (*e.g.*, using two or more instances of the antenna in Wen ’411 that operate together as an array, and controlled by control elements in Poilasne ’280, similar to the multi-element antenna embodiments shown in Figures 9-11 of Poilasne ’280); or second, by replacing the antenna in Wen ’411, with a multi-element antenna embodiment taught by Poilasne ’280. Indeed, Poilasne ’280 describes these embodiments and their practical implementations in sufficient detail to enable a POSITA to apply them using routine engineering skills that would be within the capacity of a POSITA.

As another example, modifying Wen ’835 to incorporate an “array of antennas,” including “a plurality of rod shaped monopole elements” as taught in Saliga ’888, could be done using known methods and with a reasonable expectation of success. Wen ’835 discloses embodiments including a multiband “monopole” antenna. Wen ’835, [0018]. A POSITA would recognize that Wen’s antenna (monopole) is directly compatible with Saliga 888’s antenna array (plurality of monopole antenna). Saliga ’888, [0006]. A POSA merely needs to stack or otherwise aggregate multiple antenna as described in Wen ’835 to match the plurality in Saliga ’888, and could do so without difficulty, combining known components in common ways.

For further example, modifying the “planar antennas” described in Rubinshteyn ’027 to incorporate the antenna array structure taught in Poilasne ’280, could be done using known methods and with a reasonable expectation of success. A POSITA would understand that the antenna taught in Rubinshteyn may be implemented as a dipole antenna (a type of “planar” antenna), stacked and configured as a magnetic dipole antenna array.

A POSITA would understand the need to implement control elements for operation of the combined system (the multiband antenna configured as an antenna array). For example, a

POSA would understand the benefits of active control elements in known antenna arrays, *e.g.*, passive and active tuning methods, and would be motivated to incorporate the control elements known in the art, *e.g.*, Quinn ’416, Poilasne ’280 or Saliga ’888.

A POSITA would have been motivated to include these known control elements to improve the performance of the antenna array through real-time tuning.

For example, Poilasne ’280 describes control elements that can turn individual antennas on or off, “vary the resonant frequency of the antenna” or to “control the input impedance of the antenna.” Poilasne ’280, [0062], [0046], [[0051]. The control elements enable varying the resonant frequency enables real-time switching for regional frequency bands, *e.g*., “switching from … a 800/1900 MHz US band to a 900/1800 MHz GSM Europe and Asia band.” Poilasne ’280, [0037]. Similarly, adjusting “the input impedance … maintain[s] the best antenna characteristics while the antenna’s environment is changing.” *Id.*, [0051].

For further example, a POSITA would look to the tuning method disclosed in Quinn. Quinn ’416 describes a means for efficiently tuning the antenna array through use of a “universal connection manager [that] adjusts a common antenna array structure using MEMS technology to select and tune the frequency bands and spectrum for a selected wireless device and application.” Quinn ’416, [0010].

These and other control elements, such as that described above with respect to tuners or controllers, as well as MIMO applications (*supra* Sec. VI.C.1.C) may be incorporated into an antenna array

b. ’625 and ’548 Patents

A person of ordinary skill in the art would have been motivated to combine any of the references in the 625-Obviousness Chart or 548-Obviousness chart because they are all directed to the same technological subject matter, steerable antenna(s) and/or multiband antenna(s) and related components for improving safety, quality, and/or efficiency of wireless device communications. *See, e.g.*, ’625 Pat, Abstract, 4:36-38 (“a steerable antenna within a wireless device to avoid radiating towards a person or object.”); ’548 Pat. Abstract, 4:36-38 (“a steerable antenna within a wireless device to avoid radiating towards a person or object.”); Schlub ‘928, Abstract (disclosing a “portable electronic device” with “wireless communications circuitry” that “steer[s] a phased antenna array”); Prasad ’272, [0007] (“antenna arrays ... to achieve dynamic radiation pattern, beamforming, beam steering etc.”); Seol ’994, 1:18-19 (invention relates to a “beamforming-based wireless mobile communication system”); Prasad ’217 at Abstract (“The smart dynamic radiation pattern optimising system is a design and technique to actively shape & optimise the radiation pattern of mobile device controlled by smart RF/Antenna system with signal processing algorithm that works by sensing the change in device proximity environment with nature or property, range, orientation, position, location, signal quality parameters and ambient intelligence to protect the user by controlling radiation exposure, enhance RF signal quality and to save battery power.”); Nelson ’285 at Abstract (“A technique for steering a directional antenna such as may be used with User Equipment (UE) in a wireless communication system.”), 1:18-46, 2:15-26, 2:27-47, 2:51-3:49; Schmidt at 3-5 (“This research explores the viability and effectiveness of using an inertial navigation system (INS) to control a beamforming array of microstrip patch antennas with the aim of reducing users’ exposure to electromagnetic radiation. The system reduces radiated power directed toward a cellular phone user” . . . “[i]n this report, a beamforming array of microstrip patch antennas, designed in [2], is used to direct radiation away from the user [2].”), 2 (Section 1.1 Motivation), 7, 74-75; Chen ’446 at Abstract (“An electronically steerable passive array antenna and method for using the array antenna to steer the radiation beams and nulls of a radio signal are described herein”), [0005]-[0008], [0043], [0045]-

[0050]; Yin ’455 at 6:6-19 (“In accordance with some examples, wireless communication component 202 may include a multi-element antenna array 203 that may be configured to adopt a beamforming technique, or a null-forming technique, in order to direct emanating EM waves toward one or more preferred directions and/or to avoid other directions.”); Novet ’418 (“[t]he mobile device 120a may determine that the user 160a is between the mobile device 120a and the base station 110. Accordingly, the mobile device 120a may cause the steerable antenna 245 to radiate omnidirectionally, isotropically, or in another direction. For example, the mobile device 120a may connect to a second antenna of the base station 110, and may cause the antenna 245 to radiate towards the second network antenna”); Dorsey ’648 at [0007] (“Antenna diversity systems are provided for portable electronic devices. The antenna diversity systems may use proximity sensors or other environment sensors to improve the wireless communications performance of portable electronic devices that operate in rapidly changing environments.”).

A POSITA would have been very familiar with steerable and multiband antenna technologies such as these, as well as the widespread developments that had become well known at the time, including as noted in Section V.8-V.10. Moreover, steerable and multiband antenna design and modification typically rely on well-known methods and a finite set of known, modular components, where those methods and components are combined to iteratively optimize antenna performance. Given the limited number of combinations and the plug-and-play nature of most RF components, modifications yield predictable improvements and would be obvious to try. The same is true for multiband antenna arrays. A POSITA would understand that known techniques for each individual antenna are applicable to an antenna array (either with respect to each constituent antenna or the array as a whole) and may be incorporated in a predictable manner. *See* Section V, *supra*.

A POSITA would have been motivated to apply multi-band operation to a steerable antenna system. For example, A POSITA would have been motivated to apply Oshiyama '918's teachings to Schlub '928's steerable antenna system, and would have reasonably expected the combination to succeed. For example, Oshiyama '918 identifies "situation[s] where simultaneous antenna operation in multiple frequency bands is required, for instance," when "both GPS and mobile phone systems are used." Oshiyama '918, [0016]. Others also recognized the utility of using antennas to include multi-band operation in steerable antenna systems, and recognized that this is commonly implemented. See Chen '446 at [0039]-[0042] (disclosing a radiating antenna element capable of transmitting and receiving dual band radio signals); Novet '418, 5:39-46, 8:52-65 (recognizing a wide range of communication protocols that utilize different bands, and noting that the interfaces for each can be provided using "one or more of the components can be combined or commonly implemented, and each component can be implemented using one or more separate elements."); Dorsey '648 at [0023] ("These bands may be covered by using single and multiband antennas. For example, cellular telephone communications can be handled using multiband cellular telephone antennas and local data communications can be handled using multiband wireless local area network antennas."), *see also* Dorsey '648 at [0023], [0030], [0036], [0044]. Oshiyama '918 teaches that its multi-band antenna is "favorable for mobile communications" in such situations. *Id.* Further, Oshiyama '918 teaches that a single multi-band antenna capable of simultaneous operation is preferable to multiple antennas, each operating in a different frequency band, because the single antenna solution is "ideal for the purpose of reducing antenna size and weight," which is in turn necessary to "reduce the size and weight of a mobile communication device." *Id.*, [0002], [0009]. A POSITA would look to appropriate tuning circuitry disclosed by

Oshiyama ’918 in order to operate the antenna in multiple frequency bands, including in scenarios where simultaneous multiband operation was desired.

