UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

ATLAS GLOBAL TECHNOLOGIES LLC, Plaintiff, v. ZYXEL NETWORKS CORPORATION AND ZYXEL COMMUNICATIONS CORPORATION Defendants.	Civil Action No. 6:22-cv-355-ADA **JURY TRIAL DEMANDED**
ATLAS GLOBAL TECHNOLOGIES LLC, Plaintiff, V. D-LINK CORPORATION Defendant.	Civil Action No. 6:22-cv-520-ADA **JURY TRIAL DEMANDED**

DEFENDANTS' FINAL INVALIDITY CONTENTIONS

Pursuant to the Court's Order Governing Proceedings and the Court's Scheduling Order, Defendants ZyXEL Networks Corporation, ZyXEL Communications Corporation, and D-Link Corporation (collectively "Defendants") respectfully submit these invalidity contentions with respect to the asserted claims of U.S. Patent Nos. 9,531,520 (the "'520 Patent"), 9,763,259 (the "'259 Patent"), 9,825,738 (the "'738 Patent"), 9,848,442 (the "'442 Patent"), 9,912,513 (the "'513 Patent"), 9,917,679 (the "'679 Patent"), 10,020,919 (the "'919 Patent"), 10,153,886 (the "'886 Patent"), 10,756,851 (the "'851 Patent") (collectively the "Asserted Patents") identified by Plaintiff Atlas Global Technologies LLC ("AGT" or "Plaintiff") in its Preliminary Infringement Contentions.

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The currently Asserted Claims, as reflected in Plaintiff's Preliminary Infringement Contentions, are claims 1-6, 8-16, and 18-20 of the '520 Patent, claims 1-7 and 18 of the '259 Patent, claims 1-16 of the '738 Patent, claims 1-14 of the '442 Patent, claims 1-19 of the '513 Patent, claims 1-10 of the '679 Patent, claims 1-9 and 11-19 of the '919 Patent, claims 1-16 of '886 Patent, and claims 1-5, 7-9, and 14-20 of the '851 Patent. As detailed further below, the Asserted Patents are anticipated by, or obvious in view of, one more of the prior art references that have been produced to Plaintiff or are being produced at AGTPRIORART_00000001 - AGTPRIORART_ 00043076, as well as invalid under 35 U.S.C. § 112.

Defendants' counsel hereby certifies that counsel undertook reasonable efforts to prepare Defendants' preliminary invalidity contentions and all supplements/amendments to its preliminary invalidity contentions are based on materials identified after those earlier contentions were served.

Defendants further incorporate by reference the Invalidity Contention by defendants in related proceedings that related one or more of the Asserted Patents, including but not limited to the Invalidity Contentions by Sercomm Corporation in 6:21-cv-00818-ADA (WDTX); ASUSTek Computer Inc. in 6:21-cv-00820-ADA (WDTX); OnePlus Technology in 6:21-cv-01217-ADA (WDTX); TP-Link Technologies Co., Ltd. et al. in 2:21-cv-00430 (EDTX); and Acer Inc. in 6:22-cv-00259 (EDTX).

I. PRELIMINARY STATEMENT

These invalidity contentions are based on Defendants' current knowledge, understanding, and belief of the Asserted Patents and prior art, of Plaintiff's infringement theories (inasmuch as they can be inferred from its preliminary Infringement Contentions), and of the facts and other information available as of the date of these invalidity contentions. Defendants' investigation, discovery, and analysis of information related to this action is ongoing. Additional discovery, elucidation of Plaintiff's impermissibly vague infringement contentions, and/or orders of the Court may require Defendants to amend or supplement these invalidity contentions, and Defendants expressly reserve the right to do so

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as the case proceeds. These contentions represent Defendants' good-faith effort to provide a comprehensive identification of prior art relevant to this case, but Defendants reserve the right to modify or supplement their prior art list and invalidity contentions at a later time with, or based upon, pertinent information that may be subsequently discovered.

A. No Waiver.

Nothing in these invalidity contentions is intended, nor should be construed, as a waiver of any noninfringement position or argument under 35 U.S.C. § 112. Defendants' statements herein (including the accompanying claim charts) reflect Defendants' present understanding of the purported scope of the claims as alleged by Plaintiff in its Infringement Contentions (as best those contentions can be understood in light of their present deficiencies).

The patent claims have yet to be construed. As a result, Defendants have based these invalidity contentions upon its knowledge and understanding of the potential scope of the Asserted Claims at this time, and, in part, upon the apparent interpretations of the Asserted Claims advanced by Plaintiff in its Infringement Contentions. Defendants may disagree with Plaintiff's interpretation of the meaning of many terms and phrases in the Asserted Claims. Defendants have provided these invalidity contentions based in part on their present understanding of Plaintiff's apparent constructions and interpretations of the Asserted Claims. These invalidity contentions do not represent Defendants' agreement or view as to the proper interpretation of any claim term contained therein. Any similarity between any apparent claim interpretation in any of Defendants' charts of prior art reference and Plaintiff's contentions is not an admission or agreement with Plaintiff about the meaning of any claim term, but rather a reflection of the fact that the subject matter Plaintiff believes is claimed is present in the prior art, or that the claims are otherwise invalid. These invalidity contentions are made in the alternative, and should not be interpreted to rely upon, or in any way affect, the non- infringement arguments Defendants may assert in this case. Defendants reserve the right to amend, supplement, or

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materially modify its invalidity contentions as the case proceeds. Defendants also reserve the right to amend, supplement, or materially modify its invalidity contentions based on any infringement and/or additional claim construction positions that Plaintiff may take in this case.

Defendants also reserve the right to amend, supplement, or materially modify their invalidity contentions in response to any claim construction or interpretation positions that Plaintiff may take. Defendants also reserve the right to assert that a claim is indefinite, not enabled, or fails to meet the written description requirement of 35 U.S.C. § 112 based on any claim construction or interpretation position Plaintiff may take in this case or based on any claim construction the Court may further adopt in this case.

B. No Admission.

Nothing disclosed herein is an admission or acknowledgement that any product accused of infringement by Plaintiff in its Infringement Contentions (the "Accused Products"), or any of Defendants' other products or services, infringes any of the Asserted Claims.

Defendants further note that Plaintiff appears to rely upon overly broad interpretations of the Asserted Claims. At the same time, Plaintiff's Infringement Contentions are in some places too general and vague to discern Plaintiff's infringement theories and how exactly Plaintiff contends each Accused Product meets or practices each element of the Asserted Claims. In addition, Plaintiff's Infringement Contentions, in many cases, continue to fail to put Defendants on notice of Plaintiff's interpretation of the Asserted Claims, further prejudicing Defendants' ability to identify relevant prior art. In addition, Plaintiff has not explained any theories of infringement under the doctrine of equivalents. To the extent that Plaintiff amends its contentions to pursue any currently unexplained doctrine of equivalents theories, Defendants expressly reserve the right to supplement or amend these invalidity contentions to account for such amendments.

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To the extent that any of the prior art references disclose the same functionality or feature of any of the Accused Products, Defendants reserve the right to argue that said feature or functionality does not practice any element of any of the Asserted Claims, and to argue, in the alternative, that if said feature or functionality is found to practice any element of any of the Asserted Claims, then the prior art reference demonstrates that the element is not novel, is obvious, and/or is otherwise not patentable.

Attached hereto are representative claim charts that identify where the elements of the Asserted Claims of the Asserted Patents may be found in the prior art and further identifying why those references are not novel or non-obvious. The references cited in the attached claim charts may disclose the limitations of the Asserted Claims expressly and/or inherently. The suggested obviousness combinations may be presented in conjunction with or in the alternative to Defendants' contentions regarding anticipation. These obviousness combinations should not be construed to suggest that any reference included in any combination is not anticipatory in its own right. Further, to the extent that Plaintiff contends that any of the references identified do not constitute prior art under 35 U.S.C. § 102, Defendants reserve the right to rely upon other prior art references in the same patent family with substantially identical disclosures as evidence of invalidity based on the same theories as those disclosed below.

C. Reservation of Rights.

Prior art not currently included in this disclosure may become relevant. Defendants are currently unaware of the extent, if any, to which Plaintiff will contend that limitations of the Asserted Claims are not disclosed in the prior art identified by Defendants. Defendants reserve the right to identify other references that would have made the addition of the allegedly missing limitation to the disclosed device or method obvious or show that the allegedly missing limitation would have been known or readily apparent to one of ordinary skill in the art at the time of the invention in light of the

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disclosure of the prior art at issue. Defendants further reserve the right to rely on any of the references produced at AGTPRIORART_00000001 - AGTPRIORART_ 00029957 in order to demonstrate the state of art at the alleged times of invention and as evidence of the knowledge of one of ordinary skill in the art in support of any motivations to modify or combine the charted prior art references with other references or knowledge.

Plaintiff and the named inventors may also be aware of additional prior art that is not known to Defendants. To the extent that Plaintiff produces additional prior art responsive to Defendants' discovery requests after these contentions are served, Defendants may supplement their invalidity contentions with prior art contained in such production once they have had a fair opportunity to review, analyze, and chart such prior art. Defendants reserve the right to amend their invalidity contentions with any additional potential prior art known by Plaintiff but not yet disclosed to Defendants.

Defendants provide these invalidity contentions only for the claims that have been asserted by Plaintiff, but reserve the right to seek invalidation of all claims in each of the Asserted Patents.

D. Ongoing Investigation.

Defendants' investigation is ongoing, and Defendants expressly reserve the right to amend their disclosures and document production to account for evidence uncovered as their investigation continues. Such amendments include identifying and relying on additional references that may result from Defendants' further search and analysis. Defendants reserve the right to supplement these contentions in light of any additional prior art of which Plaintiff is aware and did not disclose to Defendants in discovery, or that might be subsequently disclosed by Plaintiff in response to Defendants' discovery requests. Defendants anticipate issuing subpoenas to third parties believed to have knowledge, documentation and/or corroborating evidence concerning some of the prior art listed herein and/or additional prior art. These third parties include, but are not limited to, the authors, employers of authors, inventors, assignees, or former or current employees of assignees, of the

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references identified in these invalidity contentions. For example, Defendants anticipate issuing subpoenas to potential prior artists including but not limited to individuals and entities responsible for the development of prior art systems. Defendants reserve the right to supplement these contentions in light of any newly discovered information produced by these or other companies from which Defendants may seek discovery.

II. THE ASSERTED PATENTS ARE INVALID.

A. Identification of Prior Art

Defendants contend that the prior art references charted in Exhibits A-1 through A-8, B-1 through B-16, C-1 through C-12, D-1 through D-7, E-1 through E-15, F-1 through F-12, G-1 through G-18, H-1 through H-7, and I-1 through I-7, and/or described below anticipate and/or render obvious, alone or in combination, one or more of the Asserted Claims of the Asserted Patents. Furthermore, Defendants reserve the right to rely on any of the charted prior art references together with any of the below references to show the state of the art and the knowledge of one of ordinary skill in the art at the time of the alleged inventions of the Asserted Patents.

Bates Number	Prior Art Reference
AGTPRIORART_00000001	11-09-0992-21-00ac-proposed-specification-framework-for-tgac
AGTPRIORART_00000050	11-14-1435-00-00ax-considerations-on-obss-spatial-reuse
AGTPRIORART_00000060	11-15-0132-09-00ax-spec-framework
AGTPRIORART_00000080	11-15-0349-02-00ax-he-ltf-proposal
AGTPRIORART_00000123	11-15-1051-01-00ax-he-ndp-frame-for-sounding
AGTPRIORART_00000137	11-15-1097-01-00ax-reducing-channel-sounding-protocol-overhead-for-11ax
AGTPRIORART_00000153	11-15-1103-00-00ax-dl-sounding-sequence-with-ul-mu-feedback
AGTPRIORART_00000171	61-887431
AGTPRIORART_00000200	61-889490
AGTPRIORART_00000232	61-987435

Bates Number	Prior Art Reference
AGTPRIORART_00000260	802.11-1997
AGTPRIORART_00000719	802.11-1999
AGTPRIORART_00001248	802.11-2007
AGTPRIORART_00002480	802.11-2012
AGTPRIORART_00005273	802.11a-1999
AGTPRIORART_00005363	802.11b
AGTPRIORART_00005460	802.11e-2005
AGTPRIORART_00005671	802.11g-2003
AGTPRIORART_00005749	802.11n-2009
AGTPRIORART_00006285	802.11n-DraftStd_June2009
AGTPRIORART_00006845	802-11-Amd3-2014
AGTPRIORART_00007479	802.11-2020
AGTPRIORART_00011858	802.11ax-2021
AGTPRIORART_00012625	802.11ac-2013
AGTPRIORART_00012774	61-819233
AGTPRIORART_00012848	61-877575
AGTPRIORART_00012948	62-100605
AGTPRIORART_00012985	62-156005
AGTPRIORART_00013068	A-MPDU_using_fragmented_MPDUs.
AGTPRIORART_00013072	An Efficient Uplink Multiuser MIMO Protocol in IEEE 802.11 WLANs (Tandai)
AGTPRIORART_00013077	62-020991
AGTPRIORART_00013107	62-034756
AGTPRIORART_00013135	62-036605
AGTPRIORART_00013163	62-044404
AGTPRIORART_00013221	62-086191
AGTPRIORART_00013249	62-093354
AGTPRIORART_00013273	2011/0261806
AGTPRIORART_00013291	Enhanced_block_ACK_in_Distributed_Coordination
AGTPRIORART_00013296	Explicit_vs_Implicit_Feedback_for_SU_and_MU-MIMO

Bates Number	Prior Art Reference
AGTPRIORART_00013302	IEEE 802.11 OFDM Software Defined Radio beacon frame transmission
AGTPRIORART_00013308	IEEE 802.11-2016
AGTPRIORART_00016842	IEEE 8802-11-2012
AGTPRIORART_00019640	IEEE P802.11ac_D2.0
AGTPRIORART_00019999	IEEE_802.11ac_from_channelization_to_multi-user_MIMO
AGTPRIORART_00020006	IEEE-2420 (802.11ac-2013)
AGTPRIORART_00021644	March 1996 archit
AGTPRIORART_00021654	March 1996 mac
AGTPRIORART_00021676	P802.11_Draft_20b3
AGTPRIORART_00022068	Performance analysis of greedy fast-shift block
AGTPRIORART_00022085	Performance evaluation and enhancement of scheduled
AGTPRIORART_00022091	Preamble-based joint frame and frequency synchronization for OFDM - WMAN systems
AGTPRIORART_00022097	61-819233
AGTPRIORART_00022168	Priority Document - US2017-0338910 A1
AGTPRIORART_00022190	62-043061
AGTPRIORART_00022233	Throughput_analysis_of_IEEE802.11n_using_OPNET
AGTPRIORART_00022240	Throughput_and_delay_limits_of_IEEE_802.15.6
AGTPRIORART_00022245	Upcoming WLANs MAC access mechanisms
AGTPRIORART_00022251	US8571010B1
AGTPRIORART_00022282	US8625632B2
AGTPRIORART_00022303	US8774037B2
AGTPRIORART_00022324	US8792369B2
AGTPRIORART_00022346	US8886755B1
AGTPRIORART_00022370	US9107242
AGTPRIORART_00022390	US9203586B2
AGTPRIORART_00022411	US9252991B2
AGTPRIORART_00022429	US9253767B2
AGTPRIORART_00022446	US9295074B2
AGTPRIORART_00022480	US9414321B2

Bates Number	Prior Art Reference
AGTPRIORART_00022494	US9462504B2
AGTPRIORART_00022505	US9462607B2
AGTPRIORART_00022530	US9608789B2
AGTPRIORART_00022564	61-617666
AGTPRIORART_00022587	US9655144B2
AGTPRIORART_00022629	US9705643B2
AGTPRIORART_00022645	US9788317
AGTPRIORART_00022664	61-310713
AGTPRIORART_00022689	US9794032B2
AGTPRIORART_00022716	61-909024
AGTPRIORART_00022745	US9825678B2
AGTPRIORART_00022775	US9929787B2
AGTPRIORART_00022826	US10004031
AGTPRIORART_00022879	US10015821
AGTPRIORART_00022927	US10034288
AGTPRIORART_00022955	US10038535
AGTPRIORART_00022984	US10057389
AGTPRIORART_00023003	US10135652
AGTPRIORART_00023021	US10165584
AGTPRIORART_00023047	US10178673B1
AGTPRIORART_00023063	WO2016049800
AGTPRIORART_00023106	CN107005972
AGTPRIORART_00023134	US10219181B2
AGTPRIORART_00023158	61-889121
AGTPRIORART_00023238	US10230497B2
AGTPRIORART_00023273	US10299261
AGTPRIORART_00023357	US10321472B2
AGTPRIORART_00023379	US10349388
AGTPRIORART_00023464	US10375679
AGTPRIORART_00023532	US10439699B2

Bates Number	Prior Art Reference
AGTPRIORART_00023586	US10548156B2
AGTPRIORART_00023623	US10587381B2
AGTPRIORART_00023652	US10687342B2
AGTPRIORART_00023678	US10833828
AGTPRIORART_00023718	US10873436B2
AGTPRIORART_00023758	CN201310255933
AGTPRIORART_00023816	WO2014206115
AGTPRIORART_00023889	US11038737B2
AGTPRIORART_00023922	US11146313B2
AGTPRIORART_00023993	US11191097B2
AGTPRIORART_00024031	61-671670
AGTPRIORART_00024062	61-733888
AGTPRIORART_00013273	US20110261806A1
AGTPRIORART_00024092	61-901362
AGTPRIORART_00024125	61-977100
AGTPRIORART_00024150	62-014701
AGTPRIORART_00024175	62-017821
AGTPRIORART_00024202	US2011305176A1
AGTPRIORART_00024235	US2013010781A1
AGTPRIORART_00024262	US2016065466A1
AGTPRIORART_00024284	US2016142122A1
AGTPRIORART_00024307	US2017338910A1
AGTPRIORART_00024358	US2017367077A1
AGTPRIORART_00024373	US20040082356
AGTPRIORART_00024458	US20050163150
AGTPRIORART_00024482	US20070201468 A1
AGTPRIORART_00024502	US20070201468A1
AGTPRIORART_00024522	US20080201468A1
AGTPRIORART_00024557	US20100220679A1
AGTPRIORART_00024584	US20100260060

Bates Number	Prior Art Reference
AGTPRIORART_00024602	US20100310003A1
AGTPRIORART_00024656	US20100322166A1
AGTPRIORART_00024680	US20110199946
AGTPRIORART_00024710	61-355114
AGTPRIORART_00024756	US20110305176A1
AGTPRIORART_00024789	US20120026909
AGTPRIORART_00024805	US20120140753
AGTPRIORART_00024826	US20120314594
AGTPRIORART_00024836	US20130107819A1
AGTPRIORART_00024863	US20130223427
AGTPRIORART_00024882	US20130235947
AGTPRIORART_00024895	US20130286959
AGTPRIORART_00024962	61-644872
AGTPRIORART_00025054	US20130301551A1
AGTPRIORART_00025097	US20140050149
AGTPRIORART_00025134	US20140056188
AGTPRIORART_00025163	US20140086200A1
AGTPRIORART_00025196	US20140098701
AGTPRIORART_00025219	US20140269524A1
AGTPRIORART_00025244	US20140293916A1
AGTPRIORART_00025276	US20140294020
AGTPRIORART_00025304	US20140348255A1
AGTPRIORART_00025324	US20140348255A1
AGTPRIORART_00025344	US20150063128
AGTPRIORART_00025378	US20150063257A1
AGTPRIORART_00025410	US20150063320A1
AGTPRIORART_00025437	US20150085777A1
AGTPRIORART_00025471	U.S. Patent App. Pub. No. 2015/0110046 (“Merlin”)
AGTPRIORART_00025492	US20150124689A1
AGTPRIORART_00025526	US20150208436A1

Bates Number	Prior Art Reference
AGTPRIORART_00025567	US20150365266A1
AGTPRIORART_00025613	US20160021678A1
AGTPRIORART_00025650	US20160065466_AbrahamPriorityAppln62043061
AGTPRIORART_00025703	US20160065466A1
AGTPRIORART_00025725	US20160080115A1
AGTPRIORART_00025751	US20160081075A1
AGTPRIORART_00025800	US20160165589A1
AGTPRIORART_00025867	US20160198445 A1
AGTPRIORART_00025884	US20160255656A1
AGTPRIORART_00025941	US20160262051A1
AGTPRIORART_00025975	US20160278081A1
AGTPRIORART_00025993	US20160323424 A1
AGTPRIORART_00026034	US20160330047A1
AGTPRIORART_00026063	US20170033916A1
AGTPRIORART_00026093	US20170054542A1
AGTPRIORART_00026152	US20170170937
AGTPRIORART_00026218	US20170171878
AGTPRIORART_00026301	US20170289911
AGTPRIORART_00026344	US20170303280A1
AGTPRIORART_00026432	WO2016068582
AGTPRIORART_00026529	62-068768
AGTPRIORART_00026551	US20170338910A1
AGTPRIORART_00026602	CN20140422580
AGTPRIORART_00026632	WO2016029683
AGTPRIORART_00026665	US20170367077A1
AGTPRIORART_00026680	US20170367078A1
AGTPRIORART_00026718	US20180123655A1
AGTPRIORART_00026731	US20180220443A1
AGTPRIORART_00026774	US20190029038
AGTPRIORART_00026793	US20200267741A1

Bates Number	Prior Art Reference
AGTPRIORART_00026819	US20110235593A1
AGTPRIORART_00026827	US20110268054A1
AGTPRIORART_00026849	Wireless Fountain Coding with IEEE 802.11e Block ACK
AGTPRIORART_00026867	PCT App. Pub. No. 2017/097115 with English translation
AGTPRIORART_00026918	WO2012093794 A2
AGTPRIORART_00026954	WO2013170136 A1
AGTPRIORART_00027032	61-646040
AGTPRIORART_00027105	61-669390
AGTPRIORART_00027191	61-699531
AGTPRIORART_00027295	61-724466
AGTPRIORART_00027411	WO2014052879 A1
AGTPRIORART_00027534	WO2014168656 A1
AGTPRIORART_00027602	WO2014178678
AGTPRIORART_00027705	WO2014179713
AGTPRIORART_00027798	WO2015133646 A1
AGTPRIORART_00027869	WO2015133646_NabetaniWIPOMachineTranslation
AGTPRIORART_00027892	WO2015133646_PriorityJP2014045517
AGTPRIORART_00027937	WO2017097115 A1
AGTPRIORART_00027980	US20160353480
AGTPRIORART_00028007	61895217 (Rong)
AGTPRIORART_00028038	61947388 (Chun)
AGTPRIORART_00028062	62026706 (Chun)
AGTPRIORART_00028089	62040432 (Kim)
AGTPRIORART_00028124	62067378 (Kim)
AGTPRIORART_00028162	62068774 (Kim)
AGTPRIORART_00028201	62206862 (Chun 388)
AGTPRIORART_00028222	62209899 (Chun 388)
AGTPRIORART_00028253	62264836 (Chun 388)
AGTPRIORART_00028267	61-969794
AGTPRIORART_00028310	61-937623

Bates Number	Prior Art Reference
AGTPRIORART_00028348	61-983086
AGTPRIORART_00028388	CN102843177
AGTPRIORART_00028397	Provisional 61871269 (Merlin 258)
AGTPRIORART_00028471	US9473341 Zhang
AGTPRIORART_00028502	US9924512 Zhang
AGTPRIORART_00028531	US10165596 Choi
AGTPRIORART_00028559	US10257806 Chu
AGTPRIORART_00028616	US20070204052 Trainin
AGTPRIORART_00028626	US20100310003 Lauer
AGTPRIORART_00028680	US20120026928 Gong
AGTPRIORART_00028686	US20120087426 Zhang
AGTPRIORART_00028699	US20120155415 Seok
AGTPRIORART_00028711	US20120257605 Abraham
AGTPRIORART_00028761	US20120327915 Kang
AGTPRIORART_00028787	US20130229996 Wang
AGTPRIORART_00028841	US20140269964 Du
AGTPRIORART_00028859	US20150029996 Yuan
AGTPRIORART_00028864	US20150043459 Seok
AGTPRIORART_00028907	US20150063190 Merlin
AGTPRIORART_00028937	US20150063191 Merlin
AGTPRIORART_00028961	US20150063258 Merlin
AGTPRIORART_00028982	US20150124690 Merlin
AGTPRIORART_00029015	US20160143010 Kenney
AGTPRIORART_00029025	US20160270079 Seok
AGTPRIORART_00029052	US20160295581 Ghosh
AGTPRIORART_00029070	US20170041952 Kim
AGTPRIORART_00029090	US20170127298 Ryu
AGTPRIORART_00029112	US20170127451 Chun
AGTPRIORART_00029136	US20170201364 Wang
AGTPRIORART_00029177	US20170272138 Chun

Bates Number	Prior Art Reference
AGTPRIORART_00029247	US20170339692 Chun
AGTPRIORART_00029327	11-10-1361-02-00ac-proposed-tgac-draft-amendment
AGTPRIORART_00029457	11-15-0099-04-00ax-payload-symbol-size-for-11ax
AGTPRIORART_00029490	11-15-0349-02-00ax-he-ltf-proposal
AGTPRIORART_00029533	802.11ac-2013, Part 11, Amendment 4

B. The '520 Patent Is Invalid

1. Effective Filing Date.

The '520 patent was issued from U.S. Patent App. No. 15/078,920, filed March 23, 2016. U.S. Patent App. No. 15/078,920 claims priority to U.S. Provisional Application No. 62/137,138, filed March 23, 2015, and U.S. Provisional Application No. 62/140,349, filed March 30, 2015. However, the claims of the '520 patent here are not described in the provisional applications and, thus, are not entitled to the benefit of any filing date before March 23, 2016.