Similarly, a POSITA would have likewise been motivated to apply Oshiyama ’918’s teachings regarding simultaneous multi-band operation to the steerable antenna system in other prior art for at least the same reasons, including the systems and methods described in prior art such as Prasad ’272, Prasad ’217, Seol ’994, Yin ’455, Schmidt, Chen ’446, Novet ’418, or Nelson ’285.

A POSITA would have been motivated to operate a wireless communication device and steerable antenna in millimeter-wave (mmWave) frequency bands. For example, Seol ’994 discloses that “demands for [wireless] traffic have accelerated due to increased demands for smartphones and tablet Personal Computers.” Seol ’994, 1:31-36. Seol ’994 teaches that “recent interest has focused on a millimeter-wave wireless communication system” to solve this problem. *Id.* Other references corroborate the advantages of mmWave communications. For example, U.S. Patent Publication No. 2011/0182174 (“Pi”), published in 2011, discloses that “the larger amount of spectrum available in the mmWave bands” allows for a “data rate … much higher than that provided in cellular bands.” Pi, [0051]. Thus, mmWave frequency bands “achieve data communications with very high throughput and low latency, thus greatly improving user experience and enabling new mobile communication applications.” *Id.*As prior art references acknowledge, mmWave communications were well known and in use. Seol ’994, 1:31-38; Pi, [0009]. *See also* Section V.11-V.12, supra, discussing well known use of mmWave communications.

In addition, as both Prasad ’272 and Seol ’994 and other prior art references acknowledge and confirm, antenna steering techniques (including beamforming and beam steering) were also well known and in use. *See, e.g.,* Prasad '272, [0007]; Prasad '217, Abstract; Seol '994, 1:43-1:59; Pi, [0033], [0042]; Nelson '285 at Abstract; Schmidt at 3-5; Chen '446 at Abstract; Yin '455 at 6:6-19; Novet '418; Dorsey '648 at Abstract, [0007]; Schlub '928 at Abstract. A POSITA would thus have been deeply familiar with capable of configuring steerable antennas to operate at desirable frequencies, including mmWave frequencies such as those within the 10 GHz to 500 GHz range, by applying known techniques incorporated in a predictable manner. Notably, the aforementioned references are not limited to or dependent on certain operating frequencies, and a POSITA would have understood that their steerable antenna technologies could readily be configured to operate at frequencies including in the 10-500 GHz band. By way of example only, Prasad '272's implementation is not limited to or dependent on certain operating frequencies, and a POSITA would have understood that Prasad '272's steerable antenna may be configured to operate at frequencies including in the 10-500 GHz band. All these changes, whether to Prasad '272, Prasad '217, Seol '994, Nelson '285; Chen '446; Yin '455; Novet '418; Dorsey '648, Schlub '928, or other prior art cited herein, would have required only routine engineering with predictable results.

A POSITA would have likewise understood the benefit of wireless communication in mmWave frequencies, including for at least the reasons explained in the references identified in Section V.11-V.12, as well as other prior art cited herein discussing well known use of mmWave communications.

A POSITA would have similarly understood that communications at mmWave frequencies experience increased propagation loss caused by obstacles, and would have therefore been motivated to implement steering techniques to guide beams in desirable directions to maintain signal integrity. By way of example only, Seol '994 teaches that for wireless communication in mmWave frequencies, "propagation loss … is increased … and resulting shortened propagation distance reduces service coverage." Seol '994 , 1:38-43. Thus, implementing effective mmWave communication systems requires "mitigating the path loss of waves using beamforming and thus increasing the propagation distance of the waves." Id., 1:43-47. Accordingly, mmWave communication systems uniquely benefit from the beamforming capabilities of steerable antenna systems such as Prasad '272's. Prasad '272, [0024] (Prasad '272 disclosing that its steerable antenna is capable of "beamforming and beam steering"). Pi similarly discloses that beamforming can be used to overcome these known disadvantages of mmWave systems to "achieve good quality of communication," providing additional motivation. Pi, [0042]. A POSITA would have understood all of this well before the time of the '625 and '548 patents.

Additionally, a POSITA would have understood that using a steerable antenna in mmWave frequencies offers the added benefit of protecting users from potentially harmful radiation in that frequency band. For example, prior art references such as Prasad '272 disclose that the "[o]bjective of the invention is to protect the user from mobile cell phone radiation and its adverse health effects simultaneously maintaining the quality of communication." Prasad '272, [0006]; see also, e.g., Prasad 217 at [0003]-[0004]. Prasad '272's smart directional radiation protection system, which incorporates a steerable antenna and utilizes techniques such as beamforming and beam steering, achieves this goal. Prasad '272, Abstract.

A POSITA would have been motivated to configure a wireless device and steerable antenna to use different radiation patterns for transmission and reception. For example, prior art references such as Seol '994 disclose that propagation loss in a mmWave system can be minimized, while maximizing performance, by determining and selecting the best directional beam (*i.e.*, the best radiation pattern) in each of the uplink direction (*i.e.*, from wireless device to base station) and downlink direction (i.e., from base station to wireless device). Seol ’994, 19:49-58 (“[E]xemplary embodiments of the present invention can mitigate a large propagation loss in a millimeter-wave band and maximize efficiency and diversity by additional use of MIMO/BF by performing an efficiency hybrid beam forming scheme in which one or more best beams are selected from a set of one or more analog beams having directivity on uplink/downlink and digital MIMO/BF is performed in the selected beams during transmission and reception between an MS and a BS.”)

Furthermore, a POSITA would have understood that objects in the environment of a mobile device (*e.g.*, a user or structure) may move over time, such that the optimal transmit path (during uplink) may be different from the optimal receive path (during downlink). Accordingly, a POSITA would have been motivated to enable the mobile device to use different transmit and receive beam patterns such that the optimal pattern can be selected for a particular communication. A POSITA would further have been motivated to enable the mobile device to use different transmit and receive patterns so that the mobile device is capable of communicating with older devices, which may use an omnidirectional antenna that cannot be steered.

A POSITA would have further been motivated to configure a wireless device and steerable antenna to use Time Division Duplex (TDD), as taught by prior art references such as Seol ’994, Nelson ’285, and Pi. For example, Seol ’994 discloses that TDD can be used to synchronize the base station and mobile device in order to identify the best beam pattern in the uplink or downlink direction. Seol ’994, 9:39-11:5. Nelson ’285 teaches that its “technique for steering a directional antenna . . .is of particular use in a Time Division Duplex (TDD) system where transmit and receive functions can be operating independently at different times.” Nelson ’285 at Abstract. Pi similarly teaches that the use of TDD enables bidirectional communication, which is necessary for the base station and mobile device to synchronize their beam patterns. Pi, [0041], [0042]. In addition, a POSITA would have known that bidirectional communications can be accomplished using one of two well-known methods: TDD or FDD (Frequency Division Duplexing). Accordingly, the use of TDD would have constituted the application of a known technique to a well-known device type (*i.e.*, a wireless communication device) with predictable results.

3. Network Monitoring Patents

A person of ordinary skill in the art would have been motivated to combine any of the references in the 794-Obviousness Chart, 925-Obviousness Chart, or 700-Obviousness Chart because they are all directed to the same technological subject matter, collection of wireless device information. *See, e.g.*, '794 Pat., Title ("Clearinghouse system, method, and process for inventorying and acquiring infrastructure, monitoring and controlling network performance for enhancement, and providing localized content in communication networks"), '925 Pat., Abstract ("Clearinghouse system, method, and process for inventorying and acquiring infrastructure, monitoring and controlling network performance for enhancement, and providing localized content in communication networks"), '700 Pat., Title ("Clearinghouse systems and methods for collecting or providing quality or performance data for enhanced availability of wireless communications"), Daley '800, Abstract ("A log file is employed to collect information on various device features for which tracing or debugging is turned on in a mobile electronic device"), Scherzer '882, Abstract ("An improved connectivity to radio access point is enabled by a server that includes a database storing data about various radio access points"), Aaron '747, Abstract ("Descriptive information associated with a service quality is collected and stored and subsequently transmitted to a central processor at a later time along with location information."), Chmaytelli '453, Abstract ("Systems and methods for sending and receiving ads from a server to a client device are disclosed."), Dawson '953, [0009] ("The present invention meets the aforementioned need to a great extent by providing a method and system for organizing information relating to various aspects of a fixed wireless service provider enterprise."), Baumeister '911, Abstract ("The present invention provides a mobile device and a method for generating and maintaining a signal strength database that provides an assignment between a location within a building and corresponding signal strengths of signals that are emitted by a plurality of access points of a wireless data communication network."), Risbood '748, Abstract ("A method and apparatus for monitoring a wireless subscriber's perception of the quality of service (QoS) parameters of a wireless network and correlate such perception to an actual location in a coverage area within the network for assuring and improving QoS parameters."), Mizkovsky '115, Abstract ("A communication device locates a wireless service provider in a multi-service provider environment using a stored list of preferred service providers, the list has a plurality of uniquely identified sublists, each sublist is associated with a different geographic area and identifies a more preferred service provider and a less preferred service provider."), Deshpande '933, Abstract ("In an area being serviced by multiple wireless network access service providers, a service provider is selected for use by a communication device based upon information received from each of the available service providers and a provider selection criterion.").

A POSITA would have been motivated to collect and provide device location information, to the extent absent in the references, and would have reasonably expected the combination to succeed. A POSITA would have known that when assessing an issue with a wireless device, and especially when attempting to assess and resolve an issue with the network performance of the device, one of the most helpful pieces of information is the location of the device. A POSITA would understand that a system for monitoring, diagnosing, and resolving issues with wireless devices, would benefit from having access to (1) information about the location of the devices at the time of the monitored performance and (2) information about the infrastructure (e.g., base stations or towers) with which the device was or could have been in communication. The references also demonstrate that a POSITA would have known about the benefits of having such information available in a device monitoring and management system. Such benefits of location information include, but is not limited to, using such information (1) to identify coverage gaps, congestion zones, and areas with poor signal, (2) to improve radio resource allocation and handoff decisions, (3)load balancing and capacity planning, (4) to assist with troubleshooting and diagnostics during failures, (5) to provide emergency services support, (6) to allow for asset tracking for IT departments, and (7) to improve location-based services for consumer devices, such as performing triangulation of the location of nearby base stations. A POSITA would therefore have looked to art that describes collecting and leveraging device location information.

A POSITA would have been motivated to collect and provide base station information, to the extent absent in the references, and would have reasonably expected the combination to succeed. A POSITA would have been aware that because mobile devices were oftentimes within range of multiple cell towers or access points (base stations), connecting a mobile device to a different base station (e.g., switching to a new base station to maintain service quality as the mobile device moves or if performance on the current base station degrades) was a common exercise. Information about handovers, including transitions from a home network to a roaming network, could be both a useful diagnostic tool (e.g., to determine whether an issue is rooted in the device or in the network infrastructure). Allowing or encouraging a connection to another base station or tower is also a potential remedy (e.g., if another base station would be more performant or less expensive). Handovers might occur based on factors including service quality measurements, cell load and capacity, and mobility patterns (e.g., speed of the mobile device movement). They were also influenced by the location of the cell tower, including relative to the device, and the properties of the tower (e.g., transmission bands, load, carrier affiliation).

A POSITA would have known the benefits of storing information about base stations because having such information can help determine if a device is optimally configured for use with its current base station, if its configuration settings should be changed, or if it can (or perhaps should) connect to a different base station. Customers and carriers would expect such a system to leverage its access to location information by providing location-related functionality such as base station recommendations or rankings. Such information would also improve user experiences with mobile devices as they are on the move. For example, real-time location data facilitates providing configuration information, including lists of relevant towers and how best to connect to them, to resolve immediate problems or mitigate ongoing risks. Historical location data can facilitate more systemic analysis by identifying locations in which customers frequently encounter issues or by identifying common configurations in devices that do not experience problems in a given location. *See, e.g.*, Daley at [0060] (contemplating "anticipatory tracing" or collection of data "for a problem that is expected to occur at some time in the future.").

A POSITA would have been motivated to collect and provide location information and base station information, to the extent absent in the references, and would have reasonably expected the combination to succeed. Collecting both kinds of information can help determine whether an issue is location-specific (e.g., dues to a storm, power outage, or some source of interference), base station specific (e.g., excessive demand, a misconfiguration, or a malfunction), or a device or user specific issue.

A POSITA would also have understood that it was in the best interests of customers and carriers to expeditiously and accurately remedy, and not just diagnose, a wide range of issues. A

POSITA would have understood that by augmenting the prior art references with location and base station information, the system would have been enabled to address a wider range of remedial actions, including configuring a device to avoid interference and optimize connectivity, avoiding excessive power use if there appears to be a regional power outage, or connecting to alternative base stations if a base station appears overloaded or unavailable. The latter remedy, in particular, was known to possibly have financial implications for a device user (e.g., because of roaming or off network fees). A POSITA would have understood that in some circumstances it would be appropriate (or even required) to empower the end user to make the final decision as to what base stations to connect to because connecting to certain base stations might have incurred additional end user cost (such as by triggering roaming charges). Therefore, a POSITA would have known that it would be advantageous to be able to provide a list of available base stations (ideally ranked according to various metrics such as availability, performance, or cost) and allow the device user to make the final decision. A POSITA would also have been motivated by the knowledge that providing these features would likely provide a competitive advantage (e.g., by improving customer satisfaction and retention) or at least be necessary to avoid competitive disadvantage as these features became "table stakes."

A POSITA would have been motivated to provide for telecommunications infrastructure procurement, to the extent required in the claims and absent in the references, and would have reasonably expected the combination to succeed. A POSITA would have known that telecommunications networks may have issues associated with overall network capacity and infrastructure deployment, and that a solution to such issues might be to expand the network's infrastructure, e.g., by deploying more base stations or towers. A POSITA would have recognized that data encompassing network capacity and the location of users and their devices is a key input into longer-term capacity planning. Moreover, for business and competitive reasons, carriers would have been motivated to expand the network to alleviate systemic issues and strategically improve capacity and performance by deploying infrastructure to meet observed customer demand.

For example, Daley discloses generating diagnostic statistics for groups of devices and Aaron recognizes that quality-of-service maps allow technicians to identify problems and determine whether changes are needed to the communication network or its components. Daley at [0277], Fig. 17; Aaron at [0036]. A POSITA would have been motivated to incorporate the diagnostic statistics and quality-of-service maps to improve the information available to technicians regarding the status of the wireless communication network, its components, and the network services because the combination would allow technicians to analyze the network's behavior and identify patterns related to the timing and location of service degradation, facilitating both issue remediation and issue prevention. A POSITA would have recognized that it is commercially advantageous to manage the wireless communication network based on comprehensive quality-of-service data from mobile devices.

A POSITA would have further recognized the complementary nature of (1) monitoring, diagnostic, and management systems and (2) systems supporting network expansion and been motivated to combine the two because the same information that is reported or monitored regarding subscriber's experience of network performance is highly relevant to future network planning. For example, the performance of wireless devices at a particular location, the demand from wireless devices on the network at a particular location, and the presence of user devices in locations with no adequate carrier infrastructure all inform whether and to what extent a carrier should pursue deployment of additional network infrastructure supporting that location. Further, a POSITA would have recognized the technical efficiency of consolidating data repositories and processing infrastructure to serve multiple operational needs, such as network expansion planning and infrastructure procurement. The use of a unified data platform would reduce duplicated storage, decrease system complexity, lower costs from redundant data acquisitions, minimize data synchronization challenges, and enable consistent analytics across operational and strategic functions.

D. Simultaneous "Invention" By Others

As evidenced by the material presented in the Background section and the invalidity charts, the subject matter of the Asserted Patents was being (indeed, had been) actively explored by others at the time of alleged invention. The world-wide cross-industry activity in this field, loosely characterized as network repeaters and relays, UWB, smart antennas, steerable antenna, beamforming, beamsteering, active or passive multibeam combining, MIMO, phasing, and network monitoring, is its own motivation to combine the various cited references: a person of ordinary skill in the art at the time would have been aware of work done by Ganz, Larrick, Wen, Schlub, Prasad, Schmidt, Novet, Chen, Seol, Yin, Nelson, Dorsey, Hyde, Kanj, Daley, Aaron, Scherzer, and Dawson, as well as established industry players such as Nokia, NETGEAR, Linksys, Apple, Sierra, Qualcomm, Bitfone, SOTI, Blackberry, Samsung, Cisco, Ruckus, D-Link, and XtremeSpectrum. Such a person would also have been aware of the many standardization efforts, analyst reports, whitepapers, customer trials, and actual deployments.

E. No Secondary or Objective Indications of Non-Obviousness

Objective indications of non-obviousness include: (1) commercial success, (2) copying, (3) industry praise, (4) skepticism, (5) long-felt but unsolved need, and (6) failure of others. *See, e.g.*, *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling U.S., Inc.*, 699 F.3d 1340, 1349–56 (Fed. Cir. 2012). Samsung is not aware of any evidence that would tend to establish any secondary indications of non-obviousness. This lack of evidence further renders the Asserted Claims obvious. Proving any such secondary considerations is Plaintiff's burden. *See, e.g.*, *ZUP, LLC v. Nach Mfg., Inc.*, 896 F.3d 1365, 1373 (Fed. Cir. 2018) ("[A] patentee bears the burden of production with respect to evidence of secondary considerations of nonobviousness."). Accordingly, Samsung reserves all rights regarding its full contention in this respect until after Plaintiff completes its final and binding disclosure of any such evidence and contentions. In the meantime, Samsung note the complete lack of any such evidence in the record.