Claim 1 requires, *inter alia*, "generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including **a plurality of resource units (RUs),"** "assigning **each RU of the plurality of RUs** to a respective station in the plurality of stations," "including a respective set of MAC Protocol Data Units (MPDUs) in **each RU of the plurality of RUs**," and "wherein an MPDU in one or more of **the RUs in the plurality of RUs** includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the **RU** is assigned is requested to transmit to acknowledge the downlink multi-user frame." The '520 patent, 30:50-65. Claim 4 requires "wherein one of the one or more MPDUs in **each of the RUs of the plurality of RUs** is **a unicast trigger frame** that contains the acknowledgement information for the respective station in the plurality of stations." *Id.* at 31:24-28.

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Neither U.S. Provisional Application No. 62/137,138 nor U.S. Provisional Application No. 62/140,349 discloses "generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs)," "assigning each RU of the plurality of RUs to a respective station in the plurality of stations," "including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs," "wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame," and "wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations," as required by claims 1 or 4. Thus, Applicant does not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). Thus, the '520 patent's claims are not entitled to filing dates of the provisional applications.

2. The '520 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the '520 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit A-1 and A-8, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

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Defendants identify the following references as anticipating one or more of the Asserted Claims of ’520 Patent under 35 U.S.C. § 102. The table of anticipating references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the ’520 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	**Anticipating Prior Art**
A-1	U.S. Patent No. 10,230,497 to Merlin et al. (“Merlin497”)
A-2	U.S. Patent Appln. Pub. No. 2017/0338910 to Chun et al. at LG Electronics Inc. (“Chun910”)
A-3	U.S. Patent Appln. Pub. No. 2017/0367077 to Shu et al. (“Shu”)
A-4	U.S. Patent No. 9,462,607 to Ma et al. (“Ma 607”)
A-5	U.S. Patent No. 10,219,181 to Ma et al. (“Ma 181”)
A-6	U.S. Patent No. 10,257,806 (“Chu 806”)
A-7	U.S. Patent Appln. Pub. No. 2010/0310003 (“Lauer”)
A-8	IEEE Std 802.11ac-2013, Part 11, Amendment 4 (“802.11ac-2013”)
A-9	Prior 802.11ac Device
A-10	WiMAX Device

Defendants further incorporate by reference the Petition for *Inter Parte* Review and the exhibits thereto in IPR2023-00863, including but not limited to the prior art references against any limitation of an asserted claim of the ’520 Patent and/or the technology background of the ’520 Patent.

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the ’520 Patent, Defendants reserve the right to argue

that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The '520 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '520 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits A-1 and A-8, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits A-1 and A-8 with each other because all of these references relate to wireless communication methods and wireless transmission protocol procedures for MU-MIMO systems (*i.e.*, those in which multiple users communicate using multiple antennas) using a set of MAC Protocol Data Units (MPDUs) in each resource unit of the plurality of resource units in a downlink multi-user frame. For example, Merlin497 teaches a wireless channel access control method for "setting of ACK policies and signaling for allocating MU-MIMO or FDMA resources to the recipient STAs for the replies." Merlin497, 12:57-60. Merlin497 also teaches "the AP may send DL MU-MIMO A-MPDUs to multiple STAs. In the DL MU-MIMO A-MPDUs, the AP may indicate that the transmission opportunity is transferred to the STAs." Merlin497, 19:53-56. Chun910 teaches a wireless channel access control method that "[i]f an aggregated MPDU (A-MPDU) scheme is used, a plurality of MPDUs (in this case, each MPDU may carry an A-MSDU) may be aggregated in a single A-MPDU…. The A-MPDU may include an aggregation of various types of MPDUs (e.g., QoS data, acknowledge (ACK), and a block ACK

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(BlockAck))." Chun910, [0095]. Similarly, Shu teaches a wireless channel access control method where an "access point may send the acknowledgment request message to the multiple stations by means of multicast (multicast), or may send the acknowledgment request message to a corresponding station by means of unicast (unicast). When the access point sends the acknowledgment request message to the multiple stations by means of multicast, the channel resource information included in the acknowledgment request message indicates the channel resources allocated by the access point to the multiple stations." Shun, [0059]. Ma 607 teaches a wireless channel access control method where an "AP [] may send to STAs [] UL scheduling (UL-SCH) frames [] including scheduling information to assign UL resources to the STAs []. For example, transmitter [] may transmit to device [] an UL-SCH frame[] including UL resources, e.g., in the form of synchronization information, e.g., time, frequency, and/or power, corresponding to the uplink transmission scheduled for device []." Ma 607, 14:36-43. Ma 181 teaches a wireless channel access control method for "requesting and sending block acknowledgment requests (BARs) and block acknowledgments (BAs)," where an "AP [] may use DensiFi or 802.16. The 802.11 protocol may be 802.11ax." Ma 181, Abstract and 2:25-40.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

Furthermore, to the extent that it is determined that any of the above references do not disclose "generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource

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units (RUs)" and "assigning each RU of the plurality of RUs to a respective station in the plurality of stations," in claim 1, it would further have been obvious to modify the teachings of the charted references to include in a downlink multi-user frame, resource units to a respective one of multiple receiving stations. *See, e.g.*, 802.11ac Standard (2013) at Section 4.3.10a Very high throughput (VHT) STA ("The AP transmits the A-MPDUs simultaneously in separate space-time streams such that each recipient STA is able to demodulate the space-time streams carrying its A-MPDU.…"). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Similarly, to the extent that it is determined that any of the above references do not disclose "receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement transmissions respectively and simultaneously transmitted by two or more stations in the plurality of stations," in claim 1, "wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station," in claim 8 or "wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station," in claim 18, it would further have been obvious to modify the teachings of the charted references to permit a receiving stations to transmit its acknowledgement frame in SU format to the AP. *See, e.g.*, 802.11ac Standard (2013) at Section 22.3.11.3 Maximum Number of Total Spatial Streams in VHT MU PPDUs ("An MU-capable STA shall support reception of VHT MU PPDUs with the total number of space-time streams across the NUM-USERS users…"). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '520 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '520 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions,

Defendants assert that the Asserted Claims of the ’520 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- “wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions” (claim 1)

- “wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station” (claim 8)

- “wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station” (claim 18)

Based on Defendants’ present understanding of Plaintiff’s Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the ’520 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants’ present understanding of Plaintiff’s asserted scope of the claims of the ’520 Patent, to the extent such positions can be understood from Plaintiff’s Infringement Contentions, Defendants assert that the Asserted Claims of the ’520 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- “wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions” (claim 1)

- “wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station” (claim 8)

- "wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station" (claim 18)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

C. The '259 Patent Is Invalid

1. Effective Filing Date.

The '259 patent issued from a U.S. Patent App. No. 14/862,078 filed September 22, 2015, which claims priority to U.S. Provisional Application No. 62/054,270 filed September 23, 2014. However, the claims of the '259 patent here are not described in the provisional application and, thus, are not entitled to the benefit of the filing date of the provisional application.

Independent claims 1 and 18 of the '259 patent require "the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided." U.S. Provisional Application No. 62/054,270 does not disclose "a predetermined band," let alone dividing a predetermined band into subchannels and allocating the subchannels to the devices as required by claims 1 and 18. Thus, the provisional application does not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir.

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2010) (en banc). Thus, the ’259 patent’s claims are not entitled the filing date of the Provisional Application No. 62/054,270.

2. The ’259 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the ’259 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit B-1 through B-16, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as anticipating one or more of the Asserted Claims of ’259 Patent under 35 U.S.C. § 102. The table of anticipating references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the ’259 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	Anticipating Prior Art
B-1	802.11ac Amendment to the 802.11 Standard (“802.11ac”)
B-2	U.S. Patent App. Pub. No. 2010/0260060 (“Abraham)
B-3	U.S. Patent App. Pub. No. 2011/0199946 (“Breit”)
B-4	U.S. Patent No. 10,038,535 (“Chun 535”)
B-5	U.S. Patent App. Pub. No. 2011/0261806 (“Chun 806”)
B-6	U.S. Patent App. Pub. No. 2017/0170937 (“Chun 937”)

Exhibit	Anticipating Prior Art
B-7	U.S. Patent App. Pub. No. 2012/0140753 ("Lee")
B-8	U.S. Patent App. Pub. No. 2013/0286959 ("Lou")
B-9	U.S. Patent App. Pub. No. 2012/0314594 ("Mahadevappa")
B-10	U.S. Patent App. Pub. No. 2012/0026909 ("Seok")
B-11	U.S. Patent App. Pub. No. 2013/0223427 ("Sohn 427")
B-12	U.S. Patent App. Pub. No. 2014/0098701 ("Sohn 701")
B-13	U.S. Provisional App. No. 61/892,314 ("Merlin_046")
B-14	U.S. Patent App. Pub. No. 20150043459A1 ("Seok_459")
B-15	U.S. Patent No. US9473341B2 ("Zhang_341")
B-16	U.S. Patent App. Pub. No. 20120087426A1 ("Zhang_426")
B-17	U.S. Patent App. Pub. No. 2015/0372795 ("Wu")
B-18	Prior 802.11ac Device

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '259 Patent, Defendants reserve the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The '259 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '259 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits B-1 through B-16, any purported differences are such that the claimed subject matter as a whole would have been obvious to

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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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits B-1 through B-16 with each other because all of these references relate to wireless communication methods and wireless sounding procedures in the same field of endeavor. More specifically, each of the references in Exhibits B-1 through B-16 teach a sounding method in which a base station sends a null data packet announcement ("NDPA") followed by a null data packet ("NDP") after which the station responds with a feedback message. For example, 802.11ac teaches, "A VHT beamformer shall initiate a sounding feedback sequence by transmitting a VHT NDP Announcement frame followed by a VHT NDP after a SIFS." 802.11ac at 9.31.5.2. Furthermore, Chun 535 teaches "a method and apparatus for transmitting a frame on the basis of a sounding procedure is disclosed. The method for transmitting the frame on the basis of a sounding procedure in a wireless LAN may comprise the steps of: transmitting an NDPA frame to each of multiple STAs by an AP wherein the NDPA frame notifies of the transmission of NDP; transmitting the NDP to each of the multiple STAs by the AP; receiving, by the AP, multiple feedback frames transmitted through multiple transmission sources allocated to the multiple STAs in time sources overlapped by the multiple STAs, respectively; and transmitting, by the AP, multiple downlink frames to the multiple STAs respectively." Chun 535 at Abstract. Furthermore, Lee teaches "a channel sounding method in a wireless local area network (WLAN) system is provided. The method, performed by a transmitter, includes transmitting a null data packet announcement (NDPA) frame to a receiver to initiate a channel sounding procedure; transmitting a null data packet (NDP) to the receiver and receiving a feedback frame. The feedback frame includes a plurality of segment frames and a channel feedback report. The channel feedback report is split into

a plurality of feedback segments. Each of the plurality of feedback segments is respectively included in each of the plurality of segment frames. The each of the plurality of segment frames includes a first-segment subfield indicating whether the each of the plurality of feedback segment included is a first segment and a remaining-segment subfield indicating the number of remaining feedback segments." Lee at Abstract. Furthermore, Seok teaches "a method for reporting channel state information (CSI), performed by a beamformee, in a wireless local area network system using multi-channels is provided. The method includes receiving, from a beamformer, an NDP announcement (NDPA) frame announcing that a null data packet (NDP) frame follows the NDPA frame, receiving the NDP frame from the beamformer, estimating a channel from a training symbol of the NDP frame and transmitting to the beamformer a CSI report frame containing a result obtained by estimating the channel, wherein the channel is a multi-channel acquired by aggregating first and second channels which are non-contiguous to each other, and wherein the CSI report frame includes an average signal to noise ratio (SNR) for each space-time stream of the first channel and a steering matrix for each subcarrier of the first channel and an average SNR for each space-time stream of the second channel and a steering matrix for each subcarrier of the second channel." Seok at Abstract.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

a) State of the Art

The advent of WLAN made wireless internet access available in homes, business, and regions providing Wi-Fi services. *See, e.g.*, Sohn 427, [0002]. Various IEEE standards were created in order

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to rectify limited data rates that were considered to be a drawback of traditional WLAN systems. *See, e.g.*, Sohn 427, [0002] (IEEE 802.11n); Chun 535, 3:35 (802.11X); Chun 937, [0003]-[00010] (802.11ac and 802.11ax). Each of the aforementioned standards are based on MU-MIMO techniques wherein multiple antennas are used in both a transmitter and receiver to minimize a transmission error and optimize a data rate. *See, e.g.*, Sohn 427, [0005] ("The next-generation WLAN system supports the transmission of a Multi-User Multiple Input Multiple Output (MU-MIMO) scheme in which a plurality of non-AP STAs accesses a radio channel at a same time in order to efficiently use the channel."); Chun '937, [0004] ("Furthermore, in order to minimize a transfer error and to optimize a data rate, IEEE 802.11n is based on a multiple inputs and multiple outputs (MIMO) technology in which multiple antennas are used at both ends of a transmission unit and a reception unit."); Seok, [0008] ("To effectively utilize a radio channel, the next-generation WLAN system supports multi user-multiple input multiple output (MU-MIMO) transmission in which a plurality of non-access point (AP) stations (STAs) concurrently access to a channel.").

MU-MIMO systems brought complications in that the participating stations may have different capabilities and environmental factors. *See* Sohn 427 at [0006]. Thus, to accommodate these stations, supportable bandwidth, modulation coding scheme (MCS), forward error correction, and other transmission characteristics may vary depending on STA type, usage, channel environment, and other factors. *See id*. at [0007]. It was known to perform channel sounding in MU-MIMO systems in order to detect these different characteristics and provide for different transmission settings based on the measured characteristics. Specifically, it was known to perform a procedure wherein a transmitter requests channel information to be used for frame transmission and reception from a receiver and the receiver estimates the channel and feeds the channel information about the channel to the transmitter. *See id*. at [0007]. It was further known to perform this sounding procedure through the transmission

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of a NDPA to "announce" to the stations that a subsequent NDP will be sent for channel sounding purposes followed by transmission of that NDP. *See, e.g.*, *id*. at [0010]; Seok at Abstract; Chun 535 at Abstract; Lee at Abstract. The well-known sounding procedure further involved the transmission of a plurality of feedback frames to the base station, reporting various channel characteristics (*e.g.*, SNR). *See, e.g.*, Chun 937 at [0316]; Seok at [0012]; Breit [0075].

b) Prior Art Combinations

All of the asserted claims of the '259 Patent are obvious based on one or more combinations of the prior art references above. The sections below provide motivations to combine the prior art references above. These obviousness combinations are provided in the alternative to Plaintiff's anticipation and single-reference obviousness contentions and are not to be construed to suggest that any references included in the combination is not itself anticipatory or would not render the asserted claims obvious in light of the knowledge of a person having ordinary skill in the art. For example, at least the following combinations would have been obvious to a person of ordinary skill of the art ("POSITA"):

- Chun 535, Sohn 427, or Seok with any reference that teaches that the NDPA frame includes allocation information of the first subchannel. A POSITA would have understood that such a technique would improve the sounding mechanism by not only increasing efficiency but also the minimizing error rate. For example, as disclosed in any of Exhibits B-1 through B-16. *See, e.g.*, Chun 937, [0548].

- Chun 937, Chun 806, or Lee with any reference that teaches that the NDPA frame includes information corresponding to the predetermined length of the feedback frame. A POSITA would have understood that such a technique would improve the sounding mechanism by increasing the efficiency of data communication between a receiving device and a transmitting device and reducing the likelihood of failed communication. For example, as disclosed in any of Exhibits B-1 through B-16. *See, e.g.*, Chun 535, 10:34-35, 10:60-63.

- Sohn 427, Seok, Chun 937, Chun 806, or Lee with any reference that teaches "the plurality of feedback frames from the plurality of receiving devices are received at a same time." A POSITA would have understood that such a technique would improve the speed at which a transmitting device may adapt to changes in the wireless network such as increases and

decreases in SNR of the various space-time streams. For example, as disclosed in any of Exhibits B-1 through B-16. *See, e.g.*, Chun 535 at Figure 8.

c) Motivation to Combine

To the extent that it is determined that any of the above references do not disclose "transmitting to the transmitting device a feedback frame including subchannel information measured on a first subchannel after receiving the NDP frame, the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided" it would further have been obvious to modify the teachings of that reference to include "transmitting to the transmitting device a feedback frame including subchannel information measured on a first subchannel after receiving the NDP frame, the first subchannel being a subchannel that is allocated to the first receiving device among a plurality of subchannels into which a predetermined band is divided" in view of the teachings of at least Lee, Abraham, and/or Chun 806, which teach at least transmitting a feedback from to a transmitting device including subchannel information. *See, e.g.*, Lee at [0058] ("In the WLAN system of FIG. 1, if the AP 10 intends to transmit data to the STA1 21, the STA2 22, and the STA3 23, then a PPDU may be transmitted to an STA group including the STA1 21, the STA2 22, the STA3 23, and the STA4 24. In this case, as shown in FIG. 2, no spatial stream may be allocated to the STA4 24, and a specific number of spatial streams may be allocated to each of the STA1 21, the STA2 22, and the STA3 23 and then data can be transmitted according thereto. In the example of FIG. 2, one spatial stream is allocated to the STA1 21, three spatial streams are allocated to the STA2 22, and two spatial streams are allocated to the STA3 23."); Abraham at [0063] ("At 602, an AP transmits a training request message (TRM) followed by downlink sounding packets to a station (STA) to initiate a calibration procedure. At 604, the station receives the TRM message and the downlink sounding packets from an access point (AP). At 606, the station calculates the channel state information (CSI) from the downlink sounding packets. At 608, the station transmits

uplink sounding packets and channel state information (CSI) feedback to the AP for calibration. At 610, the access point receives uplink sounding packets and channel state information (CSI) feedback from the station."); Chun 806 at [0010] ("According to another example embodiment, a method may include receiving, in a downlink direction, an allocation, within a single physical resource unit (PRU), of a plurality of channel sounding groups. Wherein each channel sounding group includes both a frequency division multiplexing (FDM) allocation and a code division multiplexing (CDM) allocation. The method may also include broadcasting a channel sounding signal in an uplink direction via one or more channel sounding groups."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels," it would further have been obvious to modify the teachings of that reference to include "wherein transmitting the feedback frame includes: transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device, the second subchannel being a subchannel that is allocated to the second receiving device among the plurality of subchannels" in view of the teachings of at least Mahadevappa, Garikpati, and/or Chun 535, which teach at least transmitting a feedback frame to a transmitting device while a second transmitting device transmits a second feedback frame. *See, e.g.*, Mahadevappa at [0020] ("Next, the AP 102 receives link quality metrics from each of the STAs 104, via step 204. As described in more detail below in

connection with FIG. 3, the link quality metrics are based on a ratio of a sum of desired signal strengths to a sum of interference signal strengths."); Lee at [0058] ("In the WLAN system of FIG. 1, if the AP 10 intends to transmit data to the STA1 21, the STA2 22, and the STA3 23, then a PPDU may be transmitted to an STA group including the STA1 21, the STA2 22, the STA3 23, and the STA4 24. In this case, as shown in FIG. 2, no spatial stream may be allocated to the STA4 24, and a specific number of spatial streams may be allocated to each of the STA1 21, the STA2 22, and the STA3 23 and then data can be transmitted according thereto. In the example of FIG. 2, one spatial stream is allocated to the STA1 21, three spatial streams are allocated to the STA2 22, and two spatial streams are allocated to the STA3 23."); Chun 535 at 2:6-8. ("In order to achieve the above object of the present invention, according to another aspect of the present invention, an AP for transmitting a frame on the basis of a sounding procedure in a WLAN may include: a radio frequency (RF) unit implemented to transmit or receive a radio signal; and a processor operatively coupled to the RF unit. The processor may be configured for: transmitting an NDPA frame to each of a plurality of STAs, wherein the NDPA frame reports transmission of an NDP; transmitting the NDP to each of the plurality of STAs; receiving a plurality of feedback frames to be transmitted respectively through a plurality of transmission resources allocated respectively to the plurality of STAs on an overlapping time resource respectively by the plurality of STAs; and transmitting a plurality of downlink frames respectively to the plurality of STAs. The plurality of feedback frames may respectively include a plurality of pieces of channel state information determined on the basis of the NDP. The plurality of downlink frames may be respectively transmitted based on the plurality of pieces of channel state information within a specific time after respectively receiving the plurality of feedback frames."); U.S. Patent App. Pub. No, 2015/0063128 ("Garikipati") at [0130] ("In accordance with an example embodiment of the invention, a signaling method for MU-MIMO feedback via ZC-sequence may be based on parallel

acknowledgements. Each STA is identified by a unique ZC-sequence assigned by the AP. The STAs that qualify for the feedback process transmit their individual sequences simultaneously following a broadcast of NDP by the AP. The AP runs a ZC-sequence detection algorithm to identify the qualified STAs, which the AP then polls sequentially to obtain the feedback."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the subchannel information includes an average signal-to-noise ratio (SNR) of the first subchannel," it would further have been obvious to modify the teachings of that reference to include "wherein the subchannel information includes an average signal-to-noise ratio (SNR) of the first subchannel" in view of the teachings of at least Lou, Chun 535, Seok, and/or 802.11ac, which teach at least feedback that includes an average SNR of a subchannel. *See, e.g.*, Lou at [0114] ("In a feedback channel example, the feedback channel may be utilized for SNR feedback or sounding feedback. The feedback channel may be used for closed loop schemes."); Chun 535 at 9:59-10:4 ("If the NDP 410 is transmitted based on beamforming, the feedback frame 420 may include an HT control field, a channel information control field, and a channel information field. The HT control field may include information regarding Nsts, MCS, BW, and SNR. The channel control field may include information regarding Nc, Nr, Ng, etc., and/or control information for OFDMA-based transmission. The channel information control field may include SNR information per stream, information of a beamforming feedback matrix for each subcarrier, SNR information for each frequency resource (e.g., subband) in OFDMA-based transmission, etc"); Seok at [0062] ("A CSI Report field indicates an average SNR for each space time stream and a CSI matrix for each subcarrier with respect to the corresponding channel."); 802.11ac at Section 8.4.1.29 ("The SNR values in Table 8-50 and Table 8-51 are encoded as an 8-bit twos complement value of 4 x (SNR_average-22), where SNR_average is the sum of the

values of SNR per tone (in decibels) divided by the number of tones represented."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the subchannel information includes average signal-to-noise ratios (SNRs) of the first subchannel for a plurality of space-time streams," it would further have been obvious to modify the teachings of that reference to include "wherein the subchannel information includes average signal-to-noise ratios (SNRs) of the first subchannel for a plurality of space-time streams" in view of the teachings of at least Chun 806, Chun 535, Yao, and/or 802.11ac, which teach average SNRs for a plurality of space-time streams. *See, e.g.*, Chun 806 at [0058] ("In one embodiment, the BS may simply average the channel quality provided via the CSGs 402. In another embodiment, the BS may use a finer level of granularity is estimate the channel quality. In one embodiment, a rough curve or values representing a mathematical equivalent may be formed using the data points provided by the CSGs 402. In another embodiment, a pre-defined or configurable weighting of the data points provided by the CSGs 402 may be used. Although, it is understood that the above are merely a few illustrative examples to which the disclosed subject matter is not limited."); Chun 535 at [0316] ("The VHT Compressed Beamforming Report field is used for feeding back information on the beamforming matrix including the SNR information for the space-time stream used for transmitting the data."); 802.11ac at Section 8.4.1.29 ("The SNR values in Table 8-50 and Table 8-51 are encoded as an 8-bit twos complement value of 4 x (SNR_average-22), where SNR_average is the sum of the values of SNR per tone (in decibels) divided by the number of tones represented."); U.S. Patent App. Pub. No. 2013/0235947 ("Yao") at [0035] ("The spatial stream measurement information may include: average signal-to-noise ratio (Average SNR) information, feedback matrix V (Feedback Matrix V) information, and delta signal-to-noise ratio (Delta SNR) information that correspond to each spatial

stream."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the feedback frame further includes subchannel information measured on other subchannels excluding the first subchannel," it would further have been obvious to modify the teachings of that reference to include "wherein the feedback frame further includes subchannel information measured on other subchannels excluding the first subchannel" in view of the teachings of at least Breit, Sohn 701, Chun 535, and/or Seok, which teach a feedback frame that includes subchannel information measured on other subchannels excluding the first subchannel. *See, e.g.*, Breit at [0091] ("The AP may solicit either explicit or implicit CSI from the STAs. In the case of explicit CSI, the AP may transmit a training signal to the STAs. Based on the training signal, the STAs may estimate CSI for channels from the AP to the STAs, and transmit the CSI estimates to the AP in an uplink data transmission. This is the mechanism of CSI feedback utilized in the protocol 500 from FIG. 5. On the other hand, in the case of implicit CSI feedback, the AP may transmit a training request message to the STAs, and each STA may respond with a training (sounding) signal. After that, the AP may estimate CSI for channels from the STAs to the AP using the received training signals. Then, the AP may apply the channel reversibility principle in order to compute CSI for channels from the AP to the STAs."); Sohn 701 at [0065] ("At step S160, the AP 100 transmits the NDP frame to the sounding target STA after the NDPA frame transmission. The NDP frame is beam-formed by an AP 310, and transmitted to the sounding target STA through at least one spatial stream. Accordingly, the sounding target STAs 111, 112, and 113 may estimate the channel based on the VHT-LTF of the NDP."); Chun 535 at 9:40-49 ("The STA may perform channel estimation on the basis of the NDP 410, and may transmit acquired channel state information to the AP through the feedback frame 420. A channel bandwidth used for