Plaintiff has disclosed no evidence of, and Samsung knows of no viable evidence to suggest:

The alleged invention's commercial success. No products are known to practice the Asserted Claims. To the extent Plaintiff asserts that Samsung's products practice the Asserted Patents, Samsung denies that assertion and incorporates its responses to date and any future contentions, expert reports, and testimony. Further, Samsung knows of no nexus between any commercial success and the Asserted Claims. *See, e.g.*, *Windsurfing Int'l Inc. v. AMF*, 782 F.2d 995 (Fed. Cir. 1986) (considerations such as intervening, non-covered technological innovations, popularity of accessories, and advertising expense are all relevant to the nexus determination). If any commercial success is due to any of the concepts discussed in the Asserted Patents, those concepts are also present in the prior art, as described above, and thus do not support any commercial success that is relevant to the question of obviousness. *See Tokai Corp. v. Easton Enters, Inc.*, 632 F.3d 1358, 1369–70 (Fed. Cir. 2011) ("If commercial success is due to an element in the prior art, no nexus exists."); *In re Huai-Hung Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) ("Where the offered secondary consideration actually results from something other than what is both claimed and novel in the claim, there is no nexus to the merits of the claimed invention.");

Ormco Corp. v. Align Tech., Inc., 463 F.3d 1299, 1312 (Fed. Cir. 2006) ("[I]f the feature that creates the commercial success was known in the prior art, the success is not pertinent.").

Nor has Plaintiff presented evidence of commercial success via a licensing program.

Long felt but unresolved needs. Plaintiff has presented no evidence of any long felt and unresolved need. To the contrary, multiple solutions to the alleged problems pre-dated the Asserted Claims.

Industry praise. There is also no evidence of industry praise for the alleged invention of the Asserted Claims. To the extent any praise is related to any functionality that allegedly practices the Asserted Claims, that praise is not due to any novel features of the Asserted Patents, but instead only to features present in the prior art, which is not a sufficient nexus to be relevant to the question of industry praise for purposes of obviousness. *See Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318, 1328 (Fed. Cir. 2008). Praise of Samsung's mobile phones and features is not praise of the Asserted Patents.

Unexpected results. No evidence of any such unexpected results is known. As discussed above, the concepts contained in the Asserted Claims were already combined in the same manner as in those claims. These prior art systems, as described in the above-referenced exhibits, disclosed the same combination of elements, and the same result of that combination, that is recited in the claims. Thus, there were no unexpected results that arose from combining the well-known elements in the Asserted Claims.

The failure of others. No evidence of any such failure is known, and no such failure is associated with a problem that was first solved by the Asserted Claims.

Skepticism by experts. No experts or person of skill expressed skepticism about implementing the alleged inventions.

<u>Teaching away by others.</u> No evidence of any such teaching is known.

<u>Recognition of a problem.</u> As discussed above, the industry recognized the problem and had already discussed multiple approaches that implemented the Asserted Claims to solve that problem.

<u>Copying of the alleged invention by competitors.</u> No evidence of any such copying is known. *See Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1366 (Fed. Cir. 2001) (allegedly copied feature must be an embodiment of the patented claims).

VII. INVALIDITY UNDER 35 U.S.C. § 112

Pursuant to the Order Governing Proceedings, Samsung identifies below grounds of invalidity under 35 U.S.C. § 112.

A. Legal Background Regarding The Indefiniteness, Enablement, And Written Description Requirements

Section 112, ¶ 2 includes a definiteness requirement: "[T]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. "[A] patent is invalid for indefiniteness if its claims, read in light of the patent's specification and prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014).

The definiteness requirement requires that the claim set forth what the applicant regards as the invention, and do so with sufficient particularity and definiteness. *Allen Eng'g Corp. v. Bartell Indus.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002). Where it would be apparent to one of skill in the art, based on the patent specification, that the "invention" set forth in a claim is not what the patent applicant regarded as the invention, the claim is invalid. *Id.*

35 U.S.C. § 112 further includes an enablement requirement: "The specification shall contain a written description . . . of the manner and process of making and using [the invention] in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same." 35 U.S.C. § 112, ¶ 1. To satisfy the enablement requirement, the disclosure "must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation.'" *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997); *MagSil Corp. v. Hitachi Glob. Storage Techs., Inc.*, 687 F.3d 1377, 1381 (Fed. Cir. 2012); *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008). If a specification teaches away from a substantial portion of the claim or does not enable the full scope of the claim, there is no enablement. *AK Steel Corp. v. Sollac*, 344 F.3d 1234 (Fed. Cir. 2003); *see also MagSil Corp.*, 687 F.3d at 1383-84 (Fed. Cir. 2012).

35 U.S.C. § 112 further includes a written description requirement: "The specification shall contain a written description of the invention…." 35 U.S.C. § 112, ¶ 1. "To satisfy the written description requirement, a patent applicant must convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention." *ICU Medical Inc. v. Alaris Medical Systems, Inc.*, 558 F.3d 1368, 1377 (Fed. Cir. 2009) (internal quotation marks and citations omitted); *see also Synthes USA, LLC v. Spinal Kinetics, Inc.*, 734 F.3d 1332, 1340 (Fed. Cir. 2013). "The test [for written description support] requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed." *Ariad Pharmaceuticals, Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc).

The specification must describe the claimed invention in sufficient detail so that a POSITA can recognize what is claimed. "The appearance of mere indistinct words in a specification or a claim, even an original claim, does not necessarily satisfy that requirement." *University of Rochester v. G.D. Searle & Co.*, 358 F.3d 916, 923 (Fed. Cir. 2004) (internal quotation marks and citations omitted).

B. Invalidity Grounds Under 35 U.S.C. § 112

Based on Plaintiff's Infringement Contentions, and subject to the reservations set out above, Samsung identifies grounds upon which it contends that the Asserted Claims are invalid for failure to meet the requirements of 35 U.S.C. § 112 ¶¶ 1, 2 and/or 4. Although its investigation continues, Samsung believes that the Asserted Claims identified below are invalid for failure to comply with 35 U.S.C. § 112 for at least the following reasons: (1) the specification of the Asserted Patents lacks a written description of the alleged inventions of the Asserted Claims in full, clear, concise, and exact terms as required by 35 U.S.C. § 112 ¶ 1; and/or (2) the specification of the Asserted Patents does not enable the Asserted Claims as required by 35 U.S.C. § 112 ¶ 1; (3) one or more of the Asserted Claims fail to specify the scope of the claimed inventions with reasonable particularity as required under 35 U.S.C. § 112 ¶ 2. Samsung specifically reserves the right to amend and/or supplement these Invalidity Contentions based on a failure to comply with the requirements of 35 U.S.C. § 112, including, for example, based on supplementation or amendments to Plaintiff's deficient Infringement Contentions.

The Asserted Claims fail to meet the written description requirement because the alleged inventions claimed therein are not sufficiently described in the specification of the Asserted Patents. Specifically, the Asserted Claims fail to meet the written description requirement for at least the terms identified below because, based on those terms, the specification of the Asserted Patents does not adequately convey to those skilled in the art that the inventors had possession of the claimed subject matter as of the filing date. The Asserted Claims additionally fail to meet the enablement requirement because the specification of the Asserted Patents does not describe the manner and process of making and using the alleged inventions in the Asserted Claims to enable a person of skill in the art to make and use the full scope of the alleged invention without undue experimentation. Specifically, the Asserted Claims fail to meet the enablement requirement for at least the terms identified below because the specification of the Asserted Patents does not describe the manner and process of making and using the alleged invention in the Asserted Claims. Based on Samsung's present understanding of the Asserted Claims and Plaintiff's apparent interpretation of these claims as reflected in its Infringement Contentions, the Asserted Claims may fail to satisfy the requirements of § 112, ¶ 2 because the precise scope of at least the phrases listed below (or terms contained therein) cannot be determined with reasonable certainty by a POSITA when reading the claims in light of the specification and prosecution history.

The Asserted Claims fail the requirements of 35 U.S.C. § 112 in view of at least the following claim terms and phrases:[4]

Asserted Claims[5]	**Claim Term**	**Invalidity Based on 35 U.S.C. § 112**
'194 Patent		
1, 4, 7, 8, 9, 12, 13, 14, 17, 20, 22, 23	A broadband wireless repeater	Lack of Written Description; Lack of Enablement; Indefinite

[4] As set forth above, these positions are preliminary and subject to further revision. These disclosures relate specifically to invalidity issues only, and do not address any other defense or ground, including claim construction. Samsung reserves all rights with respect to such issues, including but not limited to their position that the Asserted Claims are to be construed in a particular manner.