transmission of the feedback frame 420 may be set to be narrower than or equal to a channel bandwidth used for transmission of the NDPA frame 400. The feedback frame 420 may include channel state information (or stream state information) for each of an indicated space-time stream (or spatial stream)."); Seok at [0057] ("A number-of-channel field indicates the number of sub-channels for which CSI included in an extended CSI frame is provided."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "adding pad bits to a data field of the feedback frame when a length of data to be transmitted by the feedback frame is shorter than a predetermined length, or partitioning the data into a plurality of fragments and inserting any one of the fragments to the data field of the feedback frame when the length of the data is longer than the predetermined length," it would further have been obvious to modify the teachings of that reference to include "adding pad bits to a data field of the feedback frame when a length of data to be transmitted by the feedback frame is shorter than a predetermined length, or partitioning the data into a plurality of fragments and inserting any one of the fragments to the data field of the feedback frame when the length of the data is longer than the predetermined length" in view of the teachings of at least Chun 535, Chun 937, and/or 802.11ac, which teach adding pad bits to a feedback frame and/or fragmenting a feedback frame. *See, e.g.*, Chun 535 at 10:34-35, 10:60-63 ("FIG. 5 is a concept view illustrating a format of an NDPA PPDU according to an embodiment of the present invention. . . The L-SIG 510 may be used to transmit control information. The L-SIG 510 may include information for a data rate and a data length."); Chun 937 at [0362] ("Referring to FIG. 17, the MU PPDU is configured to include L-TFs (i.e., an L-STF and an L-LTF), an L-SIG field, a VHT-SIG-A field, a VHT-TFs (i.e., a VHT-STF and a VHT-LTF), a VHT-SIG-B field, a service field, one or more PSDUs, a padding field, and a tail bit. The L-TFs, the L-SIG field, the VHT-SIG-A field,

the VHT-TFs, and the VHT-SIG-B field are the same as those of FIG. 4, and a detailed description thereof is omitted."); 802.11ac at Section 9.31.5.3 at ("If VHT Compressed beamforming feedback would result in a VHT Compressed Beamforming frame that exceeds the VHT beamformer's maximum MPDU length capability, the VHT Compressed Beamforming feedback shall be split into up to 8 feedback segments, which each feedback segment sent in a different VHT Compressed Beamforming frame and containing successive portions of the VHT Compressed Beamforming feedback consisting of the VHT Compressed Beamforming Report information followed by any MU Exclusive Beamforming Report information"); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the NDPA frame indicates information corresponding to the predetermined length," it would further have been obvious to modify the teachings of that reference to include "wherein the NDPA frame indicates information corresponding to the predetermined length" in view of the teachings of at least Lee, Kim, and/or Sohn 427, which teach an NDPA frame indicating information corresponding to a predetermined length. *See, e.g.*, Lee at [0107] ("Referring to FIG. 10, an NDPA frame 1000 includes a frame control field 1010, a duration field 1020, a receiver address (RA) field 1030, a transmitter address (TA) field 1040, a sounding sequence field 1050, at least one or more STA information fields 1060, and an FCS field 1070."); Sohn 427 at [0080] ("The NDPA frame includes information for identifying an STA which will estimate a channel and transmit a feedback frame, including channel state information, to an AP. In other words, the STA determines whether it is an STA participating in channel sounding by receiving the NDPA frame. Accordingly, the AP 410 includes an STA information field, including information about a target sounding STA, in the NDPA frame and then transmits the NDPA frame. The STA information field may be included for every

target sounding STA."); U.S. Patent App. Pub. No. 2016/0081075 ("Kim") at [0092] ("The first operation includes duplicating the NDPA frame, which includes the first terminal information, for each sub-band, and transmitting the same. The first terminal information includes information, such as, for example, an association ID (AID), a feedback type, feedback length, or information on the streams that are to be transmitted/received at the same time, about all of the terminals that intend to receive the channel information feedback."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the NDPA frame includes allocation information of the first subchannel," it would further have been obvious to modify the teachings of that reference to include "wherein the NDPA frame includes allocation information of the first subchannel" in view of the teachings of at least Sohn 427, Merlin, Kim, and/or Chun 937, which teach an NDPA frame including allocation information. *See, e.g.*, Sohn 427 at [0087] ("As pieces of control information included in the NDP frame when the NDP frame is transmitted, length information, indicating the length of a PSDU included in a data field or the length of an Aggregate-MAC Protocol Data Unit (A-MPDU) included in the PSDU, is set to 0, and information indicating the number of target transmission STA to which the NDP frame will be transmitted is set to 1. Furthermore, a group ID, indicating whether a transmission scheme used to transmit the NDP frame is MU-MIMO or SU-MIMO and a target transmission, is set as a value indicating SU-MIMO transmission. Information indicating the number of spatial streams allocated to a target transmission STA is set to indicate the number of spatial streams transmitted to the target transmission STA through MU-MIMO or SU-MIMO. Information about a channel bandwidth used to transmit the NDP frame may be set as a bandwidth value used to transmit the NDPA frame"); Chun 937 at [0548] ("Further, the NDPA frame 2810 may further include the resource allocation field for

the UL MU transmission. Alternatively, the resource allocation information for the UL MU transmission allocated to each STA may be transmitted by using the Nc Index subfield of the STA Info field. Hereinafter, the field including the resource allocation information is collectively called the 'resource allocation field'."); U.S. Patent App. Pub. No. 2016/0081075 ("Kim") at [0111] ("By using the information collected through one of the above-described methods, the AP may allocate the resource to feed back the channel information to each STA such that the channel feedback times of all STAs match. Such resource allocation information may be transmitted from the AP to the STA by using the STA info field that is included in the NDPA, which can be implemented as shown in FIGS. 8A and 8B, FIGS. 9A and 9B, and FIGS. 10A and 10B."); U.S. Patent App. Pub. No. 2015/0110046 ("Merlin") at [0065] ("In some aspects, a sounding announcement frame (as shown in FIGS. 4-6) may comprise a clear to transmit (CTX) frame. FIG. 8 is a diagram of an example of a CTX structure. In this embodiment, the CTX frame 800 includes a frame control (FC) field 805, a duration field 810, a transmitter address (TA) field 815, a control (CTRL) field 820, a PPDU duration field 825, a STA info field 830, and a frame check sequence (FCS) field 855. The FC field 805 indicates a control subtype or an extension subtype. The duration field 810 indicates to any receiver of the CTX frame 800 to set the network allocation vector (NAV)."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "receiving from each receiving device a feedback frame including subchannel information measured on a subchannel that is allocated to each receiving device among a plurality of subchannels into which a band is divided, after transmitting the NDP frame," it would further have been obvious to modify the teachings of that reference to include "receiving from each receiving device a feedback frame including subchannel information measured on a subchannel that is allocated to each receiving device

among a plurality of subchannels into which a band is divided, after transmitting the NDP frame" in view of the teachings of at least Lee, Abraham, and/or Chun 806, which teach at least receiving from at least one receiving device a feedback frame including subchannel information. *See, e.g.*, Lee at [0058] ("In the WLAN system of FIG. 1, if the AP 10 intends to transmit data to the STA1 21, the STA2 22, and the STA3 23, then a PPDU may be transmitted to an STA group including the STA1 21, the STA2 22, the STA3 23, and the STA4 24. In this case, as shown in FIG. 2, no spatial stream may be allocated to the STA4 24, and a specific number of spatial streams may be allocated to each of the STA1 21, the STA2 22, and the STA3 23 and then data can be transmitted according thereto. In the example of FIG. 2, one spatial stream is allocated to the STA1 21, three spatial streams are allocated to the STA2 22, and two spatial streams are allocated to the STA3 23."); Abraham at [0063] ("At 602, an AP transmits a training request message (TRM) followed by downlink sounding packets to a station (STA) to initiate a calibration procedure. At 604, the station receives the TRM message and the downlink sounding packets from an access point (AP). At 606, the station calculates the channel state information (CSI) from the downlink sounding packets. At 608, the station transmits uplink sounding packets and channel state information (CSI) feedback to the AP for calibration. At 610, the access point receives uplink sounding packets and channel state information (CSI) feedback from the station."); Chun 806 at [0010] ("According to another example embodiment, a method may include receiving, in a downlink direction, an allocation, within a single physical resource unit (PRU), of a plurality of channel sounding groups. Wherein each channel sounding group includes both a frequency division multiplexing (FDM) allocation and a code division multiplexing (CDM) allocation. The method may also include broadcasting a channel sounding signal in an uplink direction via one or more channel sounding groups."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels," it would further have been obvious to modify the teachings of that reference to include "wherein the plurality of feedback frames from the plurality of receiving devices are received at a same time, and the NDPA frame includes allocation information of the plurality of subchannels" in view of the teachings of at least Mahadevappa, Chun 535, Merlin, Garikipati, Kim, and/or Chun 935, which teach at least the plurality of feedback frames from the plurality of receiving devices are received at the same time and that the NDPA frame includes allocation information. *See, e.g.*, Mahadevappa at [0020] ("Next, the AP 102 receives link quality metrics from each of the STAs 104, via step 204. As described in more detail below in connection with FIG. 3, the link quality metrics are based on a ratio of a sum of desired signal strengths to a sum of interference signal strengths."); Lee at [0058] ("In the WLAN system of FIG. 1, if the AP 10 intends to transmit data to the STA1 21, the STA2 22, and the STA3 23, then a PPDU may be transmitted to an STA group including the STA1 21, the STA2 22, the STA3 23, and the STA4 24. In this case, as shown in FIG. 2, no spatial stream may be allocated to the STA4 24, and a specific number of spatial streams may be allocated to each of the STA1 21, the STA2 22, and the STA3 23 and then data can be transmitted according thereto. In the example of FIG. 2, one spatial stream is allocated to the STA1 21, three spatial streams are allocated to the STA2 22, and two spatial streams are allocated to the STA3 23."); Chun 535 at 2:6-8. ("In order to achieve the above object of the present invention, according to another aspect of the present invention, an AP for transmitting a frame on the basis of a sounding procedure in a WLAN may include: a radio frequency (RF) unit implemented to transmit or receive a radio signal; and a processor operatively coupled to the RF unit. The processor may be configured for: transmitting an NDPA frame to each of a plurality of

STAs, wherein the NDPA frame reports transmission of an NDP; transmitting the NDP to each of the plurality of STAs; receiving a plurality of feedback frames to be transmitted respectively through a plurality of transmission resources allocated respectively to the plurality of STAs on an overlapping time resource respectively by the plurality of STAs; and transmitting a plurality of downlink frames respectively to the plurality of STAs. The plurality of feedback frames may respectively include a plurality of pieces of channel state information determined on the basis of the NDP. The plurality of downlink frames may be respectively transmitted based on the plurality of pieces of channel state information within a specific time after respectively receiving the plurality of feedback frames."); Chun 937 at [0548] ("Further, the NDPA frame 2810 may further include the resource allocation field for the UL MU transmission. Alternatively, the resource allocation information for the UL MU transmission allocated to each STA may be transmitted by using the Nc Index subfield of the STA Info field. Hereinafter, the field including the resource allocation information is collectively called the 'resource allocation field'."); U.S. Patent App. Pub. No. 2015/0110046 ("Merlin") at [0065] ("In some aspects, a sounding announcement frame (as shown in FIGS. 4-6) may comprise a clear to transmit (CTX) frame. FIG. 8 is a diagram of an example of a CTX structure. In this embodiment, the CTX frame 800 includes a frame control (FC) field 805, a duration field 810, a transmitter address (TA) field 815, a control (CTRL) field 820, a PPDU duration field 825, a STA info field 830, and a frame check sequence (FCS) field 855. The FC field 805 indicates a control subtype or an extension subtype. The duration field 810 indicates to any receiver of the CTX frame 800 to set the network allocation vector (NAV)."); U.S. Patent App. Pub. No, 2015/0063128 ("Garikipati") at [0130] ("In accordance with an example embodiment of the invention, a signaling method for MU-MIMO feedback via ZC-sequence may be based on parallel acknowledgements. Each STA is identified by a unique ZC-sequence assigned by the AP. The STAs that qualify for the feedback process transmit their individual

sequences simultaneously following a broadcast of NDP by the AP. The AP runs a ZC-sequence detection algorithm to identify the qualified STAs, which the AP then polls sequentially to obtain the feedback."); U.S. Patent App. Pub. No. 2016/0081075 ("Kim") at [0107] ("As illustrated in FIG. 2A above, STAs that simultaneously feed back the channel information using the OFDMA scheme may have different channel information feedback times, which may result in a waste of resources. In order to eliminate the time difference, the AP may allocate the frequency and time resources for the feedback in consideration of the amount of information to be fed back by each STA, such that the feedbacks of the STAs end at the same time. In order to make the resource allocation, the AP must recognize the amount of feedback information and the transmission time of each STA. The amount of feedback information and the transmission time of each STA may be obtained through one of the following methods, and either may be applied to embodiments of the present disclosure."); etc. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '259 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '259 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '259 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- transmitting the feedback frame to the transmitting device while a second feedback frame including subchannel information measured on the second subchannel is transmitted to the transmitting device by a second receiving device" (claim 1-7)

This phrase, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least this phrase of the '259 Patent is indefinite because a POSITA at the time of the invention would be unable to ascertain when or even whether the "first receiving device" is transmitting a feedback frame

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"while a second feedback frame…is transmitted to the transmitting device by a second receiving device." As such, a POSITA would but unable to determine when or whether alleged infringement was occurring, thereby rendering the claim scope indefinite.

D. The '738 Patent Is Invalid

1. Effective Filing Date.

The '738 patent claims the priority to U.S. Provisional Application Nos. 61/975,622 and 61/981,427, filed on Apr. 4, 2014 and Apr. 18, 2014, respectively, in the U.S. Patent and Trademark Office. However, the limitations added during the prosecution that led to the issuance of the '738 patent are not supported by the provisional applications, and thus the '738 patent is not entitled to the benefit of any filing dates of the provisional applications.

During the prosecution of the '738 patent, the limitation "wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames" was added in the response to the non-final office action mailed on September 23, 2016. *See* new claims 39 and 40 in the Office Action response dated December 22, 2016. This limitation was subsequently incorporated into the independent claims in the response to the final office action mailed on March 24, 2017 and led to the allowance. *See* amended claims 21 and 30 in the Office Action response dated June 15, 2017.

U.S. Provisional Application No. 61/981,427 fails to teach the above-identified limitation regarding the "function of a total number of space time streams." While U.S. Provisional Application No. 61/975,622 refers to the "total number of **data streams,**" that is different from the "function of a total number of **space time streams**" cited in the independent claims of the '738 patent. Thus, the provisional applications do not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*).

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2. The ’738 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the ’738 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit C-1 and C-12, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as anticipating one or more of the Asserted Claims of ’738 Patent under 35 U.S.C. § 102. The table of anticipating references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the ’738 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	Anticipating Prior Art
C-1	PCT Patent Publication WO 2015/133646 to Nabetani et al. (“Nabetani”)
C-2	U.S. Patent No. 9,825,678 to Chu et al. (“Chu678”)
C-3	U.S. Patent Application Publication 2013/0301551 to Ghosh et al. (“Ghosh551”)
C-4	U.S. Patent No. 9,794,032 to Kang et al. (“Kang”)
C-5	U.S. Patent No. 11,038,737 to Yang et al.(“Yang”)
C-6	U.S. Patent Application Publication No. 20120026928A1 to Gong et al. (“Gong928”)
C-7	U.S. Patent Application Publication No. 20130229996A1 to Wang et al. (“Wang996”)

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Exhibit	Anticipating Prior Art
C-8	U.S. Patent Application Publication No. 20160143010A1 to Kenny et al. ("Kenny010")
C-9	U.S. Patent No. US9924512B1 to Zhang et al. ("Zhang512")
C-10	U.S. Patent Application Publication No. 20150063258A1 to Merlin et al. ("Merlin258")
C-11	U.S. Patent Application Publication No. 20150029996A1 to Yuan et al. ("Yuan996")
C-12	U.S. Patent No. US8571010B1 to Zhang et al. ("Zhang010")

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '738 Patent, Defendants reserve the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The '738 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '738 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits C-1 and C-12, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits C-1 and C-12 with each other because all of these references relate to wireless communication methods and wireless transmission protocol procedures for MU-MIMO systems (*i.e.*, those in which multiple users

communicate using multiple antennas) for transmitting uplink setup information in a single physical downlink frame to a plurality of stations. For example, Nabetani teaches a wireless channel access control method where an "access point []transmits a notification frame to be a trigger for matching the transmission timing for each of the notified wireless terminals to perform uplink multi-user MIMO transmission. In the present embodiment, the permission terminal information of the uplink multi-user MIMO transmission is included in the notification frame serving as the trigger." Nabetani, [0025]. Chu678 teaches a wireless channel access control method for setting an uplink group definition frame that "indicates an uplink multi-user multiple input multiple output (MU-MIMO) transmission schedule for the client uplink group for members of the client uplink group to simultaneously transmit to an access point." Chu678, Abstract. Similarly, Ghosh551 teaches a wireless channel access control method for setting and "sending a first message to one or more stations (STAs) that comprises a beamformee capability element that indicates the AP is capable of Very High Throughput (VHT)." Ghosh551, [0005]. Kang teaches a wireless channel access control method for generating "transmission channel bandwidth information to be signaled to each of the plurality of MIMO-paired STAs [which] may be included in the VHT-SIGB field." Kang, 13:23-41. Yang teaches a wireless channel access control method for "sending, by an access point AP, indication information to at least two stations STAs, wherein the indication information is used for indicating that the at least two STAs perform an uplink multiuser data transmission." Yang, Abstract.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary

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skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

Furthermore, to the extent that it is determined that any of the above references do not disclose "wherein the uplink setup information includes a common information portion and a dedicated information portion, the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup information," and "wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames," in claim 1, it would further have been obvious to modify the teachings of the charted references to include in a downlink multi-user frame, resource units to a respective one of multiple receiving stations. *See, e.g.*, 802.11ac Standard (2013) at Section 4.3.10a Very high throughput (VHT) STA ("The AP transmits the A-MPDUs simultaneously in separate space-time streams such that each recipient STA is able to demodulate the space-time streams carrying its A-MPDU …"), Section 8.6.3 A-MPDU contents ("All QoS data frames within an A-MPDU that have a TID for which an HT-immediate Block"), and Table 8-283 A-MPDU Contexts. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Similarly, to the extent that it is determined that any of the above references do not disclose "wherein the uplink setup information includes a common information portion and a dedicated information portion, the common information portion includes a second information being common to all of the plurality of stations to receive the uplink setup frame," and "wherein the second information is a function of a total number of space time streams to be used to perform the simultaneous transmission of the uplink frame and the one or more uplink frames from the one or more other stations," in claim 9, it would further have been obvious to modify the teachings of the charted references to include in a downlink multi-user frame, resource units to a respective one of multiple

receiving stations. *See, e.g.*, 802.11ac Standard (2013) at Section 4.3.10a Very high throughput (VHT) STA ("The AP transmits the A-MPDUs simultaneously in separate space-time streams such that each recipient STA is able to demodulate the space-time streams carrying its A-MPDU …"), Section 8.6.3 A-MPDU contents ("All QoS data frames within an A-MPDU that have a TID for which an HT-immediate Block"), and Table 8-283 A-MPDU Contexts. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '738 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '738 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '738 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- "wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames" (claim 1)
- "wherein the second information is a function of a total number of space time streams to be used to perform the simultaneous transmission of the uplink frame and the one or more uplink frames from the one or more other stations" (claim 9)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the '738 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '738 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions,

Defendants assert that the Asserted Claims of the ’738 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- “wherein the second information is a function of a total number of space time streams to be used to transmit the multiple uplink frames” (claim 1)
- “wherein the second information is a function of a total number of space time streams to be used to perform the simultaneous transmission of the uplink frame and the one or more uplink frames from the one or more other stations” (claim 9)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants’ present understanding of Plaintiff’s Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff’s apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

E. The ’442 Patent Is Invalid

1. Effective Filing Date.

The ’442 patent issued from a U.S. Patent App. No. 14/937,284 filed November 10, 2015, which claims priority to U.S. Provisional Application No. 62/077,771 filed on November 10, 2014. However, the claims of the ’442 patent here are not described in the provisional application and, thus, are not entitled to the benefit of the filing date of the provisional application.

Claim 1 requires “when ... the first PPDU is a frame having a mode that is High Efficiency and having a PHY header that includes duration information for setting a virtual carrier sensing, setting a PHY-level virtual carrier sensing, wherein setting the PHY-level virtual carrier sensing includes setting a virtual carrier sensing by using the duration information included in the PHY header of the

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first PPDU; when ... the first PPDU is a frame having a PHY header that does not include duration information for setting the virtual carrier sensing, setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU." The '442 patent, 15:42-65. Claim 8 recites similar limitations. *Id.* at 16:36-59.

U.S. Provisional Application No. 62/077,771 does not disclose "duration information," let alone use duration information in PHY or MAC header to set a virtual carrier sensing as required by claims 1 and 8. The provisional application failed to "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). Thus, the '442 patent's claims are entitled, at the earliest, to the filing date of November 10, 2015.

2. The '442 Patent Is Rendered Invalid by the Prior Art.

Some or all of the Asserted Claims of the '442 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit D-1 through D-7, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as disclosing one or more elements of the Asserted Claims of '442 Patent under 35 U.S.C. § 102. The table of references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the '442 Patent.

Exhibit	Prior Art Reference
D-1	WIPO Int'l Pat. Pub. No. WO2014178678 and/or US Patent No. 10,004,031 ("Seok")
D-2	US Patent App. Pub. No. 2005/0163150 ("Yang")
D-3	WIPO Int'l Pat. Pub. No. WO2014179713 ("Oteri") and/or US Pat. No. 10,015,821
D-4	IEEE 802.11-2012 as amended by IEEE 802.11ac ("802.11ac")
D-5	US Patent Pub No. 2019/0029038 ("Kim 038")
D-6	US Patent Pub. No. US20160353480 ("Choi") or US Pat. No. 10165596
D-7	US Patent Pub No. 2017/0041952 ("Kim 952")
D-8	US Patent Pub No. 2014/0328269 ("Zhu")
D-9	Prior 802.11ac Device

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '442 Patent, any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art.

3. The '442 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '442 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits D-1 through D-7, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits D-1 through D-7 with each other because all of these references relate to wireless communication methods and networks and the management of frame timing, BSS management, virtual carrier sensing, collision avoidance, clear channel assessment, and associated functionalities. For example, Seok teaches, "The present invention relates to a wireless communications system, and more particularly to a method for sensing a channel dynamically in a wireless LAN system and an apparatus therefor. A method for performing CCA (Clear Channel Assessment) by a station (STA) in a wireless LAN system according to an embodiment of the present invention includes the steps of: receiving by a physical layer (PHY) of the STA a request primitive including a parameter indicating a CCA level type from an upper layer, and determining whether a signal equal to or greater than a prescribed CCA threshold is sensed based on the value of the parameter. Here, the parameter may be set so as to indicate one of a plurality of different CCA level types." Seok, Abstract. Furthermore, Yang teaches, "Methods and apparatuses for setting, transmitting, and receiving virtual carrier sensing information in wireless network communications are provided. A receiving station in a wireless communications network receives a frame transmitted according to various modulation schemes and extracts information concerning virtual carrier sensing from a portion of the frame modulated using a basic modulation scheme, so that virtual carrier sensing is achieved using the extracted virtual carrier sensing information." Yang, Abstract. Furthermore, Oteri teaches, "Systems, methods, and instrumentalities are described to implement an interference management method in a WLAN. An access point (AP) or an inter-BSS coordinator (IBC) may identify a station (STA) associated with a first basic service set (BSS) as an edge STA or a non-edge STA. The AP or the IBC may group the edge STA into an edge group and a non-edge STA into a non- edge group. The AP or the IBC may receive information associated with a second BSS. The AP or the IBC may coordinate access of the edge group and/or the non-edge group.