[5] Includes unlisted claims that depend from listed claims.

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 4, 7, 8, 9	at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network	Lack of Written Description; Lack of Enablement; Indefinite
1, 4, 7, 8, 9	at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may function alternatively as a receiver and as a transmitter	Lack of Written Description; Lack of Enablement
1, 4, 7, 8, 9	a controller, which is either pre-programmed or programmable with network information which at least identifies said one or more ultrawideband wireless devices	Lack of Written Description; Lack of Enablement
1, 4, 7, 8, 9	which controls the screening of data received by said at least one receiver, and either passes, ignores, rejects, redirects, modifies, or kills received data	Lack of Written Description; Lack of Enablement
1, 4, 7, 8, 9	said controller providing such data screening in order to differentiate between desired and undesired data for network security, network management, or interference mitigation purposes for said network	Lack of Written Description; Lack of Enablement; Indefinite
1, 4, 7, 8, 9	said controller controlling reception of electronic signals or data by said at least one receiver from said one or more ultrawideband wireless devices	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	**Claim Term**	**Invalidity Based on 35 U.S.C. § 112**
	and transmission by said at least one transmitter to said one or more ultrawideband wireless devices	
1, 4, 7, 8, 9	said controller further providing for the collecting, reporting, or storing of network usage, network statistics, or network information for said network	Lack of Written Description; Lack of Enablement
8, 20	The broadband repeater of claim 1 wherein said controller either or both a) uses adaptive or steerable antennas or MIMO technologies to control the direction or coverage zones or capacity or quality of transmissions or reception, and b) directs undesired user or intruder information to be passed to other components of a network from said at least one transmitter using either wireless or wired connectivity.	Lack of Written Description; Lack of Enablement; Indefinite
12, 13, 14, 17, 20	at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network,	Lack of Written Description; Lack of Enablement; Indefinite
12, 13, 14, 17, 20	at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	function alternatively as a receiver and as a transmitter	
12, 13, 14, 17, 20	a controller which is either pre-programmed or programmable with provisioning information which at least identifies said one or more ultrawideband wireless devices for purposes of network traffic provisioning	Lack of Written Description; Lack of Enablement
12, 13, 14, 17, 20	wherein said controller uses said provisioning information to prioritize either or both reception of data by said at least one receiver and transmission of data by said at least one transmitter to said one or more ultrawideband wireless devices	Lack of Written Description; Lack of Enablement
12, 13, 14, 17, 20	said controller controlling reception of electronic signals or data by said at least one receiver and transmission of electronic signals or data by said at least one transmitter to said one or more ultrawideband wireless devices	Lack of Written Description; Lack of Enablement
22, 23	at least one receiver for receiving electronic signals at least some of which are sent by one or more ultrawideband wireless devices in a network	Lack of Written Description; Lack of Enablement; Indefinite
22, 23	at least one transmitter for transmitting received, modified, or stored electronic signals or data, wherein said at least one receiver and at least one transmitter may be separate components or be combined as a transceiver, and wherein said at least one receiver and at least one transmitter may be dedicated receive only and transmit only or may	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	function alternatively as a receiver and as a transmitter	
22, 23	a controller which is either pre-programmed or programmable to collect traffic information or security information related to received and transmitted data at least some of which is received from or sent to said one or more ultrawideband wireless devices in said network	Lack of Written Description; Lack of Enablement
22, 23	said controller controlling reception of electronic signals or data by said at least one receiver and transmission by said at least one transmitter	Lack of Written Description; Lack of Enablement
23	The broadband repeater of claim 22 further comprising one or more of a means for exporting traffic information or security information to one or more computer processors or devices, and a means for adjusting one or more operations of said controller based on said traffic information or security information.	Lack of Written Description; Lack of Enablement; Means-plus-function and indefinite
’754 Patent		
1, 2, 3, 14, 23, 24, 25	A broadband wireless repeater or relay	Lack of Written Description; Lack of Enablement; Indefinite
1, 2, 3, 14, 23, 24, 25	at least one receiver or transceiver for signal or data reception from one or more devices	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 2, 3, 14, 23, 24, 25	at least one transmitter or transceiver for signal or data transmission to one or more devices	Lack of Written Description; Lack of Enablement
1, 2, 3, 14, 23, 24, 25	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different	Lack of Written Description; Lack of Enablement
1, 2, 3, 14, 23, 24, 25	a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission	Lack of Written Description; Lack of Enablement
1, 2, 3, 14, 23, 24, 25	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more	Lack of Written Description; Lack of Enablement; Indefinite
1, 2, 3, 14, 23, 24, 25	wherein said controller is configured or configurable to perform or for performing a plurality of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters,	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	undesired users, undesired networks, or noise sources; and c) network provisioning or monitoring.	
2	The broadband wireless repeater or relay of claim 1 wherein said controller performs a)	Lack of Written Description; Lack of Enablement; Indefinite
14	The broadband wireless repeater or relay of claim 1 wherein said repeater or relay employs MIMO or adaptive antenna technology	Lack of Written Description; Lack of Enablement
23	The broadband wireless repeater or relay of claim 1 wherein said controller performs c)	Lack of Written Description; Lack of Enablement; Indefinite
’337 Patent		
1, 2, 3, 6, 8, 9, 11, 17, 26, 29, 30, 32, 33, 35, 48, 49	A broadband wireless repeater or relay	Lack of Written Description; Lack of Enablement; Indefinite
1, 2, 3, 6, 8, 9, 11, 17, 26	at least one receiver or transceiver for signal or data reception from one or more devices	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	at least one transmitter or transceiver for signal or data transmission to one or more devices	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 2, 3, 6, 8, 9, 11, 17, 26	a controller that is configured or configurable for operation in one or more wireless networks	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more	Lack of Written Description; Lack of Enablement; Indefinite
1, 2, 3, 6, 8, 9, 11, 17, 26	wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices	Lack of Written Description; Lack of Enablement
1, 2, 3, 6, 8, 9, 11, 17, 26	wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users,	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	networks, data sources, or noise sources; and b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources	
6	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform a)	Lack of Written Description; Lack of Enablement; Indefinite
8	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform network provisioning or monitoring	Lack of Written Description; Lack of Enablement; Indefinite
17	The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology	Lack of Written Description; Lack of Enablement
26	The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay	Lack of Written Description; Lack of Enablement; Indefinite
29, 30, 32, 33, 35, 48, 49	at least one receiver or transceiver for signal or data reception from one or more devices	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
29, 30, 32, 33, 35, 48, 49	at least one transmitter or transceiver for signal or data transmission to one or more devices	Lack of Written Description; Lack of Enablement
29, 30, 32, 33, 35, 48, 49	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different	Lack of Written Description; Lack of Enablement
29, 30, 32, 33, 35, 48, 49	a controller that is configured or configurable for operation in one or more wireless networks	Lack of Written Description; Lack of Enablement
29, 30, 32, 33, 35, 48, 49	said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission	Lack of Written Description; Lack of Enablement
29, 30, 32, 33, 35, 48, 49	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more	Lack of Written Description; Lack of Enablement; Indefinite
29, 30, 32, 33, 35, 48, 49	wherein said repeater or relay employs MIMO or adaptive antenna technology	Lack of Written Description; Lack of Enablement
29, 30, 32, 33, 35, 48, 49	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
29, 30, 32, 33, 35, 48, 49	wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources	Lack of Written Description; Lack of Enablement; Indefinite
30	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform a)	Lack of Written Description; Lack of Enablement; Indefinite
32	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform network provisioning or monitoring	Lack of Written Description; Lack of Enablement; Indefinite
49	The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
’999 Patent		
1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28	a wireless transmitter that is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second	Lack of Written Description; Lack of Enablement
1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28	a wireless receiver that is configured for receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second	Lack of Written Description; Lack of Enablement
1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver	Lack of Written Description; Lack of Enablement
1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement
1, 8, 9, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
12	The wireless network device of claim 11 wherein the wireless network	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	device is configured for using MIMO antenna technology	
13	The wireless network device of claim 1 wherein the wireless network device is configured for performing beamforming	Lack of Written Description; Lack of Enablement
14	The wireless network device of claim 1 wherein the wireless network device comprises an adaptable antenna; and wherein the wireless transmitter is configured for using the adaptable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
15	The wireless network device of claim 1 wherein the wireless network device comprises a steerable antenna; and wherein the wireless transmitter is configured for using the steerable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
21	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	data through electromagnetic signals in more than one frequency band, and wherein the wireless receiver is configured for receiving wireless data through electromagnetic signals in more than one frequency band	
22	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data at more than one data rate	Lack of Written Description; Lack of Enablement; Indefinite
23	The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless data at more than one data rate	Lack of Written Description; Lack of Enablement; Indefinite
26	The wireless network device of claim 1 wherein the wireless network device is configured to operate in a cellular network	Lack of Written Description; Lack of Enablement
27	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 100 MHz	Lack of Written Description; Lack of Enablement
28	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 160 MHz	Lack of Written Description; Lack of Enablement
31	transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	second with a wireless transmitter that is part of or in communication with a wireless network device	