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The access may be coordinated to minimize interference of the edge STA. The access may be based at least on the received information associated with the second BSS. The AP or the IBC may adjust transmit power of a plurality of STAs identified as edge group STAs and non-edge group STAs." Oteri, Abstract. Furthermore, 802.11-2012 teaches "The scope of this standard is to define one medium access control (MAC) and several physical layer (PHY) specifications for wireless connectivity for fixed, portable, and moving stations (STAs) within a local area." 802.11, § 1.1; *see also id.* § 1.3. Furthermore, 802.11ac teaches, "The purpose of this amendment is to improve the IEEE 802.11 wireless local area network (WLAN) user experience by providing significantly higher basic service set (BSS) throughput for existing WLAN application areas and to enable new market segments for operation below 6 GHz including distribution of multiple multimedia/data streams." 802.11ac, Introduction. Furthermore, Kim 038 teaches, "The present document relates to a method for determining whether a corresponding medium (for example, a channel) is reusable so as to improve a space reuse rate in a wireless communication system, particularly, a wireless LAN system, and an apparatus for the same. To this end, a station receives a wireless LAN signal through a specific wireless medium, compares the received signal intensity of the wireless LAN signal with a CCA level selected from between a first CCA level and a second CCA level lower than the first CCA level according to the type of the received wireless LAN signal, determines that the corresponding wireless medium is usable if the received signal intensity is lower than the selected CCA level, and can use the wireless medium in a signal transmission." Kim 038, Abstract. Furthermore, Choi teaches, "Disclosed is a method and an apparatus for transmitting a frame in a wireless local area network. A method for transmitting a frame in a wireless local area network may comprise the steps of: an STA, operating on the basis of TPC, transmitting a TPC configuration request frame to an AP, the TPC configuration request frame containing information for a TPC STA communication resource requested by the STA;

the STA receiving, from the AP, a TPC configuration response frame as a response to the TPC configuration request frame, the TPC configuration response frame containing information for allocating requested TPC STA communication resource; and the STA transmitting the frame to the AP by means of the requested TPC STA communication resource." Choi, Abstract.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

a) State of the Art

At the time of the alleged invention of the '442 Patent, it was known in the art that wireless networks, including IEEE 802.11-based networks, were being deployed in dense environments, including mesh networks. Kim 038, ¶ 2. This dense deployment was known to result in overlap of basic service sets, called BSSs. *Id.* It was known that simultaneous transmission from multiple access points and stations in such dense deployments could cause collisions between traffic, which may require extensive management traffic, leading to reduced throughput. *Id.* Several techniques to mitigate interference from adjacent, neighboring, or overlapping BSSs were known, but those techniques could not entirely prevent these collisions. *Id.*

It was also known that demand for increased throughput was increasing at the time of invention due to widespread public use of the Internet and a rapid increase of multimedia data. Yang ¶ 5. The rapidly increasing usage and deployment of the high-speed Ethernet transmission was further causing increased demand for WLAN systems with high throughput and efficiency. *Id.* Due in part to the need for greater transmission rates and the ongoing development of wireless transmission technology,

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the initial IEEE 802.11 standard evolved into more advanced standards and amendments over time, including 802.11a, 802.11b, 802.11g, and so on. *Id.* ¶ 6. The Ethernet and WLAN both utilize a carrier sensing multiple access (CSMA) method, which allowed data to be transmitted when channels were idle in order to prevent collisions. *Id.* ¶ 8. Persons of skill in the art were familiar with a variety of collision detection and collision avoidance methods, which optionally pre-check where a channel is occupied or not before transmitting data or suspended the transmission of signals when collisions or "jams" are detected. *Id.* After the transmission of a jam signal, it was known to have a station wait for a predetermined duration of time and then restart transmitting signals. *Id.*

The duration information was included in a MAC header of frames sent over a WLAN network. *Id.* ¶ 10. "This duration information contains a duration of time taken from transmission of a frame by a transmitting station to reception of an acknowledge (ACK) frame from a receiving station. The receiving station receives the frame transmitted from the transmitting station and transmits the ACK frame after a short duration, known as a short inter-frame space (SIFS), to the transmitting station. A station sets a network allocation vector (NAV) using duration information. This method is called virtual carrier sensing. In order for a station to transmit a frame to another station, the station waits for a distributed inter-frame space (DIFS) after the lapse of an NAV period of time, and then performs a random backoff, and finally transmits the frame. When a carrier is sensed in a medium while performing the random backoff, however, the station suspends the random backoff, and waits until the channel is empty. Then, the station waits for a DIFS, and performs the random backoff." *Id.*

WLAN technologies standardized by the IEEE 802.11 Working Group under the IEEE 802 Standard Committee included 802.11n, providing High Throughput (HT) technology, and 802.11ac, providing Very High Throughput (VHT) technology. '442 Patent, § 2 (Related Art). "In addition to the above-described standards, various standards on WLAN technologies have been developed, and

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are being developed. As representative recent technologies, a WLAN technology according to IEEE 802.11af standard is a technology which has been developed for WLAN operation in TV white space bands, and a WLAN technology according to IEEE 802.11ah standard is a technology which has been developed for supporting a great number of stations operating with low power in sub 1 GHz band, and a WLAN technology according to IEEE 802.11ai standard is a technology which has been developed for supporting fast initial link setup (FILS) in WLAN systems. Also, IEEE 802.11ax standard is being developed for enhancing frequency efficiency of dense environments in which numerous access points and stations exist." *Id.* The 802.11ax standard was being developed to support High Efficiency modes. It was known that the PHY header of an 802.11 PPDU may include a legacy-short training field (L-STF), a legacy-long training field (L-LTF), a legacy-signal (L-SIG), a high efficiency-signal A (HE-SIG A), a high efficiency-short training field (HE-STF), a high efficiency-long training field (HE-LTF), and a high efficiency-signal B (HE-SIG B), and that the PHY header may be divided into a legacy part before the L-SIG and a high efficiency (HE) part after the L-SIG. Choi, ¶ [0164].

b) Prior Art Combinations

All of the asserted claims of the '442 Patent are obvious based on one or more combinations of the prior art references above. The sections below provide motivations to combine the prior art references above. These obviousness combinations are provided in the alternative to Defendants' anticipation and single-reference obviousness contentions and are not to be construed to suggest that any references included in the combination is not itself anticipatory or would not render the asserted claims obvious in light of the knowledge of a person having ordinary skill in the art. For example, at least the following combinations would have been obvious to a POSITA:

- Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi together with any reference that teaches setting virtual carrier sensing based on duration information included in either the PHY header or the MAC header. A POSITA would have understood that such a technique would ensure increased channel efficiency and decrease collisions and would be desirable to include the duration information in the header of the PPDU so that the receiving station could use that

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duration information quickly using known techniques. A POSITA would further have understood that this duration information could be optionally included in either the PHY header or the MAC header and that the information could be passed between layers using known techniques and services in the 802.11 standard.

- Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi together with any reference that teaches use of TXOP windows for obtaining transmission opportunities in systems using virtual carrier sensing and/or collision avoidance. A POSITA would have understood that such a technique would ensure increased channel efficiency and decrease collisions and would be desirable to allow the station to content for access or seek a transmission opportunity when the channel is idle.

- Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi together with any reference that teaches use of overlapping BSS (OBSS) networks and identifying the BSS for the PPDU based on known information included in such PPDUs in 802.11. A POSITA would have understood that such a technique would ensure increased channel efficiency in dense networks and allowed these stations

- Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi with 802.11ac and any 802.11ax working group document that suggests use of High Efficiency mode PPDUs and legacy PPDUs, together optionally with proposals that suggest dynamic CCA schemes or spatial reuse schemes, or BSS Color to differentiate between intra-BSS and inter-BSS PPDUs (e.g., OBSS environments). A POSITA would know that these working group documents were options being considered for use together with the 802.11 standard and would expect success implementing such combinations based on the fact that experts in WLAN networking technology were proposing these documents specifically as modifications to the 802.11 standard. Examples of such prior art documentation that would further meet the limitations of the asserted claims include, for example, IEEE 802.11-14-1435R0 ("Considerations on OBSS Spatial Re-Use")'s disclosure of spatial reuse and dynamic sensitivity control using CCA enhancement (see, e,g., slides 2, 4, 7); IEEE 802.11-14-0628R0 ("Measurements on CCA Thresholds in OBSS Environments")'s disclosure of CCA threshold adjustments in OBSS environments where non-overlapping channels are utilized to achieve performance improvements with an increased receive CCA threshold for access points in 802.11ax (see, e.g., slides 2, 4-7); and/or IEEE 802.11-14-1148R0 ("Consideration of asynchronous interference in OBSS environment")'s disclosure of Rx sensitivity control and BSS color to address asynchronous interference from overlapping BSSs (see, e.g., slides 2-7).

- Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi with 802.11ah's BSS color field that includes inter-BSS and intra-BSS CCA threshold differentiation to increase performance in overlapping BSS scenarios.

c) Motivation to Combine

To the extent that it is determined that any of the above references do not disclose "receiving a first physical layer (PHY) protocol data unit (PPDU)" it would have been obvious to include this

functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach receiving a PPDU. For example, Seok teaches, "A PPDU (Physical Layer Convergence Protocol (PLCP) Packet Data Unit) frame format may be composed of an STF (Short Training Field), an LTF (Long Training Field), a signal (SIG) field and a data field." Seok 20:43-21:30, *see also* Seok Fig. 4. Furthermore, Yang teaches, "FIGS. 5A through 5C illustrate a conventional PPDU (PLCP Protocol Data Unit) frame format as defined by IEEE 802.11a, and exemplary modified PPDU formats for embodying the present invention. The PPDU is a complete PLCP (Physical Layer Convergence Procedure) frame, including a PLCP header, a PSDU, tail bits and pad bits. First of all, PLCP will be described briefly. A relatively complicated physical (PHY) layer is required when using radio waves therein. A physical layer according to IEEE 802.11a includes a PLCP and a PDM (Physical Medium Dependent) system. The PLCP, which is a upper layer portion of the physical layer in an IEEE 802.11 network, matches a frame of a MAC layer with a medium. Each physical layer has its own PLCP, which provides an auxiliary frame to the MAC layer. The PMD system is responsible for transmitting a radio frequency (RF) signal to another station in order to transmit the frame of the MAC layer. The PLCP header according to an illustrative embodiment of the present invention stores basic information required for interaction between the PHY layer and the MAC layer." Yang, ¶ [0044]. Furthermore, Oteri teaches, "FIG. 1 illustrates exemplary wireless local area network (WLAN) devices. The WLAN may include, but is not limited to, access point (AP) 102, station (STA) 110, and STA 112. STA 1 10 and 112 may be associated with AP 102. The WLAN may be configured to implement one or more protocols of the IEEE 802.11 communication standard, which may include a channel access scheme, such as DSSS, OFDM, OFDMA, etc. A WLAN may operate in a mode, e.g., an infrastructure mode, an ad-hoc mode, etc." Oteri, ¶ [0038]. Furthermore, 802.11ac teaches receiving a first PPDU. 802.11-2012 Fig. 18-1. Furthermore, Kim 038 teaches, "The method may further include, if a PPDU is

detected within the predetermined time period without reception of the CTS frame after the reception of the RTS frame, determining whether the PPDU is from a basic service set (BSS) of the STA. If it is determined that the PPDU is not from the BSS of the STA and a received signal strength of the PPDU is equal to or less than the first CCA level, the specific wireless medium may be determined to be available." Kim 038, ¶ [0010]. Furthermore, Choi teaches, "In FIG. 14, it is disclosed a PPDU format according to an embodiment of the present invention. The PPDU format disclosed in FIG. 14 may be used to deliver the aforementioned frame (e.g., a beacon frame, a TPC configuration request frame, a TPC configuration response frame, etc.)." Choi, ¶ [0163]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "determining whether a basic service set (BSS) of the first PPDU is a BSS to which the first station belongs or a BSS to which the first station does not belong," or taking certain actions depending on "when the BSS of the first PPDU is the BSS to which the first station does not belong" or "when the BSS of the first PPDU is the BSS to which the first station belongs," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that it would be desirable to review the contents of the receive PPDU to determine whether the BSS of that PPDU is a BSS to which the station belongs in order to perform processing of that PPDU depending on whether it is from the target BSS or an overlapping or neighboring BSS. For example, Seok teaches, "To access all services of a BSS infrastructure, the STA should be associated with the BSS. Such association may be dynamically established and may involve use of a distribution system service (DSS)." Seok 5:53-6:20, *see also* Seok Fig. 4. Furthermore, Yang teaches, "Due to the need for a greater transmission rates and the development of wireless transmission technology, the initial IEEE 802.11 standard,

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which specifies a 1-2 Mbps transfer rate, has evolved into more advanced standards including 802.11b, 802.11g and 802.11a. Recently, conferences for establishing the new IEEE standard, 802.11g have been held. The IEEE 802.11a standard, which specifies a 6-54 Mbps transmission rate in the 5 GHz-National Information Infrastructure (NII) band, uses orthogonal frequency division multiplexing (OFDM) as transmission technology. With an increasing public interest in OFDM transmission and use of 5 GHz band, much greater attention has been paid to the IEEE 802.11a than other wireless LAN standards." Yang, ¶ [0006]. Furthermore, Oteri teaches, "FIG. 3 illustrates an example of an overlapping BSS with fractional CSMA/CA and TPC. In case of transmission between an AP and a BSS-edge STA (e.g., API 302 to (STAl, BSS1) 306), the neighboring BSS, e.g., BSS2 310 may limit its transmission to BSS-center STAs. The neighboring BSS may also control its power. This may limit its interference effect on the STA in BSS1 (e.g., AP2 304 to (STA2, BSS2) 312)." Oteri, ¶ [0068], *see also* Oteri Figs. 3, 20. Furthermore, Kim 038 teaches, "The method may further include, if a PPDU is detected within the predetermined time period without reception of the CTS frame after the reception of the RTS frame, determining whether the PPDU is from a basic service set (BSS) of the STA. If it is determined that the PPDU is not from the BSS of the STA and a received signal strength of the PPDU is equal to or less than the first CCA level, the specific wireless medium may be determined to be available." Kim 038, ¶ [0010]. Furthermore, Choi teaches, "Further, the HE-SIG A 1430 may include color bit information for BSS identification information, bandwidth information, a tail bit, a CRC bit, modulation and coding scheme (MCS) information for an HE-SIG B 1460, symbol count information for the HE-SIG B 1460, and cyclic prefix (CP) (or guard interval (GI)) length information." Choi, ¶ [0170]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose performing the claimed limitations "when . . . a received signal strength of the first PPDU is higher than a first threshold," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that certain steps should be taken when the received or measured signal strength of a received PPDU is above a threshold, including a CCA threshold. For example, Seok teaches, "Furthermore, a CCA threshold for preamble detection and a CCA threshold for energy detection may be separately set for one CCA type. The preamble detection CCA threshold corresponds to a value of signal strength of an STF, an LTF and an SIG field corresponding to a PLCP preamble. When the signal strength of a preamble is greater than a predetermined threshold, it is possible to detect presence of a valid 802.11 signal by receiving the preamble. The energy detection CCA threshold is used to detect a channel which is being used when strength of a specific signal is greater than a predetermined threshold in a state that a preamble is not received." Seok at 42:20-32. Furthermore, Yang teaches, "The Ethernet and the WLAN, which are currently being widely used, both utilize a carrier sensing multiple access (CSMA) method. The CSMA method is used to determine whether a channel is in use or not. When it is determined that the channel is not in use, that is, when the channel is idle, then data is transmitted. If the channel is busy, retransmission of data is attempted after a predetermined period of time. A carrier sensing multiple access with collision detection (CSMA/CD) method is an improvement of the CSMA method, which is used in a wired LAN, whereas a carrier sensing multiple access with collision avoidance (CSMA/CA) method is used in packet-based wireless data communications. In the CSMA/CD method, a station suspends transmitting signals when a collision is detected during transmission. Unlike the CSMA method which pre-checks whether a channel is occupied or not before transmitting data, in the CSMA/CD method, the station suspends transmission

of signals when a collision is detected during the transmission of signals and transmits a jam signal to another station to inform the occurrence of the collision. After the transmission of the jam signal, the station must wait for a random backoff period and then restarts transmitting signals. In the CSMA/CA method, the station does not transmit data immediately after the channel becomes idle but must wait for a random backoff period after a predetermined duration before transmission to avoid collision of signals. If a collision of signals occurs during transmission, the duration of the random backoff period is increased twofold for lowering the probability of collision (interference)." Yang, ¶ [0008]. Furthermore, Oteri teaches, "STA(s) and/or AP(s) may use a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) channel access mechanism. In CSMA/CA a STA and/or an AP may sense the primary channel. For example, if a STA has data to send, the STA may sense the primary channel. If the primary channel is detected to be busy, the STA may back off. For example, a WLAN or portion thereof may be configured so that one STA may transmit at a given time, e.g., in a given BSS. Channel access may include RTS and/or CTS signaling. For example, an exchange of a request to send (RTS) frame may be transmitted by a sending device and a clear to send (CTS) frame that may be sent by a receiving device. For example, if an AP has data to send to a STA, the AP may send an RTS frame to the STA. If the STA is ready to receive data, the STA may respond with a CTS frame. The CTS frame may include a time value that may alert other ST As to hold off from accessing the medium while the AP initiating the RTS may transmit its data. On receiving the CTS frame from the STA, the AP may send the data to the STA." Oteri, ¶ [0042]. Furthermore, 802.11ac teaches overlapping basic service sets and determining whether received PPDUs' BSS's are the BSS of the station or a neighboring BSS. 802.11-2012, § 8.2.4.3. Furthermore, Kim 038 teaches, "The method may further include, if a PPDU is detected within the predetermined time period without reception of the CTS frame after the reception of the RTS frame, determining whether the PPDU is from a basic

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service set (BSS) of the STA. If it is determined that the PPDU is not from the BSS of the STA and a received signal strength of the PPDU is equal to or less than the first CCA level, the specific wireless medium may be determined to be available." Kim 038, ¶ [0010]. Furthermore, Choi teaches, "When channel access is performed based on CSMA-CA in the WLAN system, the STA may determine whether a medium is occupied (or whether the channel is busy or idle) on the basis of a CCA threshold. The CCA threshold may be configured on the basis of a minimum receiver sensitivity of an STA (or AP) configured in the system. If strength of a signal sensed in the medium is greater than or equal to the CCA threshold, the STA may determine a state of the medium as a busy state. On the contrary, if the strength of the signal sensed in the medium is less than the CCA threshold, the STA may determine the state of the medium as an idle state." Choi, ¶ [0058]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "when . . . the first PPDU is a frame having a mode that is High Efficiency and having a PHY header that includes duration information for setting a virtual carrier sensing, setting a PHY-level virtual carrier sensing, wherein setting the PHY-level virtual carrier sensing includes setting a virtual carrier sensing by using the duration information included in a the PHY header of the first PPDU," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that it is desirable to perform virtual carrier sensing to avoid collisions and that this virtual carrier sensing can and should be performed based on duration information received from the PPDU, and that such information can be includes in the PHY and/or MAC headers and passed between layers using known functionalities. For example, Seok teaches, "As described above, the CSMA/CA mechanism includes not only physical carrier sensing through which the AP and/or STA directly sense the medium, but

also virtual carrier sensing. The virtual carrier sensing is performed to address some problems (such as a hidden node problem) encountered in medium access. In the virtual carrier sensing, MAC of the WLAN system may use a network allocation vector (NAV). By means of the NAV value, the AP and/or STA which is using the medium or has authority to use the medium indicates, for another AP and/or another STA, the remaining time before a time at which the medium becomes available. Accordingly, the NAV value may correspond to a reserved period during which the medium is used by the AP and/or STA to transmit a frame. An STA having received the NAV value may be prohibited from accessing the medium during the corresponding period. For example, NAV may be set according to the value of the duration field in the MAC header of a frame," Seok 14:24-15:38, and "A PPDU (Physical Layer Convergence Protocol (PLCP) Packet Data Unit) frame format may be composed of an STF (Short Training Field), an LTF (Long Training Field), a signal (SIG) field and a data field. A basic (e.g., non-HT (High Throughput)) PPDU frame format can be composed of an L-STF (Legacy-STF), an L-LTF (Legacy-LTF), a SIG field and a data field. Furthermore, additional STF, LTF and SIG field may be included between the SIG field and the data field according to PPDU frame format type (e.g., HT-mixed format PPDU, HT-greenfield format PPDU, VHT (Very High Throughput) PPDU and the like)." Seok 20:43-55. Furthermore, Yang teaches, "To address a solution for delay problems caused by the conventional virtual carrier sensing technology, the present invention proposes a new virtual carrier sensing method, which will now be described with reference to FIG. 3. As described above, in order for all the stations to establish their respective NAVs, duration information 324 is included in a signal that is transmitted by a basic modulation scheme. Therefore, a physical layer 310 can transmit the NAV (duration) value 324 to a MAC layer 320. "PHY-RXSTART.indicate", which provides information concerning the reception of the NAV value from the physical layer 310 by the MAC layer 320, may have a vector value. To this end, previous vector

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values must be changed, which will be described later with reference to FIGS. 8 and 10." Yang, ¶ [0039]. Furthermore, Oteri teaches, "A device may reserve spectrum via a network allocation vector (NAV) field. For example, in an IEEE 802.11 frame, the NAV field may be used to reserve a channel for a time period. A STA that wants to transmit data may set the NAV to the time for which it may expect to use the channel. When a STA sets the NAV, the NAV may be set for an associated WLAN or subset thereof (e.g., a BSS). Other STAs may count down the NAV to zero. When the counter reaches a value of zero, the NAV functionality may indicate to the other STA that the channel is now available," Oteri, ¶ [0043], and "Enhanced TPC in WLANs may be provided. For example, in IEEE802.11, the open loop transmission and reception of the TPC request and/or response frames may estimate the correct transmit power. Open loop TPC may suffer from inaccuracies due to the dependence on the receiver sensitivities and number of antennas used at the APs and/or STAs. In an outdoor scenario using IEEE802.1 lah or High Efficiency Wireless (HEW), the possible change in the channel may use estimation of the transmit power for each transmission. The TPC request and/or response exchange may be inefficient. To reduce this inefficiency, the system may aggregate and transmit the TPC request and/or response frames with the RTS/CTS frames, which may result in data transmission with correct TPC levels. The system may add a field to the physical layer (PHY) signal field (SIG) to indicate the transmit power and link margin that may be needed in each of the frames. Each STA/AP may be able to estimate the path loss from the transmitter and estimate the instantaneous power needed. The system may implement different TPC loops for the control frames and the data frames." Oteri ¶ [0069]. Furthermore, 802.11ac teaches setting the PHY-level virtual carrier sensing and setting a virtual carrier sensing by using the duration information included in a the PHY header of the first PPDU depending on the mode of the PPDU, and High Efficiency modes were already being contemplated with respect to the 802.11ax standard under discussion at the time of invention. 802.11-

2012 § 9.3.2. Furthermore, Kim 038 teaches, "If the PPDU is a HE PPDU, the STA determines whether the channel is busy or idle based on a HE CCA level. For example, if the RSSI of the received signal is higher than both the legacy CCA level and the HE CCA level, the STA holds CCA as busy and decodes the remaining frame. If the RSSI is higher than the legacy CCA level and lower than the HE CCA level, the STA changes CCA to idle. The RSSI may be a value which has been measured previously in L-STF and then stored, or a newly measured value. If the RSSI is lower than the HE CCA level, the STA may set idle in a CCA indication and transmits the CCA indication to the MAC, or include the measured RSSI in RXSTART.Indication and transmit RXSTART.Indication to the MAC. A method for setting CCA as busy or idle based on BSS Color information (BSS ID information by which it may be determined whether a BSS is identical to the BSS of the STA) included in HE-SIG A may be used. If the STA determines that the BSS matches the BSS of the STA by checking the BSS Color/BSS ID set in HE-SIG A, the STA sets CCA as busy even though the RSSI is lower than the HE CCA level. That is, in the case of a different BSS, if the measured RSSI is lower than the HE CCA level, the STA holds CCA as idle and if the measured RSSI is higher than the HE CCA level, the STA holds CCA as busy, as described above. The STA operates as described above, according to whether CCA is busy or idle." Kim 038, ¶ [0087]. Furthermore, Choi teaches, "An HE-SIG A 1430 may include information for indicating an STA for receiving a PPDU. For example, the HE-SIG A 1430 may include an identifier of a specific STA for receiving the PPDU and information for indicating a group of the specific STA. Further, if the PPDU is transmitted on the basis of orthogonal frequency division multiple access (OFDMA) or multiple input multiple output (MIMO), the HE-SIG A 1430 may also include resource allocation information for the STA," Choi, ¶ [0168], "The STA may receive the HE-SIG A 1405 and the RE-SIG B 1415. If it is instructed to receive the downlink PPDU by the STA identifier field of the HE-SIG A 1405, the STA may perform decoding on the downlink PPDU

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starting from the HE-STF 1425 by changing the FFT size. On the contrary, the STA may receive the HE-SIG A 1405, and if it is not instructed to receive the downlink PPDU on the basis of the HE-SIG A 1405, may configure the NAV." Choi ¶ [0176]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "when . . . the first PPDU is a frame having a mode of a standard previous to a standard defining the High Efficiency mode, and the first PPDU is a frame having a PHY header that does not include duration information for setting the virtual carrier sensing, setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that it is desirable to perform virtual carrier sensing to avoid collisions and that this virtual carrier sensing can and should be performed based on duration information received from the PPDU, and that such information can be included in the PHY and/or MAC headers and passed between layers using known functionalities. For example, Seok teaches, "As described above, the CSMA/CA mechanism includes not only physical carrier sensing through which the AP and/or STA directly sense the medium, but also virtual carrier sensing. The virtual carrier sensing is performed to address some problems (such as a hidden node problem) encountered in medium access. In the virtual carrier sensing, MAC of the WLAN system may use a network allocation vector (NAV). By means of the NAV value, the AP and/or STA which is using the medium or has authority to use the medium indicates, for another AP and/or another STA, the remaining time before a time at which the medium becomes available. Accordingly, the NAV value may correspond to a reserved period during which the medium is used

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by the AP and/or STA to transmit a frame. An STA having received the NAV value may be prohibited from accessing the medium during the corresponding period. For example, NAV may be set according to the value of the duration field in the MAC header of a frame," Seok 14:24-15:38, and "A PPDU (Physical Layer Convergence Protocol (PLCP) Packet Data Unit) frame format may be composed of an STF (Short Training Field), an LTF (Long Training Field), a signal (SIG) field and a data field. A basic (e.g., non-HT (High Throughput)) PPDU frame format can be composed of an L-STF (Legacy-STF), an L-LTF (Legacy-LTF), a SIG field and a data field. Furthermore, additional STF, LTF and SIG field may be included between the SIG field and the data field according to PPDU frame format type (e.g., HT-mixed format PPDU, HT-greenfield format PPDU, VHT (Very High Throughput) PPDU and the like)." Seok 20:43-55. Furthermore, Yang teaches, "First, referring to FIG. 1A, a frame transmitted through a channel is received by a station without error. A station cannot transmit a frame through a channel while the frame is being received in another station: this method is referred to as physical carrier sensing. A medium access control (MAC) header of the received frame contains duration information. This duration information contains a duration of time taken from transmission of a frame by a transmitting station to reception of an acknowledge (ACK) frame from a receiving station. The receiving station receives the frame transmitted from the transmitting station and transmits the ACK frame after a short duration, known as a short inter-frame space (SIFS), to the transmitting station. A station sets a network allocation vector (NAV) using duration information. This method is called virtual carrier sensing. In order for a station to transmit a frame to another station, the station waits for a distributed inter-frame space (DIFS) after the lapse of an NAV period of time, and then performs a random backoff, and finally transmits the frame. When a carrier is sensed in a medium while performing the random backoff, however, the station suspends the random backoff, and waits until the channel is empty. Then, the station waits for a DIFS, and performs the random backoff."