31	receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second with a wireless receiver that is part of or in communication with the wireless network device	Lack of Written Description; Lack of Enablement
31	processing wireless data received by the wireless receiver with a processor that is part of or in communication with the wireless network device	Lack of Written Description; Lack of Enablement
31	determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
31	wherein the wireless data transmitted in the transmitting step contains information present in or determined from wireless data that was received by the wireless receiver in the receiving step	Lack of Written Description; Lack of Enablement
32	a wireless transmitter that is capable of transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
32	a wireless receiver that is capable of receiving wireless data through electromagnetic signals that have a	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	
32	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver	Lack of Written Description; Lack of Enablement
32	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement
32	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
32	wherein the wireless network device is configured for transmitting beacon frames with the wireless transmitter	Lack of Written Description; Lack of Enablement
39	a wireless transmitter configured for transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
39	a wireless receiver is configured for receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
39	wherein the wireless transmitter is configured for transmitting wireless	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	data that contains information present in or determined from wireless data that has been received by the wireless receiver	
39	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement
39	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
’783 Patent		
1, 2, 3, 6	a wireless transmitter that tramsits wireless data throught electromagnetic signales that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement; Indefinite
1, 2, 3, 6	a wireless receiver that receives wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
1, 2, 3, 6	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver	Lack of Written Description; Lack of Enablement
1, 2, 3, 6	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 2, 3, 6	wherein the wireless network is configured for determining whether and, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement
1, 2, 3, 6	wherein the wireless network device is configured for transmitting beacon frames with the wireless transmitter	Lack of Written Description; Lack of Enablement
2	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data at more than one data rate	Lack of Written Description; Lack of Enablement; Indefinite
3	The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless data at more than one data rate	Lack of Written Description; Lack of Enablement; Indefinite
6	The wireless network device of claim 1 wherein the wireless network device is configured to operate in a cellular network	Lack of Written Description; Lack of Enablement
13, 14, 15	a wireless transmitter that transmits wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
13, 14, 15	a wireless receiver that receives wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
13, 14, 15	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	that has been received by the wireless receiver	
13, 14, 15	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement
13, 14, 15	wherein the wireless network device is configured for determining whether any, a portion, or all informaiton in the process wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
13, 14, 15	wherein the wireless transmitter is configured for transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
	wherein the wireless receiver is configured for receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
14	The wireless network device of claim 13 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 100 MHz	Lack of Written Description; Lack of Enablement
15	The wireless network device of claim 13 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 160 MHz	Lack of Written Description; Lack of Enablement
16	a wireless transmitter that transmits wireless data through electromagnetic	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	
16	a wireless receiver that receives wireless data through electromagnetic signals that have a bnadwidth greater than or equal to 100 MHz and less than or equal to 500 MHz	Lack of Written Description; Lack of Enablement
16	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver	Lack of Written Description; Lack of Enablement
16	wherein the wireless network device is configured for processing wireless data received by the wireless receiver	Lack of Written Description; Lack of Enablement
16	wherein the wireless network device is configured for determining whether any, a portion, or all information in the process wireless data should be transmitted by the wireless transmitter	Lack of Written Description; Lack of Enablement; Indefinite
16	wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second	Lack of Written Description; Lack of Enablement
16	wherein the wireless receiver is configured for receiving wireless data throught electormagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second	
’763 Patent		
1, 6, 10, 13	“one or more antennas,” “at least one multiband antenna,” or “at least one antenna”	Lack of Written Description; Lack of Enablement
1	a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands	Indefinite
1, 6	is tuned by one or more passive elements which are selected or interconnected using electronic control	Lack of Written Description; Lack of Enablement; Indefinite
3, 7	used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands	Indefinite
13	at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands	Lack of Written Description; Indefinite
13	two or more components transmit or receive electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands	Lack of Written Description; Indefinite
15	one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components	Lack of Written Description; Lack of Enablement Indefinite
16	isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands	Lack of Written Description; Lack of Enablement; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
’358 Patent		
1, 8, 14, 19	“at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array,” “at least one multiband antenna which includes one or more elements or sub-elements and which is configured to form an antenna array,” “at least one antenna of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array”	Lack of Written Description; Lack of Enablement; Indefinite
1	a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands	Indefinite
1, 8	is tuned by one or more passive elements which are selected or interconnected using electronic control	Lack of Written Description; Lack of Enablement; Indefinite
3, 9, 15	used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands	Indefinite
6, 12, 17, 23	configured for use and implemented in a multiple input multiple output (MIMO) system	Lack of Written Description; Lack of Enablement
7, 13, 18, 24	configured for use and implemented in a beam switchable array	Lack of Written Description; Lack of Enablement
19	said one or more antennas radiating or receiving electromagnetic energy at particular frequency bands, at least one of said one or more antennas radiating or receiving electromagnetic energy at a plurality of particular frequency bands	Lack of Written Description; Lack of Enablement
19	at least one of said one or more components transmits or receives electromagnetic energy	Lack of Written Description; Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	simultaneously at two or more of said plurality of particular frequency bands	
19	two or more components transmit or receive electromagnetic energy at two or more of said plurality of particular frequency bands	Lack of Written Description; Indefinite
21	one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components	Lack of Written Description; Lack of Enablement Indefinite
22	isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands	Lack of Written Description; Lack of Enablement; Indefinite
’625 Patent		
1, 6, 7, 9	A method for avoiding radiation of a user or structure by a wireless device having at least one steerable antenna	Indefinite; Lack of Enablement; Lack of Written Description
1, 6, 7, 9	detecting in a three dimensional space, using one or more cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors, an orientation of said wireless device relative to either or both said user and said structure;	Lack of Enablement; Lack of Written Description
1, 6, 7, 9	determining zones or spans of directions in the three dimensional space corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna	Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 6, 7, 9	wherein said at least one steerable antenna is configured to steer or direct its energy in particular directions while providing nulls or dead zones in other directions,	Indefinite; Lack of Enablement; Lack of Written Description
1, 6, 7, 9	and wherein said adjusting step adjusts the one or more beam radiation patterns for direction of energy to one or more of said particular directions while avoiding said zones or spans of directions in the three dimensional space, and	Indefinite; Lack of Enablement; Lack of Written Description
1, 6, 7, 9	wherein said at least one steerable antenna operates on one or multiple bands and radiates at one or more frequencies in the range of 10 GHz to 500 GHz	Indefinite; Lack of Enablement; Lack of Written Description
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	zones or spans of directions	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	particular directions	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	other directions	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	nulls or dead zones	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	user or structure	Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	an orientation of said wireless device relative to either or both said user and said structure	Indefinite
1, 6, 7, 9	avoiding said zones or spans of directions	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	one or more directions which are not in said zones or spans	Indefinite
11, 12, 13, 17, 18, 19, 21	said particular directions	Indefinite
1, 6, 7, 9, 11, 12, 13, 17, 18, 19, 21, 23, 25, 27, 29, 30, 31, 33	steerable antenna	Lack of Written Description; Lack of Enablement
11, 12, 13, 17, 18, 19, 21	perform the steps of	Indefinite
11, 12, 13, 17, 18, 19, 21	directions of said particular directions	Indefinite
2	said detecting step comprises one or more of: capturing one or more images with at least one camera; detecting ambient light or blockage thereof with at least one light sensor; detecting motion of said wireless device with at least one gyroscope; detecting one or more of audio or ultrasonic signals relating to the orientation of the user or structure with one or more of a microphone,	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	ultrasonic sensor, or ultrasonic transducer; and detecting relative position of the user or structure with at least one capacitive sensor.	
5	wherein said at least one steerable antenna or said another antenna uses one or more of: beamforming, beamsteering, beam or antenna element selection, adaptive beamforming, multibeam combining, MIMO, phasing, beam switchable array, active combining, passive combining, and hybrid antenna structure	Lack of Written Description; Lack of Enablement
6, 7	wherein a directional radiating pattern of said one or more beams is different from a receiving pattern used in said step of receiving said signals	Indefinite; Lack of Enablement; Lack of Written Description
7	using time division duplexing for communication, using said one or more beams radiated by said at least one steerable antenna and signals received by at least one of said at least one steerable antenna	Indefinite; Lack of Enablement; Lack of Written Description
9, 21, 33	at least one steerable antenna operates on multiple bands	Lack of Enablement; Lack of Written Description
11, 12, 13, 17, 18, 19, 21	one or more sensors selected from the group consisting of cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors configured to detect in a	Lack of Enablement; Lack of Written Description

Asserted Claims[5]	**Claim Term**	**Invalidity Based on 35 U.S.C. § 112**
	three dimensional space an orientation of said wireless device relative to either or both said user and said structure	
11, 12, 13, 17, 18, 19, 21	wherein said at least one steerable antenna is configured to adjust a beam radiation pattern so as to steer or direct its energy in particular directions while providing nulls or dead zones in other directions	Indefinite; Lack of Enablement; Lack of Written Description
11, 12, 13, 17, 18, 19, 21	wherein said at least one steerable antenna radiates at one or more frequencies in the range of 10 GHz to 500 GHz; and	Lack of Enablement; Lack of Written Description
11, 12, 13, 17, 18, 19, 21	using said signals, computing zones or spans of directions corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna in the three dimensional space	Lack of Enablement; Lack of Written Description
11, 12, 13, 17, 18, 19, 21	adjusting one or more beam radiation patterns of said at least one steerable antenna to radiate in one or more directions of said particular directions which are not in said zones or spans of directions in the three dimensional space	Lack of Enablement; Lack of Written Description
12	wherein said at least one steerable antenna comprises a plurality of steerable antennas	Indefinite; Lack of Enablement; Lack of Written Description
13	said one or more sensors includes one or more cameras, gyroscopes, light or motion detectors, capacitive sensors, microphones, and ultrasound sensors or transducers	Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
17	wherein said at least one steerable antenna or said receiver uses one or more of: beamforming, beamsteering, beam or antenna element selection, adaptive beamforming, multibeam combining, MIMO, phasing, beam switchable array, active combining, passive combining, and hybrid antenna structure	Lack of Written Description; Lack of Enablement
18	a directional radiating pattern of said one or more beams radiated from said at least one steerable antenna is different from a receiving pattern used by said at least one steerable antenna or said receiver used to receive said over-the-air signals	Indefinite; Lack of Written Description; Lack of Enablement
19	configured for time division duplexing for communication, using said one or more beams radiated by said at least one steerable antenna and using over-the-air signals received by at least one of said at least one steerable antenna or said receiver.	Lack of Written Description; Lack of Enablement
21	at least one steerable antenna operates on multiple bands	Lack of Written Description; Lack of Enablement
23, 25, 27, 29, 30, 31, 33	A steerable antenna system for avoiding radiation of a user or structure by a wireless device, comprising	Indefinite; Lack of Enablement; Lack of Written Description
23, 25, 27, 29, 30, 31, 33	one or more sensors configured to detect in a three dimensional space using one or more cameras, microphones, audio sensors or transducers, ultrasound sensors, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors, an orientation of said	Indefinite; Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	wireless device relative to either or both said user and said structure	
23, 25, 27, 29, 30, 31, 33	wherein said at least one steerable antenna is configured to adjustably steer or direct its energy in particular directions while providing nulls or dead zones in other directions in the three dimensional space	Indefinite; Lack of Enablement; Lack of Written Description
23, 25, 27, 29, 30, 31, 33	configured to determine zones or spans of directions	Indefinite
23, 25, 27, 29, 30, 31, 33	configured to determine zones or spans of directions	Indefinite
25	said one or more sensors includes one or more cameras, gyroscopes, light or motion detectors, capacitive sensors, microphones, and ultrasound transducers	Lack of Enablement; Lack of Written Description
27	a directional radiating pattern of said one or more beams radiated from said at least one steerable antenna is different from a receiving pattern of said at least one steerable antenna	Lack of Enablement; Lack of Written Description
29	wherein said at least one steerable antenna or said receiver uses one or more of: beamforming, beamsteering, beam or antenna element selection, adaptive beamforming, multibeam combining, MIMO, phasing, beam switchable array, active combining, passive combining, and hybrid antenna structure	Lack of Written Description; Lack of Enablement
30	a directional radiating pattern of said one or more beams radiated from said at least one steerable antenna is	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	different from a receiving pattern used by said at least one steerable antenna or said receiver	
31	configured for time division duplexing for communication, using said one or more beams radiated by said at least one steerable antenna and signals received by at least one of said at least one steerable antenna or said receiver	Lack of Written Description; Lack of Enablement
’548 Patent		
1, 6	A wireless device configured for avoiding radiation of a user or structure	Indefinite; Lack of Enablement; Lack of Written Description
1, 6	one or more detectors selected from the group consisting of one or more cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, for detecting an orientation of said wireless device relative to either or both said user and said structure	Indefinite; Lack of Enablement; Lack of Written Description
1, 6	one or more processors for determining, based on information provided by said one or more detectors, zones or spans of directions in the three dimensional space corresponding with one or more directions of said user or structure relative to said at least one steerable antenna	Indefinite; Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1, 6	one or more steerable antennas which operate on one or multiple bands and radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz	Indefinite; Lack of Enablement; Lack of Written Description
1, 6	said one or more steerable antennas are configured to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions	Indefinite; Lack of Enablement; Lack of Written Description
1, 6, 7, 12	an orientation of said wireless device relative to either or both said user and said structure	Indefinite
1, 6, 7, 12	zones or spans of directions in three dimensional space	Indefinite; Lack of Written Description; Lack of enablement
1, 6, 12	particular directions	Indefinite
1, 6, 12	other directions	Indefinite
1, 6, 7, 12	accentuate; attenuating	Indefinite; Lack of Written Description
1, 6	said one or more computational devices	Indefinite
1, 6, 7, 12	user or structure	Indefinite
1, 6, 7, 12	steerable antenna	Lack of Enablement; Lack of Written Description
6	wherein said at least one steerable antenna comprises a plurality of steerable antennas.	Indefinite; Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
7	A method for avoiding or reducing radiation of a user or structure by a wireless device having at least one streerable antenna	Indefinite; Lack of Enablement; Lack of Written Description
7	sensing with one or more sensors selected from the group consisting of cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	Indefinite; Lack of Enablement; Lack of Written Description
7	using said signals, computing zones or spans of directions corresponding with one or more directions of said user or structure relative to said at least one steerable antenna in the three dimensional space	Indefinite; Lack of Enablement; Lack of Written Description
7	accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions	Indefinite; Lack of Enablement; Lack of Written Description
7	wherein said at least one steerable antenna radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz.	Lack of Enablement; Lack of Written Description
7	said one or more processors	Indefinite
7	said executable instructions	Indefinite
7	based on signals from said one or more processors	Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
12	A method for avoiding radiation of a user or structure by a wireless device with a steerable antenna system	Indefinite; Lack of Enablement; Lack of Written Description
12	detecting in a three dimensional space with one or more sensors selected from the group consisting of one or more cameras, microphones, audio sensors or transducers, ultrasound sensors, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	Indefinite; Lack of Enablement; Lack of Written Description
12	computing, with a computation module communicatively coupled to said one or more sensors, zones or spans of directions in the three dimensional space	Indefinite; Lack of Enablement; Lack of Written Description
12	at least one steerable antenna that operates on one or multiple bands, which radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz	Lack of Enablement; Lack of Written Description
12	at least one steerable antenna radiates or receives one or more beams in one or more directions while attenuating its radiation pattern in said zones or spans of directions in the three dimensional space	Indefinite; Lack of Enablement; Lack of Written Description
12	zones or spans of directions correspond with one or more directions or locations of said user or structure relative to said at least one	Indefinite; Lack of Enablement; Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	steerable antenna in the three dimensional space	
12	attenuating the radiation pattern in other directions in the three dimensional space	Indefinite; Lack of Enablement; Lack of Written Description
12	directions or locations	Indefinite
12	“adjusting at least one steerable antenna…” and “wherein said at least one steerable antenna is adjusted in the adjusting step…”	Indefinite
	’794 Patent	
20	clearinghouse system	Indefinite, Lack of Enablement, Lack of Written Description
20	computers which interface with a database	Lack of Written Description; Lack of Enablement
20	mapping information	Indefinite
20	electronic interfaces to said one or more computers	Indefinite, Lack of Written Description; Lack of Enablement
20	electronic interfaces to said one or more computers which permit <information> obtained from one or more mobile or fixed devices … to be automatically or manually updated into said database	Indefinite, Lack of Written Description; Lack of Enablement
20	which permits at least one of said one or more telecommunications carriers or said one or more end users or one or more parties which are not telecommunications carriers or end	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	users to review, catalog or sort information in said database; and	
20	obtaining and providing said performance or quality of service information to said one or more electronic interfaces	Lack of Written Description; Lack of Enablement
23	means for sending instructions from one of said one or more electronic interfaces to one or more wireless devices for configuring or reconfiguring said one or more wireless devices based on a ranking of performance or specific requests of an end use	Indefinite, Lack of Written Description; Lack of Enablement; Means-plus-function
25	monitoring of radio operating conditions of one or more wireless devices, wherein monitored radio operating conditions are used to update performance or quality of service information in said database	Lack of Written Description; Lack of Enablement
’925 Patent		
1, 6, 12, 17	perceived communications service quality or value information	Indefinite
1	clearinghouse for communications networks	Indefinite, Lack of Enablement, Lack of Written Description
1, 12	experienced or desired	Indefinite
1, 12	computers which interface with a database	Lack of Written Description; Lack of Enablement
1, 12	mapping information	Indefinite