Yang, ¶ [0010]. Furthermore, Oteri teaches, "In WLAN systems that may support multiple channels, and channel widths, e.g., IEEE 802.11n, IEEE 802.11ac, IEEE 802.11af, and/or IEEE 802.11ah, may include a channel, which may be designated as the primary channel. The primary channel may have a bandwidth that may be equal to the largest common operating bandwidth supported by the STAs in the BSS. The bandwidth of the primary channel may be limited by a ST A operating in a BSS that may support the smallest bandwidth operating mode. For example, in IEEE 802.1 lah, the primary channel may be 1 MHz wide, if there may be STAs (e.g., MTC type devices) that may support a 1 MHz mode even if the AP, and other STAs in the BSS, may support a 2 MHz, 4 MHz, 8 MHz, 16 MHz, or other channel bandwidth operating modes. The carrier sensing, and NAV settings, may depend on the status of the primary channel. If the primary channel is busy, for example, due to a STA supporting a 1 MHz operating mode transmitting to the AP, the available frequency bands may be considered busy even though majority of the bands may stay idle and available." Oteri, ¶ [0050]. Furthermore, 802.11ac teaches setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU when the first PPDU is a frame having a mode of a standard previous to a standard defining the High Efficiency mode (as was being discussed in 802.11ax development at the time), and when the first PPDU is a frame having a PHY header that does not include duration information for setting the virtual carrier sensing, 802.11-2012 § 9.3.2, 802.11ac, § 22.1.3. Furthermore, Kim 038 teaches, "It has been described above that in the case where the STA determines that the received PPDU is a legacy PPDU, the STA uses the legacy CCA level and if the RSSI is higher than the legacy CCA level, the STA sets or holds CCA as busy. However, in spite of a legacy PPDU, the STA may use the HE CCA level depending on whether the BSS of the legacy PPDU matches the BSS of the STA, to thereby increase a spatial reuse rate. For

example, if the PPDU is a legacy PPDU and the legacy PPDU is a packet from the BSS of the STA, the STA sets or holds CCA as busy by continuously applying the legacy CCA level. If the legacy PPDU is a packet from a different BSS (i.e., an OBSS), the STA determines whether CCA is idle or busy by applying the HE CCA level. If the STA determines that CCA is idle, the STA may perform spatial/channel reuse during a transmission period of the corresponding frame or a Transmission Opportunity (TXOP) duration indicated by the frame. This method is applicable to derived methods mentioned in the present invention." Kim 038, ¶ [0088]. Furthermore, Choi teaches, "An HE-SIG A 1430 may include information for indicating an STA for receiving a PPDU. For example, the HE-SIG A 1430 may include an identifier of a specific STA for receiving the PPDU and information for indicating a group of the specific STA. Further, if the PPDU is transmitted on the basis of orthogonal frequency division multiple access (OFDMA) or multiple input multiple output (MIMO), the HE-SIG A 1430 may also include resource allocation information for the STA," Choi ¶ [0168], and "The STA may receive the HE-SIG A 1405 and the RE-SIG B 1415. If it is instructed to receive the downlink PPDU by the STA identifier field of the HE-SIG A 1405, the STA may perform decoding on the downlink PPDU starting from the HE-STF 1425 by changing the FFT size. On the contrary, the STA may receive the HE-SIG A 1405, and if it is not instructed to receive the downlink PPDU on the basis of the HE-SIG A 1405, may configure the NAV." Choi ¶ [0176]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "when the BSS of the first PPDU is the BSS to which the first station does not belong and the received signal strength of the first PPDU is lower than the first threshold, attempting to obtain a transmission opportunity," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi,

which teach that when the channel is idle or the signal strength of received PPDUs is weak or low, the channel is clear and the STA should contend for access or seek a TXOP to increase efficiency and throughput on the channel. For example, Seok teaches, "A data unit having a channel width equal to or greater than the first channel width may be transmitted when a transmission opportunity (TXOP) is permitted as a result of the first backoff process, and a data unit having a channel width equal to or greater than the second channel width may be transmitted when a TXOP is permitted as a result of the second backoff process." Seok 3:1-30. Furthermore, Yang teaches, "The Ethernet and the WLAN, which are currently being widely used, both utilize a carrier sensing multiple access (CSMA) method. The CSMA method is used to determine whether a channel is in use or not. When it is determined that the channel is not in use, that is, when the channel is idle, then data is transmitted. If the channel is busy, retransmission of data is attempted after a predetermined period of time. A carrier sensing multiple access with collision detection (CSMA/CD) method is an improvement of the CSMA method, which is used in a wired LAN, whereas a carrier sensing multiple access with collision avoidance (CSMA/CA) method is used in packet-based wireless data communications. In the CSMA/CD method, a station suspends transmitting signals when a collision is detected during transmission. Unlike the CSMA method which pre-checks whether a channel is occupied or not before transmitting data, in the CSMA/CD method, the station suspends transmission of signals when a collision is detected during the transmission of signals and transmits a jam signal to another station to inform the occurrence of the collision. After the transmission of the jam signal, the station must wait for a random backoff period and then restarts transmitting signals. In the CSMA/CA method, the station does not transmit data immediately after the channel becomes idle but must wait for a random backoff period after a predetermined duration before transmission to avoid collision of signals. If a collision of signals occurs during transmission, the duration of the random backoff period is increased twofold for

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lowering the probability of collision (interference)." Yang, ¶ [0008]. Furthermore, Oteri teaches, "To prioritize the STAs, QoS (e.g., as provide in IEEE 802. l ie) may be extended to the traffic from the associated devices. In enhanced distributed channel access (EDCA), the random delay may be calculated as: Total Deferral period = AIFS[Access_class]+Backoff[Access_class] where both the arbitration inter frames Space (AIFS), the contention windows, and the backoff calculated may depend on the access class of the data, e.g., background traffic (AC-BK), best effort traffic (AC BE), Video (AC VI), and Voice (AC Voice). A TxOP limit may be set based on the access class. An additional user priority factor that may modify the total deferral period estimation for the STAs in the group to enable prioritization of the traffic from different groups and modify the upper limit of the TxOP needed for the relay transmission." Oteri, ¶ [0102]. Furthermore, 802.11ac teaches attempting to obtain a transmission opportunity (TXOP) when the BSS of the incoming PPDU is a neighboring or adjacent BSS (for example, an OBSS) and the channel is detected to be idle or below a signal threshold. 802.11-2012 § 9.3.2.1, 802.11ac § 22.2.4. Furthermore, Kim 038 teaches, "It has been described above that in the case where the STA determines that the received PPDU is a legacy PPDU, the STA uses the legacy CCA level and if the RSSI is higher than the legacy CCA level, the STA sets or holds CCA as busy. However, in spite of a legacy PPDU, the STA may use the HE CCA level depending on whether the BSS of the legacy PPDU matches the BSS of the STA, to thereby increase a spatial reuse rate. For example, if the PPDU is a legacy PPDU and the legacy PPDU is a packet from the BSS of the STA, the STA sets or holds CCA as busy by continuously applying the legacy CCA level. If the legacy PPDU is a packet from a different BSS (i.e., an OBSS), the STA determines whether CCA is idle or busy by applying the HE CCA level. If the STA determines that CCA is idle, the STA may perform spatial/channel reuse during a transmission period of the corresponding frame or a Transmission Opportunity (TXOP) duration indicated by the frame. This method is applicable to derived methods

mentioned in the present invention." Kim 038, ¶ [0088]. Furthermore, Choi teaches, "For example, the STA (or AP, hereinafter, the STA is assumed in the description) may decide whether a medium is idle or busy to perform channel access. More specifically, the STA may decide whether the medium is idle on the basis of a CCA threshold to transmit pending uplink data (or transmission packet). If a signal having strength greater than or equal to the CCA threshold is sensed through the medium, the STA may decide that the medium is busy. On the contrary, if a signal having strength less than the CCA threshold is sensed through the medium, the STA may decide that the medium is idle. If the medium is idle as a result of determining the medium of the STA, the STA may transmit an uplink frame to the AP. That is, the STA has a real Tx opportunity after comparing the CCA on the basis of the CCA threshold. Therefore, according to a magnitude of the CCA threshold configured by the STA, a state (busy, idle) of the medium of the STA may be decided differently." Choi, ¶ [0132]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "when the BSS of the first PPDU is the BSS to which the first station belongs, setting a virtual carrier sensing by using information included in the PHY header of the first PPDU" or "wherein the information included in the PHY header of the first PPDU indicates a duration which is set for the virtual carrier sensing," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach setting virtual carrier sensing in order to reduce collisions between networks and overlapping BSSs based on duration information that is included in the PHY and/or MAC header of the PPDU. For example, Seok teaches, "Furthermore, a CCA threshold for preamble detection and a CCA threshold for energy detection may be separately set for one CCA type. The preamble detection CCA threshold corresponds to a value of signal strength of an STF, an LTF and an SIG field

corresponding to a PLCP preamble. When the signal strength of a preamble is greater than a predetermined threshold, it is possible to detect presence of a valid 802.11 signal by receiving the preamble. The energy detection CCA threshold is used to detect a channel which is being used when strength of a specific signal is greater than a predetermined threshold in a state that a preamble is not received," Seok at 42:20-32, and "When the STA defines a CCA threshold per CCA type in the PHY layer, a CCA type which will be actually used in the PHY layer can be determined according to CCA type actually supported by a BSS to which the STA belongs. To this end, a PHY-CCATYPESET.request primitive can be defined. Parameters included in the PHY-CCATYPESET.request primitive may include a value indicating "active" or "inactive" for each CCA type. The PHY-CCATYPESET.request primitive is a primitive delivered from the MAC layer to the PHY layer of an STA, and the PHY layer of the STA can report CCA status information to the MAC layer through a PHY-CCA{n}.indication primitive only for CCA Type{n} set to "active" upon reception of the PHY-CCATYPESET.request primitive. For CCA-Type{n} set to "inactive", the PHY layer may not report CCA status information to the MAC layer through the PHY-CCA {n}.indication primitive." Seok at 45:52-67. Furthermore, Yang teaches, "The setting of virtual carrier sensing data may comprise transmitting the data to a physical layer. The method of setting virtual carrier sensing data in wireless network communications may further comprise storing the data as a parameter of a vector of a physical layer virtual carrier sensing indicator (PHY-RXSTART.indicator) and transmitting the same to the physical layer. The NAV value stored in a signal segment is also stored in a data segment to be received in a next stage. In other words, the same NAV value in the data segment is stored in the signal segment." Yang, ¶¶ [0023]-[0024]]. Furthermore, Oteri teaches, "Enhanced TPC in WLANs may be provided. For example, in IEEE802.11, the open loop transmission and reception of the TPC request and/or response frames may estimate the correct transmit power.

Open loop TPC may suffer from inaccuracies due to the dependence on the receiver sensitivities and number of antennas used at the APs and/or STAs. In an outdoor scenario using IEEE802.1 lah or High Efficiency Wireless (HEW), the possible change in the channel may use estimation of the transmit power for each transmission. The TPC request and/or response exchange may be inefficient. To reduce this inefficiency, the system may aggregate and transmit the TPC request and/or response frames with the RTS/CTS frames, which may result in data transmission with correct TPC levels. The system may add a field to the physical layer (PHY) signal field (SIG) to indicate the transmit power and link margin that may be needed in each of the frames. Each STA/AP may be able to estimate the path loss from the transmitter and estimate the instantaneous power needed. The system may implement different TPC loops for the control frames and the data frames." Oteri, ¶ [0069]. Furthermore, 802.11ac teaches setting a virtual carrier sensing by using information included in the PHY header of the first PPDU. 802.11-2012 §§ 8.2.4.5.7, 9.3.2, 22.1.3, 22.2. Furthermore, Kim 038 teaches, "Information about the BSS of the STA may be included in an 11ax PHY header (e.g., a preamble/a SIG field). That is, COLOR field information or a partial BSSID, which is BSS information, may be included in the PHY header." Kim 038, ¶ [0089], Figs. 4, 5, 20. Furthermore, Choi teaches, "An HE-SIG A 1430 may include information for indicating an STA for receiving a PPDU. For example, the HE-SIG A 1430 may include an identifier of a specific STA for receiving the PPDU and information for indicating a group of the specific STA. Further, if the PPDU is transmitted on the basis of orthogonal frequency division multiple access (OFDMA) or multiple input multiple output (MIMO), the HE-SIG A 1430 may also include resource allocation information for the STA," Choi, ¶ [0168], "The STA may receive the HE-SIG A 1405 and the RE-SIG B 1415. If it is instructed to receive the downlink PPDU by the STA identifier field of the HE-SIG A 1405, the STA may perform decoding on the downlink PPDU starting from the HE-STF 1425 by changing the FFT size. On the contrary, the STA may receive the

HE-SIG A 1405, and if it is not instructed to receive the downlink PPDU on the basis of the HE-SIG A 1405, may configure the NAV." Choi ¶ [0176]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the BSS of the first PPDU is determined based on at least one of a BSS identifier (BSSID), a transmitter address, a receiver address, and a version information included in the first PPDU," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that BSSID, station addresses, and supported 802.11 version information can and should be used to identify the BSS of the incoming PPDU. For example, Seok teaches, "A MAC header includes a frame control field, a duration/ID field and an address field. The frame control field can include control information necessary for frame transmission/reception. The duration/ID field can be set to a time for transmitting a corresponding frame. Refer to IEEE 802.11-2012 for details of Sequence Control, QoS Control and HT Control subfields of the MAC header." Seok 20:43-21:30. Furthermore, Yang teaches, "FIGS. 5A through 5C illustrate a conventional PPDU (PLCP Protocol Data Unit) frame format as defined by IEEE 802.11a, and exemplary modified PPDU formats for embodying the present invention. The PPDU is a complete PLCP (Physical Layer Convergence Procedure) frame, including a PLCP header, a PSDU, tail bits and pad bits. First of all, PLCP will be described briefly. A relatively complicated physical (PHY) layer is required when using radio waves therein. A physical layer according to IEEE 802.11a includes a PLCP and a PDM (Physical Medium Dependent) system. The PLCP, which is a upper layer portion of the physical layer in an IEEE 802.11 network, matches a frame of a MAC layer with a medium. Each physical layer has its own PLCP, which provides an auxiliary frame to the MAC layer. The PMD system is responsible for transmitting a radio frequency (RF) signal to another station

in order to transmit the frame of the MAC layer. The PLCP header according to an illustrative embodiment of the present invention stores basic information required for interaction between the PHY layer and the MAC layer." Yang, ¶ [0044]. Furthermore, Oteri teaches, "The ID subfield 2010 may indicate the ID of the entity being reported. The ID may be implemented using the MAC address and/or the BSSID, e.g., when the report type is BSS or Sector(s). The ID may be implemented using the MAC address of the Coordinator or Coordination Relay, e.g., when the report type is Coordinator or Coordination Relay. The ID may be implemented using the MAC address of the STA or the group address or group ID of a group of STAs, e.g., when the report type is STA(s)." Oteri, ¶ [0177]. Furthermore, 802.11ac teaches determining the BSS of the first PPDU based on the BSSID, address information, and the supported version information included in the first PPDU. 802.11-2012, §§ 8.2.4.3.4, 8.3.2. Furthermore, Kim 038 teaches, "If at least one of the Receiver Address (RA, Address 1) and Sender Address (SA, Address 2) of a MAC Protocol Data Unit (MPDU) (e.g., a MAC header) in a legacy frame matches the BSSID of an AP/BSS to which the STA belongs, the STA determines that the BSS of the legacy frame is its BSS. In the case of an 11ac UL PPDU, if the partial AID of HE-SIG A matches the BSSID (e.g., 9 Least Significant Bits (LSBs)) of the AP/BSS to which the STA belongs, the STA determines that an STA/AP within its BSS has transmitted the packet. For a legacy PPDU, spatial reuse may be performed in one of the two methods as defined above." Kim 038, ¶ [0089]. Furthermore, Choi teaches, "Further, the HE-SIG A 1430 may include color bit information for BSS identification information, bandwidth information, a tail bit, a CRC bit, modulation and coding scheme (MCS) information for an HE-SIG B 1460, symbol count information for the HE-SIG B 1460, and cyclic prefix (CP) (or guard interval (GI)) length information." Choi, ¶ [0170]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the first threshold is a clear channel assessment (CCA) threshold," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi, which teach use of CCA thresholds for purposes of virtual carrier sensing and detecting idle channels in order to increase channel efficiency and throughput. For example, Seok teaches, "To accomplish the object of the present invention, there is provided a method for performing clear channel assessment (CCA) by a station (STA) in a wireless LAN system, the method including: receiving, by a physical layer (PHY) of the STA, a request primitive including a parameter indicating a CCA level type from a higher layer; and determining whether a signal equal to or greater than a CCA threshold set based on a value of the parameter is sensed, wherein the parameter is set to a first CCA level type for transmission of a data unit having a channel width equal to or greater than a first channel width, wherein the parameter is set to a second CCA level type for transmission of a data unit having a channel width equal to or greater than a second channel width, wherein the second channel width is wider than the first channel width, wherein a second CCA threshold set for the second CCA level type is higher than a first CCA threshold set for the first CCA level type." Seok at 1:66-2:62. Furthermore, Yang teaches, "The Ethernet and the WLAN, which are currently being widely used, both utilize a carrier sensing multiple access (CSMA) method. The CSMA method is used to determine whether a channel is in use or not. When it is determined that the channel is not in use, that is, when the channel is idle, then data is transmitted. If the channel is busy, retransmission of data is attempted after a predetermined period of time. A carrier sensing multiple access with collision detection (CSMA/CD) method is an improvement of the CSMA method, which is used in a wired LAN, whereas a carrier sensing multiple access with collision avoidance (CSMA/CA) method is used in packet-based wireless data communications. In the

CSMA/CD method, a station suspends transmitting signals when a collision is detected during transmission. Unlike the CSMA method which pre-checks whether a channel is occupied or not before transmitting data, in the CSMA/CD method, the station suspends transmission of signals when a collision is detected during the transmission of signals and transmits a jam signal to another station to inform the occurrence of the collision. After the transmission of the jam signal, the station must wait for a random backoff period and then restarts transmitting signals. In the CSMA/CA method, the station does not transmit data immediately after the channel becomes idle but must wait for a random backoff period after a predetermined duration before transmission to avoid collision of signals. If a collision of signals occurs during transmission, the duration of the random backoff period is increased twofold for lowering the probability of collision (interference)." Yang, ¶ [0008]. Furthermore, Oteri teaches, "An AP may have F-CSMA channel access and regular CSMA channel access. Within F-CSMA channel access period, intra-BSS F-CSMA may be performed as described herein. Within CSMA channel access period, the AP may choose whether F-CSMA is utilized. If F-CSMA is utilized, the AP may use time/frequency domain F-CSMA scheme defined in previous embodiments or the AP may transmit to the two groups using different power control algorithms and CCA thresholds." Oteri, ¶ [0159]. Furthermore, at least as Plaintiff appears to interpret the scope of the claims, 802.11ac teaches use of clear channel assessment thresholds as claimed. 802.11-2012 § 14.7.15.4. Furthermore, Kim 038 teaches, "In one aspect of the present invention, a method for transmitting a signal based on determination of a use state of a wireless medium by a station (STA) in a wireless local area network (WLAN) system includes receiving a WLAN signal through a specific wireless medium, comparing a received signal strength of the WLAN signal with a clear channel assessment (CCA) level selected between a first CCA level and a second CCA level according to a type of the WLAN signal, the second CCA level being lower than the first CCA level, if the received signal strength of the WLAN signal is

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less than the selected CCA level, determining the specific wireless medium to be available, and transmitting a signal of the STA according to the determination." Kim 038, ¶ [0006]. Furthermore, Choi teaches, "Referring to FIG. 13, the TPC STA 1320 and the non-TPC STA 1340 may operate in a BSS. When an AP configures the CCA threshold of the TPC STA 1320 to be relatively high (e.g., −72 dBm), sensitivity of medium sensing of the TPC STA 1320 may be decreased. In this case, the TPC STA 1320 may have a relatively greater number of Tx opportunities than the non-TPC STA 1340. On the contrary, when the CCA threshold for the non-TPC STA 1340 is configured to be relatively low (e.g., −82 dBm), the sensitivity of medium sensing of the TPC STA 1320 may be increased. In this case, the TPC STA 1320 may have a relatively smaller number of Tx opportunities than the non-TPC STA 1340." Choi, ¶ [0155]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein the first threshold is different from a threshold which is used for determining reception possibility of the first PPDU when the BSS of the first PPDU is the BSS to which the first station belongs," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that it is desirable to use different CCA threshold for the current BSS and adjacent or neighboring BSS PPDUs in order to increase efficiency and avoid collisions. For example, Seok teaches, "The first CCA threshold may be A dBm and the second CCA threshold may be A+3 dBm." Seok at 3:26-27. Furthermore, Oteri teaches, "The COBRA AP may start and/or join a COBRA F-CSMA transmission. The COBRA AP may sense heavy interference from OBSSs. The sensing of heavy interference may be performed by monitoring the energy of OBSSs, the channel or sub-channel occupation of OBSSs, etc. The COBRA AP may set up a threshold to determine whether the interference is severe enough

to switch to COBRA F-CSMA transmissions. The COBRA AP may receive a COBRA F-CSMA transmission request frame, and the COBRA AP may sense heavy interference from OBSS. The COBRA AP may decide to join the COBRA F-CSMA transmission." Oteri, ¶ [0212]. Furthermore, at least as Plaintiff appears to interpret the scope of the claims, 802.11ac teaches different CCA thresholds based on which BSS the PPDU belongs to and which mode of transmission is being used. 802.11-2012, § 14.7.15.4; 802.11ac Table 22-27. Furthermore, Kim 038 teaches, "In one aspect of the present invention, a method for transmitting a signal based on determination of a use state of a wireless medium by a station (STA) in a wireless local area network (WLAN) system includes receiving a WLAN signal through a specific wireless medium, comparing a received signal strength of the WLAN signal with a clear channel assessment (CCA) level selected between a first CCA level and a second CCA level according to a type of the WLAN signal, the second CCA level being lower than the first CCA level, if the received signal strength of the WLAN signal is less than the selected CCA level, determining the specific wireless medium to be available, and transmitting a signal of the STA according to the determination." Kim 038, ¶ [0006]. Furthermore, Choi teaches, "For example, if a CCA threshold of the non-TPC STA 1340 is −82 dBm and a CCA threshold of the TPC STA 1320 is −72 dBm, the transmit power level of the TPC STA 1320 may be determined to have a difference of 10 dB with respect to the transmit power level of the non-TPC STA 1340, and may be determined to have a difference of 0 to 10 dB by considering another system variable." Choi, ¶ [0159]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein attempting to obtain the transmission priority is performed without setting of the virtual carrier sensing," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Yang, Oteri, 802.11ac, Kim 038, and/or Choi,

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which teach that it is desirable to obtain transmission priority of the PPDU, including QoS settings or other transmission priorities, without setting the virtual carrier sensing. For example, Seok teaches, "In addition, the HCF includes a medium access mechanism for improving Quality of Service (QoS) of the WLAN, and may transmit QoS data during both the contention period (CP) and the contention free period (CFP)." Seok 13:7-21. Furthermore, Yang teaches, "FIG. 2 illustrates conventional carrier sensing, supporting two kinds of carrier sensing structures: physical carrier sensing and virtual carrier sensing. As to a physical sensing structure, information stored in a physical layer 210 has a structure 212. A physical layer convergence procedure (PLCP) preamble 214 is a PLCP synchronization signal for the purpose of informing in advance which data in the physical layer 210 will be transmitted. A signal 216, as indicated by SIGNAL, is preceded by the PLCP preamble 214, and SIGNAL is modulated by a basic modulation scheme, and carries information which is necessary to receive a next data field 218, as indicated by DATA. The SIGNAL 216 will later be described in detail with reference to FIGS. 5A-C. Information contained in the SIGNAL 216 has a segment, as indicated by RATE, corresponding to a modulation scheme used in transmission of the DATA 218. This information enables data transmission/reception using various modulation schemes. As shown in FIG. 2, physical carrier sensing is implemented based on whether the medium receives a certain signal or not. Upon receiving the PLCP preamble 214, the physical layer 210 informs a medium access control (MAC) layer 220 that the physical layer 210 is busy, through a busy signal 222. Also, at an instant when the reception of data is terminated, that is, when the channel becomes idle as indicated by reference numeral 228, the physical layer 210 informs the MAC layer 220 that the use of the physical layer 210 is terminated. In the physical carrier sensing, however, transmitting data to an arbitrary station may not be accepted by another station. In this case, it is necessary to perform virtual carrier sensing." Yang, ¶ [0015]. Furthermore, Oteri teaches, "To prioritize the STAs, QoS (e.g., as provide in IEEE

802. l ie) may be extended to the traffic from the associated devices. In enhanced distributed channel access (EDCA), the random delay may be calculated as: Total Deferral period = AIFS[Access_class]+Backoff[Access_class] where both the arbitration inter frames Space (AIFS), the contention windows, and the backoff calculated may depend on the access class of the data, e.g., background traffic (AC-BK), best effort traffic (AC BE), Video (AC VI), and Voice (AC Voice). A TxOP limit may be set based on the access class. An additional user priority factor that may modify the total deferral period estimation for the STAs in the group to enable prioritization of the traffic from different groups and modify the upper limit of the TxOP needed for the relay transmission." Oteri, ¶ [0102]. Furthermore, at least as Plaintiff appears to interpret the scope of the claims, 802.11ac teaches obtaining the transmission priority using QoS without setting virtual carrier sensing as claimed. 802.11-2012, § 4.3.7. Furthermore, Kim 038 teaches, "If the PPDU is a HE PPDU, the STA determines whether the channel is busy or idle based on a HE CCA level. For example, if the RSSI of the received signal is higher than both the legacy CCA level and the HE CCA level, the STA holds CCA as busy and decodes the remaining frame. If the RSSI is higher than the legacy CCA level and lower than the HE CCA level, the STA changes CCA to idle. The RSSI may be a value which has been measured previously in L-STF and then stored, or a newly measured value. If the RSSI is lower than the HE CCA level, the STA may set idle in a CCA indication and transmits the CCA indication to the MAC, or include the measured RSSI in RXSTART.Indication and transmit RXSTART.Indication to the MAC. A method for setting CCA as busy or idle based on BSS Color information (BSS ID information by which it may be determined whether a BSS is identical to the BSS of the STA) included in HE-SIG A may be used. If the STA determines that the BSS matches the BSS of the STA by checking the BSS Color/BSS ID set in HE-SIG A, the STA sets CCA as busy even though the RSSI is lower than the HE CCA level. That is, in the case of a different BSS, if the measured

RSSI is lower than the HE CCA level, the STA holds CCA as idle and if the measured RSSI is higher than the HE CCA level, the STA holds CCA as busy, as described above. The STA operates as described above, according to whether CCA is busy or idle." Kim 038, ¶ [0087]. Furthermore, Choi teaches, "Referring to a lower portion of FIG. 12, the AP may increase a CCA threshold of an STA2 1220 as a TPC STA, and may decrease transmit power of the STA2 1220. Further, the AP may configure respective channel resources for uplink data transmission of the STA2 1220 as the TPC STA and of an STA4 1240 as a non-TPC STA in a non-overlapping manner. When using this method, a Tx opportunity for the STA2 1220 may be increased, and an interference to a neighbor BSS caused by the STA2 1220 may be decreased. Further, a possibility of an inter-frame collision in a BSS caused by a decrease in transmission coverage of the STA2 1220 may be decreased by separately allocating a channel for transmission of an uplink frame of the STA2 1220." Choi, ¶ [0149]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose "a processor; and a memory storing at least one instruction executed by the processor" to perform the claimed steps, it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of Seok, Oteri, 802.11ac, Kim 038, and/or Choi, which teach that their inventions should be implemented on processors using memory. For example, Seok teaches, "An STA 10 may include a processor 11, a memory 12 and a transceiver 13. The transceiver 13 may transmit/receive RF signals and implement a physical layer according to IEEE 802, for example. The processor 11 may implement a physical layer and/or a MAC layer according to IEEE 802 by being connected to the transceiver 13. The processor 11 may include a PHY module 11 a and a higher layer module 11 b (e.g. MAC module). The processor 11 may be configured to perform operations according to various embodiments of the present invention. In addition, a module implementing operations

according to the aforementioned various embodiments of the present invention may be stored in the memory 12 and executed by the processor 11. The memory 12 may be included in the processor 11 or provided to the outside of the processor 11 and connected to the processor 11 through a known means." Seok 47:8-61. Furthermore, Oteri teaches, "The devices in a WLAN, such as an AP or STA, may include one or more of the following: a processor, a memory, a radio receiver and/or transmitter (e.g., which may be combined in a transceiver), one or more antennas (e.g., antennas 106 in FIG. 1), etc. A processor function may comprise one or more processors. For example, the processor may comprise one or more of: a general purpose processor, a special purpose processor (e.g., a baseband processor, a MAC processor, etc.), a digital signal processor (DSP), Application Specific Integrated Circuits (ASICs), Field Programmable Gate Array (FPGAs) circuits, any other type of integrated circuit (IC), a state machine, and the like. The one or more processors may be integrated or not integrated with each other. The processor (e.g., the one or more processors or a subset thereof) may be integrated with one or more other functions (e.g., other functions such as memory). The processor may perform signal coding, data processing, power control, input/output processing, modulation, demodulation, and/or any other functionality that may enable the device to operate in a wireless environment, such as the WLAN of FIG. 1. The processor may be configured to execute processor executable code (e.g., instructions) including, for example, software and/or firmware instructions. For example, the processer may be configured to execute computer readable instructions included on one or more of the processor (e.g., a chipset that includes memory and a processor) or memory. Execution of the instructions may cause the device to perform one or more of the functions described herein." Oteri, ¶ [0044]. Furthermore, at least as Plaintiff appears to interpret the scope of the claims, 802.11ac teaches stations comprising processors and memory, and such structures are inherent, implicit, and/or obvious to use when performing the steps outlined in the 802.11 standards. 802.11-2012, Fig. 4-1. Furthermore, Kim

038 teaches, "The STA 800 may include a processor 810, a memory 820, and a transceiver 830 and the AP 850 may include a processor 860, a memory 870, and a transceiver 860. The transceivers 830 and 880 may transmit/receive a wireless signal and may be implemented in a physical layer of IEEE 802.11/3GPP. The processors 810 and 860 are implemented in a physical layer and/or a MAC layer and are connected to the transceivers 830 and 880. The processors 810 and 860 may perform the above-described UL MU scheduling procedure." Kim 038, ¶ [0147]. Furthermore, Choi teaches a processor; and a memory storing at least one instruction executed by the processor to carry out its invention. Choi, ¶ [0015]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '442 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '442 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '442 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- "when . . . the first PPDU is a frame having a mode that is High Efficiency" (claims 1, 8)
- "setting a virtual carrier sensing by using the duration information included in [a]/[a the] PHY header of the first PPDU" (claims 1, 8)
- "when . . . the first PPDU is a frame having a mode of a standard previous to a standard defining the High Efficiency mode . . ." (claims 1, 8)
- "setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU" (claims 1, 8)
- "setting a virtual carrier sensing by using information included in the PHY header of the first PPDU" (claims 2, 9)

- "wherein the first threshold is different from a threshold which is used for determining reception possibility of the first PPDU when the BSS of the first PPDU is the BSS to which the first station belongs" (claims 5, 12)

- "attempting to obtain the transmission priority is performed without setting of the virtual carrier sensing" (claim 7, 14)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the '442 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '442 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '442 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- "***when*** the BSS of the first PPDU is the BSS to which the first station does not belong, a received signal strength of the first PPDU is higher than a first threshold, and the first PPDU is a frame having a mode that is High Efficiency and having a PHY header that includes duration information for setting a virtual carrier sensing, setting a PHY-level virtual carrier sensing, wherein setting the PHY-level virtual carrier sensing includes setting a virtual carrier sensing by using the duration information included in a PHY header of the first PPDU;
  "***when*** the BSS of the first PPDU is the BSS to which the first station does not belong, the received signal strength of the first PPDU is higher than the first threshold, the first PPDU is a frame having a mode of a standard previous to a standard defining the High Efficiency mode, and the first PPDU is a frame having a PHY header that does not include duration information for setting the virtual carrier sensing, setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU; and
  "***when*** the BSS of the first PPDU is the BSS to which the first station does not belong and the received signal strength of the first PPDU is lower than the first threshold, attempting to obtain a transmission opportunity." (claims 1, 8)

- "attempting to obtain a transmission opportunity" (claims 1, 8)

- "a the PHY header of the first PPDU" (claims 1)

- "attempting to obtain the transmission priority" (claims 7, 14)
- "having a mode that is High Efficiency" (claims 1, 8)
- "having a mode of a standard previous to a standard defining the High Efficiency mode" (claims 1, 8)
- "a processor, and a memory storing at least one instruction executed by the processor, to perform: receiving a first physical layer (PHY) protocol data unit (PPDU); determining whether a basic service set (BSS) of the first PPDU is a BSS to which the first station belongs or a BSS to which the first station does not belong; when the BSS of the first PPDU is the BSS to which the first station does not belong, a received signal strength of the first PPDU is higher than a first threshold, and the first PPDU is a frame having a mode that is High Efficiency and having a PHY header that includes duration information for setting a virtual carrier sensing, setting a PHY-level virtual carrier sensing, wherein setting the PHY-level virtual carrier sensing includes setting a virtual carrier sensing by using the duration information included in a PHY header of the first PPDU; when the BSS of the first PPDU is the BSS to which the first station does not belong, the received signal strength of the first PPDU is higher than the first threshold, the first PPDU is a frame having a mode of a standard previous to a standard defining the High Efficiency mode, and the first PPDU is a frame having a PHY header that does not include duration information for setting the virtual carrier sensing, setting a medium access control (MAC)-level virtual carrier sensing, wherein setting the MAC-level virtual carrier sensing includes setting the virtual carrier sensing by using duration information included in a MAC header of the first PPDU; and when the BSS of the first PPDU is the BSS to which the first station does not belong and the received signal strength of the first PPDU is lower than the first threshold, attempting to obtain a transmission opportunity." (claim 8)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

Based on Plaintiff's apparent constructions of the terms in its operative infringement contentions, the asserted claims are invalid on the basis that a POSITA reviewing the specification

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and prosecution history would be unable to ascertain the bounds of the asserted claims because it is unclear when the claims are infringed for the claims that include multiple contradictory "when . . ." limitations, such that a POSITA would be unable to determine if the claims are practiced or not when only one of the conditions is met, or when none of those conditions are met.

F. The '513 Patent Is Invalid

1. The '513 Patent Is Rendered Invalid by the Prior Art.

Some or all of the Asserted Claims of the '513 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit E-1 through E-15, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as disclosing one or more elements of the Asserted Claims of '513 Patent under 35 U.S.C. § 102. The table of references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the '513 Patent.

Exhibit	Prior Art Reference
E-1	U.S. Patent App. Pub. No. 2017/0289911 ("Kim")
E-2	U.S. Patent No. 10,034,288 ("Chun '288")
E-3	U.S. Patent No. 10,135,652 ("Rong")
E-4	U.S. Patent App. Pub. No. 2014/0294020 ("You")
E-5	U.S. Patent No. 10,833,828 ("Wang")

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Exhibit	Prior Art Reference
E-6	U.S. Patent App. Pub. No. 2004/0082356 ("Walton")
E-7	U.S. Patent App. Pub. No. 2014/0056188 ("Yang")
E-8	U.S. Patent No. 10,057,389 ("Fechtel")
E-9	U.S. Patent App. Pub. No. 2014/0050149 ("Cai")
E-10	U.S. Patent Application Publication No. 20180220443A1 ("Kim_443")
E-11	U.S. Patent Application Publication No. 20120327915A1 ("Kang_915")
E-12	U.S. Patent Application Publication No. 20150063191A1 ("Merlin_191")
E-13	U.S. Patent Application Publication No. 20070204052A1 ("Trainin_052")
E-14	U.S. Patent Application Publication No. 20170201364A1 ("Wang_364")
E-15	U.S. Patent Application Publication No. 20130286959A1 ("Lou_959")

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '513 Patent, any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art.

2. The '513 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '513 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits E-1 through E-15, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits E-1 through E-15 with each other because all of these references relate to wireless communication methods and the selection and transmission of subsequent frame characteristics to improve wireless communications. For example, Rong teaches "receiving scheduling information including information for an uplink transmission scheduled for the station and determining a first length of a first cyclic prefix for a transmission in accordance with the scheduling information." Rong, Abstract. Furthermore, Chun '288 teaches "receiving an uplink instruction frame from an AP; and by the STA, transmitting, to the AP, a first uplink frame as a response to the uplink transmission instruction frame." Chun '288, Abstract.

Similarly, each of the references involve the determination and transmission of an appropriate guard interval or cyclic prefix in order to decrease the effects of interference on wireless transmissions between the AP and STAs. For example, You teaches an AP that may "determine a guard interval to be set in transmitting a frame to the STA" based on information sent in a previous frame." You, [0195]. Where the channel delay is large, "an LGI may be used as CP (cyclic prefix) when transmitting frames, and in case the channel delay is determined to be small based on the predetermined threshold, an SIG may be used as CP (cyclic prefix) upon transmission of a frame." *Id*. Cai teaches that "the dynamic configuration of the variable length cyclic prefixes of mobile stations is set by the base station." Cai, [0061]. The chosen cyclic prefix is added to a frame to be transmitted by the base station to the STAs and "assign[ed] to a particular uplink sub-frame to transmit with the preferred cyclic prefix." *Id*.

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Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

a) State of the Art

An increasing need for high speed mobile communication systems brought an increasing need for these mobile communication systems to overcome various environmental conditions that frustrate the transmission and receipt of signals. Cai, [0003]. Among these operating conditions were inter-symbol interference, inter-channel interference, and multipath. *Id*. Multipath is interference resulting from radio signals reaching the receiving antenna by two or more paths, occurring as a consequence of reflections, scattering, and diffraction of the transmitted signal. *See id*. Inter-symbol interference ("ISI") is a form of distortion of a signal in which one signal interferes with subsequent signals. *Id*. Inter-channel interference ("ICI") is a form of distortion of a signal caused by transmission of signals on adjacent channels that may interfere with one another. *Id*.

In order to make OFDMA signals more robust to multipath signals, it was known to pre-pend a cyclic prefix length (*i.e.*, guard interval) to OFDMA symbols to significantly reduce ISI and ICI. Cai, [0010]; Wang, 1:24-34. The cyclic prefix acts as an extension of each OFDMA symbol by extending the duration of the symbol. Cai, [0011]. It was further known that the more severe the multipath effects that a signal felt, the longer the cyclic prefix that was needed. *Id*. at [0013]. Using cyclic prefixes to remedy the effects of interference was well known in the art, having been included in various wireless communications standards (*e.g.*, 3GPP, IEEE 802.11). Rong, 3:28-34; Wang, 1:20-43.

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OFDMA systems were known to provide an efficient way to support multiple users simultaneously by carrying traffic from different users on different portions of the communications system bandwidth. Rong, 4:13-22. In order to support OFDMA, it was required that the transmitted signals of the multiple users arrive at the base station's receiver at substantially the same time, otherwise orthogonality amongst the signals would be destroyed. Rong, 4:36-40. This was more difficult for uplink transmissions since the transmissions were from multiple users and the multiple users may operate independently. *Id*. at 4:43-47. Thus, it was known to include a variable cyclic prefix as part of a scheduling message from the base station in order to aid in maintaining orthogonality in OFDMA systems, wherein the cyclic prefix would be used in the uplink signal. *Id*. at 5:8-45. It was known for the base station to transmit multiple different cyclic prefixes, each differing in length, based on the different propagation delays experienced by different stations participating in the OFDMA transmission. *See, e.g.*, Rong at 5:46-55, 7:7-24.

b) Prior Art Combinations

All of the asserted claims of the '513 Patent are obvious based on one or more combinations of the prior art references above. The sections below provide motivations to combine the prior art references above. These obviousness combinations are provided in the alternative to Defendants' anticipation and single-reference obviousness contentions and are not to be construed to suggest that any references included in the combination is not itself anticipatory or would not render the asserted claims obvious in light of the knowledge of a person having ordinary skill in the art. For example, at least the following combinations would have been obvious to a POSITA:

- Cai with any reference that teaches transmitting an uplink frame wherein "at least a portion of the payload of the uplink frame is associated with the first guard interval length." A POSITA would have understood that such a technique would ensure the proper communication of the uplink frame by decreasing the effects of interference on the frame because Cai notes that a cyclic prefix may "significantly reduc[e] the effects of ISI [inter-symbol interference] and ICI [inter-channel interference]" which "helps to maintain orthogonally between the OFDM/OFDMA signals on the sub-carriers." Cai, [0010]; *see also* Fechtel, 1:30-39.

- Walton with any reference that teaches receiving the indication of a guard interval as part of a trigger frame that allocates resources. A POSITA would have understood that incorporating this technique with Walton would improve the efficiency of Walton's guard interval transmission process by not requiring a trigger frame to be subsequently sent, preserving the finite resources afforded to such a system. Walton, [0009]; Wang, 1:25-30.

- You with any reference that teaches transmitting an uplink frame wherein "at least a portion of the payload of the uplink frame is associated with the first guard interval length." A POSITA would have been motivated to include such a function based on You's disclosure that, in wireless communication systems, "[m]ajor data is usually transmitted on uplink and, thus, M2M is uplink-centered." You, [0007]. A POSITA would have understood that transmitting an uplink frame based on the guard interval determined by the AP would provide for a more efficient uplink transmission process with less interference.

- Wang with any reference that teaches receiving the indication of a guard interval as part of a trigger frame that allocates resources. A POSITA would have understood that including such a technique in Wang would improve the efficiency of Wang's system because the allocated resources could be sent as part of a frame to trigger the STA's next action as part of the channel sounding process, allowing the system to elect a proper guard interval to lessen interference of the triggered frame. Wang, 1:25-30; Walton, [0009].

c) Motivation to Combine

To the extent that it is determined that any of the above references do not disclose "in a trigger frame…an indication of a first guard interval length, wherein the trigger allocates one or more resources for an uplink (UL) multi-user (MU) transmission and solicits the UL MU transmission," and "transmitting the uplink frame using a resource allocated by the trigger frame," it would have been obvious to include this functionality in view of the teachings of Walton, which teaches that resources in a wireless communication system are finite and precious. Walton, [0009]. A POSITA would have understood that including the guard interval as part of a trigger frame would make the channel sounding process more efficient because they would not have to be sent as separate frames, preserving system resources. *See id*.

Additionally, to the extent that it is determined that any of the above references do not disclose "wherein at least a portion of the payload of the uplink frame is associated with the first guard interval

length," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Wang and/or Cai, which teach that employing a guard interval as part of an uplink transmission aids in decreasing or removing the effects of inter-signal and inter-channel interference by accommodating for propagation delays, improving system reliability and preserving orthogonality. *See, e.g.*, Cai at [0010] ("By significantly reducing or avoiding the effects of ISI and ICI, the cyclic prefix 402 also helps to maintain orthogonally between the OFDM/OFDMA signals on the sub-carriers 206 (Fig. 2)."); Yang at [0040] ("If a channel status is unstable (e.g., a UE is moving at high speed), it may be able to use the extended CP to further reduce the inter-symbol interference."); Rong at 6:18-25 ("With the use of this example embodiment, a CP length value used in the uplink that is greater than the CP length value used in the downlink is employed when OFDMA and/or UL MU-MIMO is being used, which will help accommodate the different propagation delays between different stations and the AP. Therefore, the orthogonality between signals from the different stations is maintained at the receiver (e.g., the AP)."). In fact, Wang discloses that the inclusion of a predetermined guard interval in uplink transmissions was common in the art in both 802.11n and 802.11ac standards, both well-known at the time of invention. Wang at 1:20-30 ("Currently, a guard interval (GI) is included in various mainstream standards (such as 802.11n and 802.11ac) of WLAN to eliminate intercode interference brought by a delay spread of a channel."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

To the extent that it is determined that any of the above references do not disclose "[t]he apparatus of claim 1, wherein the trigger frame comprises an implicit indication of when the uplink frame is to be transmitted as part of the UL MU transmission," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Kim. A POSITA reviewing Kim would have understood that scheduling uplink transmissions in MU-

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MIMO systems would aid in lessening the effects of interference on the system by decreasing collisions between signals. Kim, [0103] ("[T]he STA C waits until data transmission between the STA A and STA B is finished. By doing so, it is able to avoid a collision.").

To the extent that it is determined that any of the above references do not disclose "[t]he apparatus of claim 1, wherein the one or more processors are further configured to cause transmitting the uplink frame at a predetermined time after receipt of a PHY protocol data unit (PPDU) that carries the trigger frame," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Kim and Chun '288. A POSITA would have understood that transmitting the uplink frame at a predetermined time after receipt of the PPDU would allow for a standard time between transmissions that could be changed based on the variability of the system, providing for a more certain system that does not require the use of random backoff counts for transmission. Chun '288, 4:22-25 ("[T]he SIFS, PIFS, and DIFS values may vary in accordance with the capability of the STAs and/or in accordance with the wireless communication environment."); Kim, [0103] ("[T]he STA C waits until data transmission between the STA A and STA B is finished. By doing so, it is able to avoid a collision.").

To the extent that it is determined that any of the above references do not disclose "[t]he apparatus of claim 1, wherein the UL MU transmission comprises an uplink Orthogonal-Frequency Division Multiple Access (OFDMA) transmission, and wherein the first guard interval length is for the uplink OFDMA transmission," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Rong, Cai, and Chun '288. A POSITA would have understood that an OFDMA system allows for multi-user transmissions simultaneously, allowing it to support a large number of users. Rong, 4:13-28 ("OFDMA has the ability to support multiple users simultaneously by carrying traffic from different users on different

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portions of the communications system bandwidth. In general, OFDMA can support a large number of users more efficiently, especially when data traffic from individual users is low."); Chun '288, 4:47-51 ("In case the DL MU OFDMA transmission is used, the AP may transmit a downlink frame to each of the multiple STAs through each of the multiple frequency resources within the overlapping time resource."); Cai, [0006] ("Orthogonal Frequency Division Multiple Access (OFDMA) is a multi-user version of OFDM."). A POSITA also would have understood that including the guard interval in this OFDMA transmission would decrease the effects of interference in the multi-user OFDMA system. Cai at [0010] ("By significantly reducing or avoiding the effects of ISI and ICI, the cyclic prefix 402 also helps to maintain orthogonally between the OFDM/OFDMA signals on the sub-carriers 206 (Fig. 2)."); Yang at [0040] ("If a channel status is unstable (e.g., a UE is moving at high speed), it may be able to use the extended CP to further reduce the inter-symbol interference."); Rong at 6:18-25 ("With the use of this example embodiment, a CP length value used in the uplink that is greater than the CP length value used in the downlink is employed when OFDMA and/or UL MU-MIMO is being used, which will help accommodate the different propagation delays between different stations and the AP. Therefore, the orthogonality between signals from the different stations is maintained at the receiver (e.g., the AP).").

To the extent that it is determined that any of the above references do not disclose "[t]he apparatus of claim 1, wherein the PHY header is associated with a second guard interval length," "[t]he apparatus of claim 5, wherein the payload is comprised of a first set of orthogonal frequency-division multiplexing (OFDM) symbols and each OFDM symbol in the first set of OFDM symbols includes a guard interval of the first guard interval length," and "[t]he apparatus of claim 6, wherein the PHY header is composed of a second set of OFDM symbols and a third set of OFDM symbols and each OFDM symbol in the second set of OFDM symbols includes a guard interval of the second guard

interval length and each OFDM symbol in the third set of OFDM symbols includes a guard interval of the first guard interval length," it would further have been obvious to modify the teachings of that reference to include these functionalities in view of the teachings of at least Wang and/or Cai. A POSITA reviewing these references would have understood that variable length guard intervals were known in the art and that different guard intervals based on the type of frame being transmitted was also known. Cai, [0061]; Wang, 1:30-43 ("A GI length used in the 802.11ac standard is 0.8 us. An AP and a STA use a preamble GI length of 0.8 us and a data GI length of 0.8 us in a process of data communication between the access device and the terminal.").

To the extent that it is determined that any of the above references do not disclose "[t]he apparatus of claim 7, wherein the second set of OFDM symbols comprises a legacy short training field, a legacy long training field, a legacy signal field, and a high efficiency signal A field, and wherein the third set of OFDM symbols comprises a high efficiency long training field," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Chun '288, Wang, and/or You. A POSITA would have known that the inclusion of these fields in data frames was commonplace and that the inclusion of these fields into an OFDM system would have been nothing more than the combination of known elements to yield predictable results. You, [0034] ("Referring to Fig. 1(A), the legacy PLCP frame (100) includes a legacy short training field (L-STF) 102, a legacy long training field (L-STF) 104, a legacy signal (L-SIG) 106, and a Data 108."), Fig. 1A; Chun '288, 11:17-31 ("The legacy part may include a L-STF (legacy short training field) 600, a L-LTF (legacy long training field) 610, and a L-SIG 620."); Wang, 13:20-26 ("In a first optional implementation manner, as shown in Fig. 19, the PPDU2 includes a legacy preamble, a high efficiency wireless local area network preamble, a high efficiency wireless local area network preamble, and bearer data, where a combination of an L-STF, an L-LTF, and an L-

SIG is referred to as the legacy preamble, and a combination of an HE-SIG, an HE-STF, and another possible field is referred to as the HEW preamble.”).

To the extent that it is determined that any of the above references do not disclose “computer-implemented method of claim 15, wherein each of the plurality of frames comprises a respective non-legacy header, and wherein at least a portion of the respective non-legacy header is associated with the first guard interval,” it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Chun ’288. A POSITA would have understood that the inclusion of a non-legacy header would allow for the wireless communications systems to interface with non-legacy STAs. Chun ’288, 11:4-7. Further, Chun ’288 discloses that the “High Efficiency (HE)” part of a header is “newly configured for IEEE 802.11ax standard.” *Id*. at 11:7-10. Thus, a POSITA would have understood that non-legacy headers were a part of various IEEE standards, making them well known in the art. *Id*.