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
1	updating in said database either automatically or manually, using one or more electronic interfaces to said one or more computers, performance, quality of service, or perceived communications service quality or value information, experienced or desired, obtained for one or more mobile or fixed devices that are located in one of said one or more geographic locations	Lack of Written Description; Lack of Enablement
1, 12	review, catalog, store, view, use, or sort said performance, quality of service, or perceived communications service quality or value information, experienced or desired, in said database	Lack of Written Description; Lack of Enablement
1, 12	obtaining said performance or quality of service or perceived communications service quality or value information, experienced or desired, using one or more applications operable with said one or more mobile or fixed devices or said one or more computers; and	Lack of Written Description; Lack of Enablement
1, 12	providing said performance or quality of service or perceived communications service quality or value information, experienced or desired, to said one or more electronic interfaces using one or more applications operable with said one or more mobile or fixed devices or said one or more computers	Lack of Written Description; Lack of Enablement
4	sending instructions from one of said one or more electronic interfaces to one or more wireless devices for configuring or reconfiguring said one	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	or more wireless devices based on one or more of: ranking of performance, enhanced spectrum usage, control of interference, or requests of an end user	
6	monitoring radio operating conditions for one or more mobile or fixed devices, and using monitored radio operating conditions to update performance or quality of service information or perceived communications service quality or value information in said database	Lack of Written Description; Lack of Enablement
12	clearinghouse system for communications networks	Indefinite, Lack of Enablement, Lack of Written Description
12	one or more electronic interfaces to said one or more computers which permit performance, quality of service, or perceived communications service quality or value information, experienced or desired, obtained for one or more mobile or fixed devices that are located in one of said one or more geographic locations to be automatically or manually updated into said database	Indefinite, Lack of Enablement, Lack of Written Description
12	one or more electronic interfaces to said one or more computers … which permit at least one of said one or more telecommunications carriers or one or more of said end users or one or more parties which are not telecommunications carriers or end users to review, catalog, store, view, sort, or use said performance, quality of service, or perceived	Indefinite, Lack of Enablement, Lack of Written Description

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	communications service quality or value information, experienced or desired, in said database	
12	a monitoring application which permits monitoring of radio operating conditions for one or more mobile or fixed wireless devices, wherein monitored radio operating conditions are used to update performance or quality of service information or perceived communications quality or service value in said database	Indefinite, Lack of Enablement, Lack of Written Description
14	means for sending instructions from one of said one or more electronic interfaces to one or more wireless devices for configuring or reconfiguring said one or more wireless devices based on one or more of: a ranking of performance, enhanced spectrum usage, control of interference, or requests of an end user	Lack of Written Description; Lack of Enablement; Indefinite; Means Plus Function
17	one or more electronic interfaces to said one or more computers further permit one or more mobile or fixed devices or one or more end users to communicate said performance, quality of service, or perceived communications service quality or value information, experienced or desired, to said one or more computers	Indefinite, Lack of Written Description; Lack of Enablement
18	electronic interfaces are configured to receive geographic location information from said one or more mobile or fixed devices or one or more end users	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
22	means for determining one or more of towers or frequencies being used by one or more of said one or more mobile or fixed devices or end users	Lack of Written Description; Lack of Enablement; Indefinite; Means Plus Function
’700 Patent		
1, 10	perceived	Indefinite
1	using a computer, receiving mobile device location information of a plurality of mobile devices or end users that are associated with one or more wireless communications networks and quality or service information pertaining to wireless access characteristics for one or more mobile devices of said plurality of mobile devices or end users, and said quality or service information comprising coverage, availability or performance information of one or more wireless communications networks or said one or more mobile devices	Lack of Written Description; Lack of Enablement
1	storing, by action of said computer, said mobile device location information and said quality or service information in a memory or database	Lack of Written Description; Lack of Enablement
1	updating, by action of said computer, said mobile device location information stored in said memory or database when a mobile device of said plurality of mobile devices travels from one location to another	Lack of Written Description; Lack of Enablement
1	providing access to said quality or service information stored in said memory or database to one or more end users or one or more end user	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	communication devices or one or more carriers or third parties that provide services to said one or more end users or one or more end user communication devices or one or more carriers, or to said one or more wireless communications networks	
4	serving data based on mobile device location information and quality or service information stored in said memory or database	Indefinite, Lack of Written Description; Lack of Enablement
10	computer configured to receive mobile device location information of a plurality of mobile devices or end users that are associated with one or more wireless communications networks and quality or service information pertaining to wireless access characteristics for one or more mobile devices of said plurality of mobile devices or end users, and said quality or service information comprising coverage, availability or performance information of one or more wireless communications networks or said one or more mobile devices	Lack of Written Description; Lack of Enablement
10	a memory or database configured to store the received mobile device location information and quality or service information	Lack of Written Description; Lack of Enablement
10	interface through which one or more end users or one or more end user communication devices, or one or more carriers, or one or more third parties that provide services to said one or more end users or one or more end user communication devices or	Lack of Written Description; Lack of Enablement

Asserted Claims[5]	Claim Term	Invalidity Based on 35 U.S.C. § 112
	said one or more carriers, or one or more wireless communications networks may access said quality or service information or mobile device location information stored in said memory or database	
12	server configured to generate and serve data based on mobile device location information and quality or service information stored in said memory or database to one or more end users or one or more end user communications devices	Lack of Written Description; Lack of Enablement

Samsung reserves the right to modify, amend, or supplement its contentions relating to 35 U.S.C. § 112 as the case progresses, including in view of any claim construction orders entered by the Court in this matter.

VIII. INVALIDITY UNDER 35 U.S.C. § 101

Pursuant to Judge Gilstrap's Standing Order, Exhibits 763-C, 358-C, 794-C, 925-C, and 700-C provide charts identifying (1) each exception to eligibility (e.g., abstract idea, law of nature, and natural phenomenon) to which each Asserted Claim of the Asserted Patents is directed and the factual and legal basis therefor; (2) whether one or more of the Asserted Claims of the Asserted Patents are representative of any other claims; (3) a description of the industry, at the relevant time, in which the Asserted Claims of the Asserted Patents are alleged to be well understood, routine, and conventional, and the factual and legal basis therefor; (4) a description of how each element of the Asserted Claims of the Asserted Patents, both individually and in combination with the other elements of that claim, was well understood, routine, conventional, in the relevant industry at the relevant time, and the legal and factual basis therefor; and (5) any other factual or legal basis for how the Asserted Claims of the Asserted Patents are otherwise ineligible for patent protection.

These Ineligibility Contentions, like the rest of these Invalidity Contentions and the exhibits hereto, are based on the facts and law currently available to Samsung, and Samsung reserves the right to update these contentions in light of additional cases and guidance as they become available, the Court's claim construction order, or positions Plaintiff takes on infringement.

IX. DOCUMENT PRODUCTION ACCOMPANYING INVALIDITY CONTENTIONS

With these Invalidity Contentions and Subject Matter Eligibility Contentions, Samsung produces the documents required under Local Patent Rule 3-4 and the Standing Order Regarding Subject Matter Eligibility Contentions Applicable to All Patent Infringement Cases Assigned to Chief District Judge Rodney Gilstrap, as ordered on 25 July, 2019.

Dated: November 12, 2025

By */s/ Melissa R. Smith*

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CERTIFICATE OF SERVICE

Pursuant to the Federal Rules of Civil Procedure and Local Rule CV-5, I hereby certify that, on November 12, 2025, all counsel of record who have appeared in this case are being served with a copy of the foregoing via email.

Dated: November 12, 2025

/s/ Benjamin M. Kleinman ____________________
Benjamin M. Kleinman