3. Invalidity of the ’513 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants’ present understanding of Plaintiff’s asserted scope of the claims of the ‘513 Patent, to the extent such positions can be understood from Plaintiff’s Infringement Contentions, Defendants assert that the Asserted Claims of the ‘513 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- “wherein the trigger frame allocates one or more resources for an uplink (UL) multi-user (MU) transmission and solicits the UL MU transmission” (claim 1)
- “transmitting the uplink frame using a resource allocated by the trigger frame to the apparatus” (claim 1)
- “wherein the trigger frame comprises an implicit indication of when the uplink frame is to be transmitted as part of the UL MU transmission”

- "wherein the downlink frame is for allocating resources for an uplink (UL) multi-user (MU) transmission and for soliciting the UL MU transmission" (claim 9)
- "transmitting the uplink frame using a resource allocated by the downlink frame" (claim 9)
- "wherein the trigger frame allocates resources for the UL MU transmission and solicits the UL MU transmission" (claim 15)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation. For example, a POSITA would not be enabled to practice the claim limitations disclosing the allocation of resources to STAs and the transmission of uplink data on those allocated resources based on the specification's disclosure. Nor does the specification support the trigger frame comprising an implicit indication of when the uplink frame is to be transmitted as part of the UL MU transmission.

4. Invalidity of the '513 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '513 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '513 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- "wherein at least a portion of the payload of the uplink frame is associated with the first guard interval length" (claims 1, 9)
- "wherein the PHY header is associated with a second guard interval length" (claim 5)
- "wherein at least a portion of the legacy header is associated with a second CP length" (claim 10)
- "wherein at least a portion of the respective payload is associated with the first guard interval" (claim 15)
- "wherein at least a portion of the respective non-legacy header is associated with the first guard interval" (claim 16)

- "wherein for each of the plurality of frames, a second portion of the respective non-legacy header is associated with a second guard interval" (claim 17)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

Based on Plaintiff's apparent constructions of the terms in its operative infringement contentions, the asserted claims are invalid on the basis that a POSITA reviewing the specification and prosecution history would be unable to ascertain the bounds of the extent to which the guard interval is to be "associated with" the header and payload.

G. The '679 Patent Is Invalid

1. Effective Filing Date.

The '679 patent issued from a U.S. Patent App. No. 14/931,753, filed on November 3, 2015, which claims priority to U.S. Provisional Application No. 62/074,514, filed on November 3, 2014, and U.S. Provisional Application No. 62/080,026, filed on Nov. 14, 2014. However, the claims of the '679 patent here are not described in the provisional applications and, thus, are not entitled to the benefit of any filing date of the provisional applications.

Independent claim 1 of the '679 patent requires "receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgment information representing whether the STA is requested to transmit the acknowledgment frame in a single-user (SU) format or

in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame." The '679 patent, claim 1. The other independent claim of the '679 patent (claim 6) recites a similar feature. The '679 patent, claim 6. However, U.S. Provisional Application No. 62/074,514 does not disclose "a QoS control field," let alone "a quality of service (QoS) control field including acknowledgment information representing whether the STA is requested to transmit the acknowledgment frame in a single-user (SU) format or in a multiple-user (MU) format" as required by claims 1 and 6.

Independent claim 1 of the '679 patent requires "when the acknowledgment information represents that the STA is requested to transmit the acknowledgment frame in the MU format and the STA is allocated a resource, transmitting the acknowledgment frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgment frame from at least one other STA, and when the acknowledgment information represents that the STA is requested to transmit the acknowledgment frame in the SU format, transmitting the acknowledgment frame in SU format." The '679 patent, claim 1. The other independent claim of the '679 patent (claim 6) recites a similar feature. The '679 patent, claim 6. However, to U.S. Provisional Application Nos. 62/074,514 and 62/080,026 fail to disclose transmitting the acknowledgment frame in the format specified by any acknowledgment frame in the QoS field.

Thus, the provisional applications do not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). Thus, the '679 patent's claims are not entitled to any of the filing dates of the provisional applications 62/074,514 and 62/080,026.

2. The '679 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the '679 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit F-1

and F-12, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as anticipating one or more of the Asserted Claims of '679 Patent under 35 U.S.C. § 102. The table of anticipating references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the '679 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	Anticipating Prior Art
F-1	U.S. Patent No. 9,655,144 to Yongho Seok at LG Electronics Inc. ("Seok144")
F-2	U.S. Patent No. 10,230,497 to Merlin et al. ("Merlin497")
F-3	U.S. Patent No. 10,299,261 to Chun et al. at LG Electronics Inc. ("Chun '261 (LG)")
F-4	U.S. Patent Application Publication No. 2016/0065466 to Abraham et al. ("Abraham466")
F-5	U.S. Patent Application Publication No. 2011/0305176 to Wentink ("Wentink")
F-6	PCT Patent Application Publication WO 2013/170136 to Wang et al. ("Wang136")
F-7	U.S. Patent Appln. Pub. No. 2017/0338910 to Chun et al. at LG Electronics Inc. ("Chun910")
F-8	U.S. Patent Application Publication No. 20140269964A1 to Du et al. ("Du964")

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Exhibit	Anticipating Prior Art
F-9	U.S. Patent Application Publication No. 20160270079A1 to Seok et al. ("Seok079")
F-10	U.S. Patent Application Publication No. 20120257605A1 to Abraham et al. ("Abraham605")
F-11	U.S. Patent Application Publication No. 20120155415A1 to Seok et al. ("Seok415")
F-12	U.S. Patent Application Publication No. 20150124690 ("Merlin_690")
F-13	WiMAX Device

Defendants further incorporate by reference the Petition for *Inter Parte* Review and the exhibits thereto in IPR2023-00877, including but not limited to the prior art references against any limitation of an asserted claim of the '679 Patent and/or the technology background of the '679 Patent.

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '679 Patent, Defendants reserve the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The '679 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '679 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits F-1 through F-12, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits F-1 through F-12 with each other because all of these references relate to wireless communication methods and wireless transmission protocol procedures for MU-MIMO systems (*i.e.*, those in which multiple users communicate using multiple antennas) with a response frame policy. For example, Seok144 teaches a wireless channel access control method involving "a station (STA) of a wireless communication system… receiving a frame, the frame including a physical layer convergence protocol (PLCP) header having a response frame indication field," and "[i]f the frame supports multiuser-multiple input multiple output (MU-MIMO), the response frame indication field may be included in a field commonly received by a plurality of STAs." Seok144, 2:5-8; 2:28-31. Merlin497 teaches a wireless channel access control method for "setting of ACK policies and signaling for allocating MU-MIMO or FDMA resources to the recipient STAs for the replies." Merlin497, 12:57-60. Chun '261 (LG) teaches a wireless channel access control method involving "receiving, by a station (STA), a DL MU data frame from an access point (AP) and transmitting, by the STA, an acknowledgement (ACK) frame in response to the DL MU data frame, wherein a plurality of ACK frames transmitted by a plurality of STAs in response to the DL MU data frame." Chun '261 (LG), Abstract. Similarly, Abraham466 teaches a wireless channel access control method involving setting and transmitting "an acknowledgment policy for stations receiving MD-AMPDUs." Abraham466, [0062]. Wentink teaches a wireless channel access control method involving enabling "a normal acknowledgement (ACK) and block ACK," for example, in a VHT frame. Wentink, Abstract and FIG. 19. Wang136 teaches a wireless channel access control method involving "[an] originator [assigning] an MCS and/or bandwidth for the ACK frame, and the recipient [transmitting] an ACK frame with a pre-assigned MCS and/or bandwidth." Wang136, [0090]. Chun910 teaches a wireless channel access control method that "[i]f an aggregated MPDU (A-MPDU) scheme is used, a plurality of MPDUs (in this case,

each MPDU may carry an A-MSDU) may be aggregated in a single A-MPDU…. The A-MPDU may include an aggregation of various types of MPDUs (e.g., QoS data, acknowledge (ACK), and a block ACK (BlockAck)). Chun910, [0095].

Similarly, each of the references in Exhibits F-1 through F-12 also teach how the MU-MIMO systems supports both uplink single-user or multiple-users transmission and/or how the response frame policy in a DL MU-MIMO transmission can communicate with a 'legacy' station that prefers or requests single user transmissions. For example, Seok144 teaches that "[t]he Response frame indication field indicates the type of a response frame transmitted after the SU frame or the MU frame." Seok144, 30:64-66. Merlin497 teaches a wireless communication system where "multiple simultaneous responses may be solicited, even if one of the STAs does not support UL FDMA or UL MU-MIMO (e.g., a legacy STA or a HEW STA not supporting UL FDMA or UL MU-MIMO). For example, a legacy STA may respond with a regular SU transmission on a primary channel, while other capable STAs may respond at the same time on other channels." Merlin497, 13:64-14:3. Chun '261 (LG) addresses the wireless communication system where "a legacy STA supporting the existing IEEE 802.11a/g/n/ac may not decode a corresponding HE PPDU. In order for a legacy STA and an HE STA to coexist, the L-STF, L-LTF, and the L-SIG field are transmitted through 64 FFT in a 20 MHz channel so that a legacy STA can receive them." Chun '261 (LG), 45:21-26. Similarly, Abraham466 addresses the wireless communication system where "the STAs 106 *a*-106 *c* may comprise high efficiency (HEW) wireless stations (e.g., stations that operate according to 802.11ax or later developed communication protocols), while the STAs 106 *d*-106 *f* may comprise "legacy" wireless stations (e.g., stations that operate according to one or more of 802.11a/b/g/n/ac communication protocols)." Abraham466, [0037]. Wentink teaches the wireless communication system where "the access point 110 may also be configured to support access terminals that do not support MIMO technology.

This approach may allow older versions of access terminals (e.g., "legacy" terminals) to remain deployed in a wireless network, extending their useful lifetime, while allowing newer MIMO access terminals to be introduced as appropriate." Wentink, [0043]. Wang136 teaches the wireless communication system where "[t]he ACK responses 960 from the STAs in response to the MU-MIMO BA 950 may be transmitted by the STAs simultaneously using MU- MIMO. Alternatively, the STAs may transmit an ACK sequentially." Wang136, [0105]. Chun910 teaches a wireless communication system where "an HT-STA uses SU-MIMO," and "when transmitting the VHT NDPA frame to one target STA for SU-MIMO channel sounding, an AP unicasts the VHT NDPA frame to the target STA." Chun910, [0120] and [0275]. Chun910 also teaches a wireless channel access control method involving "[t] he HT-LTF [] used for channel estimation for the demodulation of the data field [and supporting] IEEE 802.11n [] single user multi-input and multi-output (SU-MIMO)." Chun910, [0110].

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

Furthermore, to the extent that it is determined that any of the above references do not disclose "a downlink frame including a quality of service (QoS) control field including acknowledgement information," "…to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame," or "transmitting, to the AP, the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame" in claims 1 and 6, it would further have been obvious to

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modify the teachings of the charted references to indicate in the acknowledgement policy whether the receiving station to transmit the acknowledgement frame after a SIFS. *See, e.g.*, 802.11ac Standard (2013) at Table 7-6 Ack Policy subfield in QoS Control field of QoS data frames (a certain value of Bit 5 and Bit 6 to mean "… recipient returns an ACK or QoS + CF=Ack frame after a short space (SIFS) period…"). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Moreover, to the extent that it is determined that any of the above references do not disclose "when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format" in claims 1 and 6 or "wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame," in claims 2 and 7, it would further have been obvious to modify the teachings of the charted references to permit a receiving stations to transmit its acknowledgement frame in SU format to the AP. *See, e.g.*, 802.11ac Standard (2013) at Section 9.7.6.5.2 Selection of a rate or MCS ("If a BlockAck frame is sent as an immediate response to either an implicit BlockAck request or to a BlockAckReq frame that was carried in an HT or VHT PPDU and the BlockAck frame is carried in a non-HT PPDU, the primary rate is defined to be the highest rate in the BSSBasicRateSet parameter…. The STA may elect an alternative rate.…") and Section 9.7.6.5.3 Control response frame MCS computation ("… the STA may select an alternative MCS…."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '679 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '679 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '679 Patent are invalid for failure to provide a written

description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- "wherein transmitting the acknowledgment frame comprises: when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" (claim 1)

- "[wherein transmitting the acknowledgment frame comprises:…] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format" (claim 1)

- "wherein receiving the acknowledgment frame comprises:when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format, receiving the acknowledgement frame in the MU format on an allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" (claim 6)

- "[wherein receiving the acknowledgment frame comprises:…] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, receiving the acknowledgement frame in SU format" (claim 6)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the '679 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '679 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '679 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- "wherein transmitting the acknowledgment frame comprises: when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement

frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" (claim 1)

- "[wherein transmitting the acknowledgment frame comprises:…] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format" (claim 1)

- "wherein receiving the acknowledgment frame comprises:when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format, receiving the acknowledgement frame in the MU format on an allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA" (claim 6)

- "[wherein receiving the acknowledgment frame comprises:…] when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, receiving the acknowledgement frame in SU format" (claim 6)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

H. The '919 Patent Is Invalid

1. Effective Filing Date.

The '919 patent issued from a U.S. Patent App. No. 15/497,094 filed April 25, 2017, which is a continuation application of U.S. Patent App. No. 15/291,947 filed on October 12, 2016. U.S. Patent App. No. 15/291,947 claimed priority to four provisional applications. However, the claims of the '919 patent here are not described in any of the provisional applications or the parent application and,

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thus, are not entitled to the benefit of any filing date of the provisional applications or the parent application.

Claim 1 requires the reception of a NDPA including "one or more station information fields," subsequent reception of a NDP, the determination of "the number of station information fields" in the NDPA, and in response to determining that the NDPA includes one STA information field, transmitting CSI feedback in response to receiving the NDP. The '919 patent, 32:64-33:10. Claim 11 is nearly identical, but claims the transmission of a NDPA, subsequent transmission of a NDP, and reception of CSI feedback in response to the NDP. *Id.* at 33:54-34:8. Both independent claims (i.e., claims 1 and 11) also require that "the number of the one or more station information fields in the NDPA [be] the cardinality of the one or more station information fields in the NDPA." *Id.* at 33:8-10, 34:9-11. Applicant first added this limitation to the claims during the prosecution of the '919 patent to traverse a prior art rejection. *See* Amendment filed Oct. 11, 2017 in U.S. Patent App. No. 15/497, 094 at 2, 4, and 6.

U.S. Provisional Application No. 62/333,192, U.S. Provisional Application No. 62/333,077, and U.S. Provisional Application No. 62/331,380 fail to disclose a sounding procedure. *See generally* U.S. Provisional Application No. 62/333,192, U.S. Provisional Application No. 62/333,077, and U.S. Provisional Application No. 62/331,380. U.S. Provisional Application No. 62/240,419 does not disclose any process for numbering the fields in the per STA information list in a NDPA frame, maintaining them in a set, or ensuring that the cardinality of the STA Info fields is equal to the total number of STA Info fields U.S. Provisional Application No. 62/240,419, 10-11. Nor does that provisional disclose that the STA Info fields must be discrete from one another, a requirement of ensuring that two sets of data have the same cardinality. *Id.* Thus, the provisional applications do not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject

matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*).

The parent application, Application No. 15/291,947 also does not discuss or refer to the concept of the "cardinality" of the station information field. Thus, the first time the Applicant "reasonably convey[ed]" that he had possession of the subject matter was when the application was amended on October 11, 2017. *Id.*; *see Ariad Pharms., Inc.*, 598 F.3d at 1351; SER-1001, face.

2. Chun '388 Qualifies as Prior Art.

Chun '388 claims priority to U.S. Provisional Application Nos. 62/206,862 ('862 PA), filed on Aug. 19, 2015, 62/209,899 ('899 PA), filed on Aug. 26, 2015, and 62/264,836 ('836 PA), filed on Dec. 8, 2015. Chun '388 is entitled to, at latest, a priority date of August 26, 2015, the date of the filing of its second provisional application, because '862 PA and '899 PA provide support for at least one of Chun '388's claims (e.g., claim 1) and disclosures from Chun '388 on which Defendants rely are supported in those two provisional applications. The tables below show citations in '862 PA and '899 PA that support Chun '388.

Chun '388, Claim 1	Corresponding Provisional Citation
1. A sounding method of a station (STA) for reporting feedback information including a downlink (DL) channel state in a wireless LAN (WLAN) system, the method comprising:	('862 PA at 8, 17) (Feedback method using sounding)
receiving a null data packet (NDP) announcement (NDPA) frame announcing transmission of an NDP frame;	('862 PA at 8, 17) (transmission of "VHT NDP Announcement" and "HE NDPA Trigger frame")
receiving the NDP frame;	('862 PA at 8, 17) (transmission of NDP and "HE NDP frame")
receiving a trigger frame comprising resource allocation information related to a resource unit allocated to the STA;	('862 PA at 8, 11, 17) (UL MU trigger frame including "resource areas to be used")
generating feedback information including the downlink (DL) channel state by using the received NDP frame; and	('862 PA at 8, 17) ("estimating channel using NDP" and feedback frames) ('899 PA at 25) (STAs' feedback including SNR)
transmitting a feedback frame comprising the generated feedback information by uplink (UL) multi-user (MU) transmission via the allocated resource unit,	('862 PA at 8, 17) ("estimating channel using NDP" and feedback frames)

	('899 PA at 25) (STAs' feedback including SNR)
wherein the feedback information is reported for each of a plurality of frequency granularities (FGs) with respect to a partial reception bandwidth of the received NDP frame,	('862 PA at 19) (defining minimum feedback granularity) ('899 PA at 20, 25) (feedback being carried out in units of FGsch)
wherein the partial reception bandwidth is a report target bandwidth,	('899 PA at 8, 21) (information on bandwidth to be measured and for feedback is different)
wherein each of the plurality of FGs is a report unit, and	('899 PA at 21) (dividing FB RU band into units and transmitting per unit)
wherein each of the plurality of FGs has a smaller size than the partial reception bandwidth.	('899 PA at 20-21) (dividing RU band into units and transmitting on units)

Exemplary Chun '388 Disclosures	Corresponding Provisional Citation
1:17-20	'862 PA, 17
23:26-24:33	'862 PA, 8
51:45-52:31	'862 PA, 12, 17-20
Fig. 30	'862 PA, 17-18
24:39-43, 51:45-52, 76:34-42, Fig. 9, 25:11-15, 23:29-32, 24:46-56 (NDPA)	'862 PA, 8-9, 17-18 '899 PA, 27-29
30:58-60, 31:1-2, Fig. 13	'862 PA, 4-5 '899 PA, 4-5
51:45-49	'862 PA, 14, 17-20 '899 PA, 17, 21-22
52:32-36	'862 PA, 17
38:24-46, Figs. 22-24	'862 PA, 2-3, 5
23:52-54, 24:1-3	'862 PA, 8
51:61-63	'862 PA, 8, 17
23:40-43	'862 PA, 8-9
23:55-58, 23:64-24:8	'862 PA, 8-9
72:43-51	'862 PA, 8-9, 17-18
51:50-52:6	'862 PA, 17-20
52:7-9, 72:43-51, 52:19-26	'862 PA, 17-20
Fig. 8	'862 PA, 17
52:9-18, 42:26-31, 52:24-26	'862 PA, 11, 15-16, 18
24:9-14, 24:15-18	'862 PA, 8, 10-11
24:21-24	'862 PA, 8-10

3. The '919 Patent Is Rendered Invalid by the Prior Art.

Some or all of the Asserted Claims of the '919 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit G-1 through G-18, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references

identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as disclosing one or more elements of the Asserted Claims of ’919 Patent under 35 U.S.C. § 102. The table of references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the ’919 Patent.

Exhibit	**Prior Art Reference**
G-1	U.S. Patent No. 9,107,242 (“Sohn”)
G-2	U.S. Patent No. 10,375,679 (“Chu”)
G-3	802.11ac Amendment to the 802.11 Standard (“802.11ac”)
G-4	U.S. Patent No. 10,349,388 (“Chun ’388”)
G-5	U.S. Patent No. 10,038,535 (“Chun”)
G-6	U.S. Patent App. Pub. No. 2013/0235947 (“Yao”)
G-7	U.S. Patent App. Pub. No. 2015/0063128 (“Garikipati”)
G-8	U.S. Patent No. 9,788,317 (“Ghosh”)
G-9	U.S. Patent No. 10,165,584 (“Kwon”)
G-10	U.S. Patent App. Pub. No. 2015/0110046 (“Merlin”)
G-11	U.S. Patent App. Pub. No. 2012/0026909 (“Seok”)
G-12	PCT App. Pub. No. 2017/097115 (“Weimin”)
G-13	U.S. Patent Pub. No. 2017/0272138 (“Chun_138”), U.S. Patent Pub. No. 20170280462 (“Chun_462”), U.S. Patent Pub. No. 20170310424 (“Chun_424”), or U.S. Patent Pub. No. 20170279864 (“Chun_864”)
G-14	Chinese Patent Publication No. 102843177A (“Yang_177”)

Exhibit	Prior Art Reference
G-15	U.S. Patent Pub. No. 2012/0140753 ("Lee_753")
G-16	IEEE 802.11-10/1361r1 ("IEEE_1r1")
G-17	IEEE 802.11-15/1097r1 ("IEEE_7r1")
G-18	IEEE 802.11-15/1103r0 ("IEEE_3r0")
G-19	Prior 802.11ac Device

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '919 Patent, any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art.

4. The '919 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '919 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits G-1 through G-18, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits G-1 through G-18 with each other because all of these references relate to wireless communication methods and wireless sounding procedures for MU-MIMO systems (*i.e.*, those in which multiple users communicate using multiple antennas). For example, Chun '388 teaches a channel sounding method involving "a method for the uplink multi-user transmission of a channel state measured by an STA and a device supporting the same." Chun '388, 1:17-20. Moreover, Kwon teaches "[a] wireless communication method performed by an access point according to an embodiment [that] may include

performing channel sounding on a plurality of subchannels." Kwon, Abstract. Seok discloses a "method for reporting channel state information (CSI), performed by a beamformee, in a wireless local area network system using multi-channels." Seok, Abstract.

Similarly, each of the references in Exhibits G-1 through G-18 teach a MU-MIMO sounding method in which a base station sends a null data packet announcement ("NDPA") followed by a null data packed ("NDP") after which the station responds with a channel state as part of a feedback message. *See, e.g.*, Seok, Abstract ("A method for reporting channel state information (CSI), performed by a beamformee, in a wireless local area network using multi-channels is provided. The method includes receiving, from a beamformer, an NDP announcement (NDPA) frame announcing that a null data packet (NDP frame follows the NDPA frame, receiving the NDP frame from the beamformer, estimating a channel from a training symbol of the NDP frame and transmitting to the beamformer a CSI report frame."); Chun, Abstract ("The sounding method includes receiving an NDP announcement (NDPA) frame providing notification of the transmission of a null data packet (NDP) frame; receiving the NDP frame…generating feedback information using the NDP frame; and sending a feedback frame comprising feedback information through uplink (UL) multi-user (MU) transmission."); Garikipati, [0123]-[0124]. Thus, a POSITA would have been motivated to combine any of the prior art listed above because they each teach MU-MIMO sounding procedures using the same technique.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary

skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

a) State of the Art

The advent of WLAN made wireless internet access available in homes, business, and regions providing Wi-Fi services. *See, e.g.*, Sohn, 1:46-62. Various IEEE standards were created in order to rectify limited data rates that were considered to be a drawback of traditional WLAN systems. *See, e.g.*, Sohn, 1:35-39 (IEEE 802.11n); Chun '388, 1:62-2:24 (802.11ax); Yao, [0003]-[0004] (802.11ac). Each of the aforementioned standards are based on MU-MIMO techniques wherein multiple antennas are used in both a transmitter and receiver to minimize a transmission error and optimize a data rate. *See, e.g.*, Sohn, 1:56-67 ("The next-generation WLAN system supports the transmission of a Multi-User Multiple Input Multiple Output (MU-MIMO) scheme in which a plurality of non-AP STAs accesses a radio channel at a same time in order to efficiently use the channel."); Chun '388, 1:36-39 ("IEEE 802.11n is based on a multiple inputs and multiple outputs (MIMO) technology in which multiple antennas are used at both ends of a transmission unit and a reception unit."); Yao, [0004] ("In the prior art, to prevent abnormal situations, IEEE 802.11ac specifies that the number of actual active antennas of the beamformee must be larger than or equal to the number of columns set by the beamformer in a null data packet announcement…message."), [0043] (MU-MIMO).

MU-MIMO systems brought complications in that the participating stations may have different capabilities and environmental factors. *See* Sohn, 1:63-64. Thus, to accommodate these stations, supportable bandwidth, modulation coding scheme (MCS), forward error correction, and other transmission characteristics may vary depending on STA type, usage, channel environment, and other factors. *See id*. at 1:63-67. It was known to perform channel sounding in MU-MIMO systems in order to detect these different characteristics and provide for different transmission settings based on the measured characteristics. Specifically, it was known to perform a procedure wherein a transmitter

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requests channel information to be used for frame transmission and reception from a receiver and the receiver estimates the channel and feeds the channel information about the channel to the transmitter. *See id*. at 2:5-10; Seok, [0009], '919 patent, 2:6-16. It was further known to perform this sounding procedure through the transmission of a NDPA to "announce" to the stations that a subsequent NDP will be sent for channel sounding purposes followed by transmission of that NDP. *See, e.g.*, Chun '388, 23:20-63; Sohn, 2:43-50; Ghosh, 5:61-6:3; Chun, 1:52-60. The well-known sounding procedure further involved the transmission of a plurality of feedback frames to the base station, reporting various channel characteristics (*e.g.*, SNR). *See, e.g.*, Chun, 9:60-10:4; Chun '388, 2:50-55; Ghosh, 5:67-6:2.

It was further known that, in order to identify target stations to receive the upcoming NDP, a "station info" field would be included with identifiers for those stations. *See, e.g.*, Sohn, 11:11-15 ("Accordingly, the AP 410 includes an STA information field, including information about a target sounding STA, in the NDPA frame and then transmits the NDPA frame. The STA information field may be included for every target sounding STA."); Chun, 12:3-12; Kwon, 16:34-36 ("An STA may identify a total number of streams allocated to the STA and a total number of streams (a sum of streams of an STA INFO field) through an STA INFO field of an NDPA)."); 24:52-56 ("[I]f the VHT NDPA frame includes one or more STA Info fields, the value of the RA field has a broadcast address. For example, if the VHT NDPA frame is transmitted to one or more target STAs for MU-MIMO channel sounding, an AP broadcasts the VHT NDPA frame."). Thus, sounding procedures for MU-MIMO systems with STA Info fields to identify the stations to be targeted for sounding were well-known in the art.

b) Prior Art Combinations

All of the asserted claims of the '919 Patent are obvious based on one or more combinations of the prior art references above. The sections below provide motivations to combine the prior art references above. These obviousness combinations are provided in the alternative to Defendants'

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anticipation and single-reference obviousness contentions and are not to be construed to suggest that any references included in the combination is not itself anticipatory or would not render the asserted claims obvious in light of the knowledge of a person having ordinary skill in the art. For example, at least the following combinations would have been obvious to a POSITA:

- Ghosh with any reference that teaches "the NDPA including one or more station information fields." A POSITA would have known that the inclusion of the station information fields in the NDPA would have promoted system efficiency and conservation of resources because the base station would not need to send a subsequent trigger frame for sounding, preserving finite system resources and decreasing collision between signals. Chun '388, 1:62-2:9.

- Weimin with any reference that teaches "determining exactly a number of the one or more station information fields in the NDPA." A POSITA would have understood that determining the number of station information fields in the NDPA would allow the station to ascertain whether feedback is requested from that particular STA. *See, e.g.*, Chun, 14:52-58 ("each per-STA information field 530 corresponding to a particular client or to a particular group of stations being triggered by the trigger frame").

- Any reference that teaches "in response to determining that the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP" with any reference that teaches "wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA." A POSITA would have understood that customizing the STA Info field to be the cardinality of each station would have been nothing more than changing the number of the element in the field to match where it appears in the list. *See, e.g.*, Sohn, 11:27-43.

c) Motivation to Combine

To the extent that it is determined that any of the above references do not disclose "the NDPA including one or more station information fields," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Sohn, Chun, and/or Chun '388. A POSITA would have understood that the inclusion of STA Info fields in the NDPA would allow for the identification of particular stations to participate in the sounding process. *See, e.g.*, Chun '388, 1:62-2:9; Chun, 14:52-58 ("each per-STA information field 530 corresponding to a particular client or to a particular group of stations being triggered by the trigger frame"); Sohn,

11:9-15 ("Accordingly, the AP 410 includes an STA information field, in the NDPA frame and then transmits the NDPA frame.").

To the extent that it is determined that any of the above references do not disclose "determining exactly a number of the one or more station information fields in the NDPA," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Sohn and/or Chun. A POSITA would have understood that determining the number of the station fields in the NDPA would allow for the station to determine whether it is participating in the sounding process. *See, e.g.*, Chun, 14:52-58 ("each per-STA information field 530 corresponding to a particular client or to a particular group of stations being triggered by the trigger frame"); Sohn, 11:9-11 ("[T]he STA determines whether it is an STA participating in channel sounding by receiving the NDPA frame.").

To the extent that it is determined that any of the above references do not disclose "in response to determining that the number of the one or more station information fields in the NDPA is one, transmitting first Channel State Information (CSI) feedback in response to receiving the NDP wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Sohn, Chun, and/or Ghosh. A POSITA would have understood that numbering the station information fields based on cardinality and having a station transmit feedback when that number is one is nothing more than basic mathematical concepts in numbering elements based on their order in an array and detecting that number to transmit feedback. *See, e.g.*, Chun, 14:52-58 ("each per-STA information field 530 corresponding to a particular client or to a particular group of stations being triggered by the trigger frame"); Sohn, 11:48-55 ("STAs that have received an NDPA frame may check whether they are target

sounding STAs by checking an AID subfield value included in an STA information field."); Ghosh, 11:8-11 ("At operation 325, the AP 102 may transmit a polling message to indicate a second sounding feedback period that is reserved for one or more other STAs 103 that are excluded for the STAs 103 identified in the TFS.").

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 1, further comprising: when the number of the one or more station information fields in the NDPA is greater than one: receiving a first trigger frame; and transmitting the first CSI feedback in response to receiving the first trigger frame," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Yao and/or Kwon. A POSITA would have understood that determining when the number of station information fields is greater than one would indicate whether multi-user sounding across multiple stations. *See, e.g.*, Yao, [0043] ("The beamformee extracts STA info fields sequentially from the NDPA message and compares AIDs of the STA info one by one with the locally stored AID. If a same AID is found, AID matching succeeds, which indicates that the NDPA message needs to be locally received."); Kwon, 15:57-60 ("When MU BF sounding is performed, an STA INFO field of an NDPA payload in NDPA is different by subchannel, and a number of STA INFO fields may be determined based on a number of grouped STAs.").

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 2, wherein transmitting the first CSI feedback in response to receiving the NDP comprises: transmitting the first CSI feedback a first predetermined interframe space (IFS) after receiving the NDP" and "[t]he method of claim 3, wherein transmitting the first CSI feedback in response to receiving the first trigger frame comprises: transmitting the first CSI feedback a second predetermined IFS after receiving the first trigger frame," it would further have been obvious to modify

the teachings of that reference to include this functionality in view of the teachings of at least Chun. For example, Chun notes that various types of IFS were known in the art and were typically used for different types of frames. *See, e.g.*, Chun, 4:1-22. Thus, a POSITA would have been motivated to combine it with any of the references above because it offers a standard frame spacing between transmissions in order to ensure that interference is minimized.

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 2, wherein transmitting the first CSI feedback in response to receiving the NDP comprises: transmitting the first CSI feedback in a single user transmission in response to receiving the NDP," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Sohn and/or Yao. A POSITA would have understood that SU-MIMO was well known in the art and preferred for single user transmissions and, thus, its inclusion in a wireless sounding process was nothing more than combination of known elements to lead to predictable results. *See, e.g.*, Yao, [0042] ("In the SU-MIMO scenario, one beamformee communicates with one beamformer…Therefore, when the beamformee receives a unicast NDPA message, the transmission is SU-MIMO communication if a feedback type (Feedback Type) recorded in a STA Info field in the NDPA message is 0."); Sohn, 11:22-25 ("If the NDPA frame is transmitted to one target STA for SU-MIMO channel sounding, the AP 410 may set receiver address information about the NDPA frame as the MAC address of the target STA and transmit the NDPA frame in a unicast manner.").

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 4, wherein transmitting the first CSI feedback in response to receiving the first trigger frame comprises: transmitting the first CSI feedback in a multi user transmission in response to receiving the first trigger frame," it would further have been obvious to modify the teachings of that

reference to include this functionality in view of the teachings of at least Sohn and/or Seok. A POSITA would have understood that MU-MIMO was a well-known process that would aid in minimizing transmission error and optimizing data rate for multi user systems. *See, e.g.*, Sohn, 1:40-45 ("More specifically, the IEEE 802.11n supports a high throughput (HT), i.e., a data processing rate of up to above 540 Mbps, and is based on a multiple input and multiple output (MIMO) technique which uses multiple antennas in both a transmitter and a receiver to minimize a transmission error and to optimize a data rate."); Seok, [0006].

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 5, wherein the first trigger frame comprises resource assignment information" and "[t]he method of claim 6, wherein transmitting the first CSI feedback in a multi user transmission comprises: participating in the multi user transmission based on the resource assignment information to transmit the first CSI feedback in response to receiving the first trigger frame," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Sohn and/or Ghosh. A POSITA would have understood that allocating resources to the stations as part of an initial trigger frame allows the stations to determine which resources to search for in order to determine what data it is supposed to receive and what resources it should use to transmit the feedback response. *See, e.g.*, Sohn, 8:14-17 ("Since the PPDU includes information about the number of spatial streams allocated to a reception STA, the STA can receive data by searching for spatial streams allocated thereto."); Ghosh, 8:67-9:3 ("As an example, each STA 103 may be allocated one or more sub-channels for the transmission of the sounding feedback, and indexes (or identifiers) of those sub-channels may be included in the TFS.").

To the extent that it is determined that any of the above references do not disclose "[t]he method of claim 2, further comprising: when the number of one or more station information fields in

the NDPA is greater than one: receiving a second trigger frame; and transmitting second CSI feedback in response to receiving the second trigger frame," it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Ghosh and/or Weimin. A POSITA would have understood that receiving a second trigger frame and transmitting a second feedback game in response would allow for the sounding process to occur during a second time period and to measure different environmental conditions for a second group of stations. *See, e.g.*, Ghosh, 10:58-61 ("A second portion of the sounding feedback may be received from a second STA 103 during a second time period that at least party overlaps the first time period."); Weimin, [0116].

5. Invalidity of the '919 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '919 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '919 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- "wherein the number of the one or more station information fields in the NDPA is the cardinality of the one or more station information fields in the NDPA" (claim 1)
- "transmitting the first CSI feedback in response to receiving the sounding poll frame" (claim 10)
- "wherein the number of the one or more station information fields in the NDPA is exactly the cardinality of the one or more station information fields in the NDPA" (claim 11)
- "receiving the first CSI feedback in response to transmitting the sounding poll frame" (claim 20)
- "receiving first Channel State Information (CSI) feedback transmitted in response to the NDP having only one station information field" (claim 11)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation. For example, the written description does not enable the number of the one or more station information fields to equal the cardinality of those fields in the NDPA. Nor does it enable receiving or transmitting a first CSI feedback in response to transmitting a sounding poll frame while also transmitting the first CSI feedback in response to receiving the NDP. Similarly, the written description does not enable the NDP having station information fields as found in claim 11.

6. Invalidity of the '919 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '919 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '919 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- "determining exactly a number of the one or more station information fields in the NDPA" (claim 1)
- "in response to determining that the number of the one or more station information fields in the NDPA is one" (claim 1)
- "when the number of the one or more station information fields in the NDPA is greater than one" (claims 2, 8, 12, 19)
- "when a number of the one or more station information fields in the NDPA is one" (claim 11)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent

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with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

Based on Plaintiff's apparent constructions of the terms in its operative infringement contentions, the asserted claims are invalid on the basis that a POSITA reviewing the specification and prosecution history would be unable to ascertain whether the "number of the one or more information fields in the NDPA" refers to the specific number identifying each field (*e.g.*, the cardinality) or the total number of fields in the array.

I. The '886 Patent Is Invalid

1. Effective Filing Date.

The '886 patent issued from a U.S. Patent App. No. 15/352,435, filed November 15, 2016, which claims priority to U.S. Patent App. No. 15/078,920, filed March 23, 2016. U.S. Patent App. No. 15/078,920 claims priority to U.S. Provisional Application No. 62/137,138, filed March 23, 2015, and U.S. Provisional Application No. 62/140,349, filed March 30, 2015. However, the claims of the '886 patent here are not described in the provisional application and, thus, are not entitled to the benefit of any filing date before November 15, 2016.

Claim 1 requires "a single high efficiency long training field (HE-LTF) that consists of a single orthogonal frequency-division multiplexing (OFDM) symbol." The '886 patent, 30:59-62. Claim 9 requires "a single High Efficiency Long Training Field (HE-LTF) consisting of a single orthogonal frequency-division multiplexing (OFDM) symbol and the single OFDM symbol of the HE-LTF is immediately followed by one or more data symbols." *Id.* at 32:3-8.

U.S. Provisional Application Nos. 62/137,138 and 62/140,349 do not disclose "a single High Efficiency Long Training Field (HE-LTF) consisting of a single orthogonal frequency-division

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multiplexing (OFDM) symbol" and "the single OFDM symbol of the HE-LTF is immediately followed by one or more data symbols" as required by claims 1 or 9. Thus, Applicant does not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). Thus, the '886 patent's claims are not entitled to filing dates of the provisional applications.

2. The '886 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the '886 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit H-1 through H-7, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as anticipating one or more of the Asserted Claims of '886 Patent under 35 U.S.C. § 102. The table of anticipating references below is exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the '886 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	Anticipating Prior Art
H-1	U.S. Patent Application Publication No. 2017/0171878 to Chun et al. at LG Electronics Inc. ("Chun '878 (LG)")

Exhibit	Anticipating Prior Art
H-2	U.S. Patent No. 10,299,261 to Chun et al. at LG Electronics Inc. ("Chun '261 (LG)")
H-3	U.S. Patent Pub. No. 2017/0127298 to Ryu et al. at LG Electronics Inc. ("Ryu")
H-4	U.S. Patent Pub. No. 2015/0124689 to Merlin et al. at Qualcomm Inc. ("Merlin_689")
H-5	U.S. Patent Pub. No. 2015/0063190 to Merlin et al. at Qualcomm Inc. ("Merlin_190")
H-6	IEEE 802.11-15/0349 ("IEEE_349")
H-7	IEEE 802.11-15/0099 ("IEEE_099")

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the '886 Patent, Defendants reserve the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The '886 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the asserted claims of the '886 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits H-1 through H-7, 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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits H-1 through H-7 with each other because these references relate to wireless communication methods and devices

utilizing multiple antenna elements in the same field of endeavor, and they both share the same six inventors. For example, Chun ’878 (LG) provides a very detailed disclosure of a method for transmitting multi-user uplink data in a wireless communication system that includes: receiving, by a station (STA), a UL MU scheduling frame for initiating uplink multi-user (UL MU) transmission from an access point (AP); transmitting, by the STA, a UL MU data frame to the AP through a frequency band or a stream allocated by the UL MU scheduling frame; and receiving, by the STA, an acknowledge (ACK) frame from the AP in response to the UL MU data frame, wherein the UL MU scheduling frame may include protection duration information for protecting a UL MU procedure. Similarly, Chun ’261 (LG) provides a very detailed disclosure of a method and device for downlink multi-user (DL MU) transmission in a wireless communication system. In particular, the method for downlink multi-user data transmission in the wireless communication system includes the steps of receiving, by a station (STA), a DL MU data frame from an access point (AP) and transmitting, by the STA, an acknowledgement (ACK) frame in response to the DL MU data frame, wherein a plurality of ACK frames transmitted by a plurality of STAs in response to the DL MU data frame is multiplexed to configure an uplink multi-user (UP MU) ACK frame, and the time and/or size of a frequency resource at which the ACK frame is transmitted may be determined according to the level of a modulation and coding scheme (MCS) that is applied to the ACK frame.

Accordingly, because each of the identified references are directed to similar devices in the similar field of endeavor, a person of ordinary skill in the art would be motivated to combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

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Furthermore, to the extent that it is determined that any of the above references do not disclose "wherein the uplink response frame is transmitted with space-time block coding disabled in response to the scheduling information being located in the MAC header in the downlink frame" in claims 8 and 16, it would further have been obvious to modify the teachings of the charted references to disable STBC in view of the teachings of the 802.11ac standard, which did not apply STBC in a VHT MU PPDU. *See, e.g.*, 802.11ac Standard (2013) at Table 22-12 (For VHT MU PPDU: Set [STBC] to 0) and Section 22.3.10.10.9.4 ("… STBC shall not be applied in a VHT MU PPDU…"). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the '886 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '886 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '886 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- "wherein in response to the scheduling information being located in a Media Access Control (MAC) header in the downlink frame"

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the '886 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '886 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions,

Defendants assert that the Asserted Claims of the ’886 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- “wherein in response to the scheduling information being located in a Media Access Control (MAC) header in the downlink frame”

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants’ present understanding of Plaintiff’s Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff’s apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

J. The ’851 Patent Is Invalid

1. Effective Filing Date.

The ’851 patent issued from a U.S. Patent App. No. 16/203,501 filed November 28, 2018, which is a continuation application of U.S. Patent App. No. 15/151,433 filed May 10, 2016. U.S. Patent App. No. 15/151,433 claims priority to U.S. Provisional Application No. 62/159,346, filed on May 10, 2015, U.S. Provisional Application No. 62/160,527, filed on May 12, 2015, U.S. Provisional Application No. 62/191,623, filed on Jul. 13, 2015, and U.S. Provisional Application No. 62/193,305, filed on Jul. 16, 2015. However, the claims of the ’851 patent here are not described in the provisional applications or the parent application and, thus, are not entitled to the benefit of any filing date before November 28, 2018.

Claim 1 requires “scheduling information.” In particular, claim 1 recites:

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"obtaining scheduling information from the control field when the control extension indication indicates that the control field includes the scheduling extension;

generating a second frame for a multi-user uplink transmission with the plurality of stations based on the scheduling information included in the scheduling extension;"

Independent claims 16 and 20 also recite "the scheduling extension includes scheduling information for one or more stations of the plurality of stations to transmit a corresponding uplink frame as part of a multi-user uplink transmission."

The above-mentioned provisional applications do not describe "the scheduling extension [including] scheduling information." The parent application also fails to describe the above-cited limitations. Thus, the provisional applications and the parent application do not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). Thus, the '851 patent's claims are not entitled to filing dates of the provisional applications or the parent application.

2. The '851 Patent Is Anticipated by the Prior Art.

Some or all of the Asserted Claims of the '851 Patent are invalid as anticipated under 35 U.S.C. § 102 in view of each of the prior art references identified in the claim charts included in Exhibit I-1 through I-7, which identify specific examples of where each limitation of the Asserted Claims is found in the prior art references. As explained above, the cited portions of prior art references identified in the attached claim charts are exemplary in nature and representative of the content and teaching of the prior art references, and should be understood in the context of the reference as a whole and as they would be understood by a person of ordinary skill in the art.

Defendants identify the following references as anticipating one or more of the Asserted Claims of the '851 Patent under 35 U.S.C. § 102. The table of anticipating references below is

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exemplary, and it does not constitute an admission that any reference not listed below does not also anticipate the claims of the ’851 Patent. Further, Defendants contend that any prior art reference in the attached charts that is charted for each limitation of any given claim, anticipates that claim, regardless of whether that prior art reference is listed in the following table.

Exhibit	Anticipating Prior Art
I-1	U.S. Publication No. 2017/0170937 (“Chun ’937”)
I-2	U.S. Publication No. 2017/0171878 (“Chun ’878”)
I-3	WO 2014/168656 (“Merlin ’656”)
I-4	U.S. Patent Publication No. 2015/0063257 (“Merlin ’257”)
I-5	U.S. Patent Publication No. 2016/0198445 (“Ghosh ’445”)
I-6	U.S. Patent Publication No. 2017/0339692 (“Chun 692”)
I-7	U.S. Patent Publication No. 2017/0127451 (“Chun 451”)

To the extent any item of prior art cited above is deemed not to disclose, explicitly or inherently, any limitation of an asserted claim of the ’851 Patent, Defendants reserve the right to argue that any difference between that prior art and the corresponding patent claim would have been either inherent in the art or obvious to a person of ordinary skill in the art, even if Defendants have not specifically denoted that the art is to be combined with the knowledge of a person of ordinary skill in the art.

3. The ’851 Patent is Obvious Over the Prior Art.

To the extent Plaintiff argues that any limitation of the Asserted Claims of the ’851 Patent are not explicitly disclosed by an item of prior art identified above and in Exhibits I-1 through I-7, any purported differences are such that the claimed subject matter as a whole would have been obvious to

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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 as obvious under 35 U.S.C. § 103.

Furthermore, it would have obvious to combine any of the prior art in Exhibits I-1 through I-7 with each other because all of these references relate to wireless communication methods and devices utilizing multiple antenna elements in the same field of endeavor. For example, Merlin ’656 teaches a method for wireless communication comprising generating and transmitting a control frame, and a wireless device capable of carrying out said method. Merlin ’656 at [0006]-[0008]. Specifically, the control frame taught in Merlin ’656 may include a control extension field in the control frame that contains additional control information. *Id*. at [0062]. Furthermore, Chun ’937 teaches a method of transmitting multi-user uplink data in a wireless communication system comprising the use of an HT control field included in the MAC header of an MPDU. Chun ’937 at Abstract, [0260]. Said HT control field may comprise subfields containing additional information. *Id*. at [0278]. Chun ’878 similarly teaches a method of transmitting multi-user uplink data using an HT control field in the MAC header that includes control information related to HT and/or VHT transmission and reception techniques in the HT control subfields. Chun ’878 at [0180]. Further, Ghosh teaches the use of orthogonal frequency division multi-access (OFDMA) and/or multiple-input multiple-output (MIMO) resource allocations transmitted to a plurality of stations by an access point as a trigger frame to initiate an uplink multi-user OFDMA data transmission. Ghosh at [0002]. Similarly, Merlin ’257 teaches a method and apparatus for multiple user uplink including the transmission of a scheduling message included in the payload portion of a physical layer data unit (PPDU) to two or more stations. Merlin ’257 at [Abstract].

Accordingly, because each of the identified references are directed to similar devices or methods in the similar field of endeavor, a person of ordinary skill in the art would be motivated to

combine the teachings of two or more references together because both references disclose very similar systems that solve the same problems in similar ways. Thus, it would have been obvious to one of ordinary skill in the art to combine any of the foregoing references and would have expected such a combination to be successful.

Furthermore, to the extent that it is determined that any of the above references do not disclose the "obtaining a control extension indication from a control field included in the first frame" limitation of Claim 1c, the "wherein the downlink frame comprises a control field including a control extension indication" limitation of Claim 16a, or the "wherein the multi-user frame comprises a control field including a control extension indication" limitation of Claim 20c, it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least U.S. Patent Pub. No. 2016/0323424 ("Merlin '424"), U.S. Patent Pub. No. 2015/0063320 ("Merlin '320) and/or U.S. Patent Pub. No. 2007/0201468 ("Jokela '468"), which teach a frame field indicating a control or extension subtype. *See, e.g.*, Merlin '424 at [0166] ("an NDP frame may be used to carry control or management signaling. The control information may be included in one of a first HE signal field (HE-SIG-A), a second HE signal field (HE-SIG-B), or a third HE signal field (extension). The control or management information may include one field that indicates a type of information included in a HE-SIG field."); *id*. at [0082] ("The non-legacy and extension portions 500 may also include extension portion 530. . . In some examples, an NDP frame may be identified by one or more bits (e.g., a single bit in some implementations) in HE-SIG-A 510 and/or by the value of a LENGTH field in L-SIG 415 or RL-SIG 505, for examples."); Merlin '320 at [0090] ("The RTX frame 900 includes a frame control (FC) field 910, a duration . . . The FC field 910 indicates a control subtype or an extension subtype."); Merlin '320 at [0091] ("In this embodiment, the CTX frame 1000 is a control frame that includes a frame control (FC) field 1005, . . . The FC field 1205 indicates a control

subtype or an extension subtype."); Jokela '468 at [0034] ("Frame body 204 may also include an Action field 212 set to a value indicating a PSMP frame 200."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "determining whether the control extension indication included in the first frame indicates whether the control field includes a scheduling extension" limitation of Claim 1d, or the "wherein the control extension indication indicates whether the control field includes a scheduling extension" limitation of Claim 16b, it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Merlin '320, Merlin '424, U.S. Patent No. 9,705,643 ("Li '643"), and Jokela '468, and/or U.S. Patent No. 8,774,037 ("Kim '037"), which teach determining whether a message includes scheduling information. *See, e.g.*, Merlin '320 at [0099] ("The clear to transmit message may provide information regarding a start time and a duration of a transmission opportunity during which the stations 120 a-d are granted permission to transmit data."); Merlin '424 at cl. 8 ("The method of claim 6, wherein the indication that the frame is an NDP frame comprises a value of a length indicator in a legacy signal field."); *id*. at cl. 6 ("The method of claim 5, wherein the control information comprises an indication that the frame is an NDP frame."); *id*. at [0083] ("In some examples, the extension portion 530 may include a third HE SIG field (HE-SIG-C), which may be transmitted with a single spatial stream or duplicated across spatial streams. In some examples, the extension portion 530 may include one or more of an allocation of uplink MU resources for a sounding response or per-STA parametrization of required CIS."); Li '643 at 4:23-26 ("In example embodiments, the SCH 202 is an indication of a stream and time when a HEW device 104 is scheduled for uplink transmission."); Jokela '468 at [0032] ("The PSMP frame (discussed below with reference to FIG. 2) may allow an AP 104 to provide sub-schedules to each of a plurality of stations 106, 108.

These PSMP data transmission schedules, or sub-schedules, may indicate for example a downlink start time and duration (for a scheduled transmission from the AP 104 to a specified station 106), and/or an uplink start time and duration (for a scheduled transmission time where a specified station 106 may be permitted to transmit data to the AP 104)."); Kim '037 at 6:36-39 ("The PDCCH is used to carry downlink control information. The downlink control information can include downlink scheduling information, uplink scheduling information, an uplink power control command and the like."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "obtaining scheduling information from the control field when the control extension indication indicates that the control field includes the scheduling extension" limitation of Claims 1e, or the "wherein the scheduling extension includes scheduling information" limitation of Claim 16c, it would further have been obvious to modify the teachings of that reference to include scheduling information in view of the teachings of at least Merlin '320, Merlin '424, Li '643, U.S. Patent No. 8,571,010 ("Zhang '010"), Jokela '468 and/or Kim '037, which teach scheduling information contained in a control field. *See, e.g.*, Merlin '320 at [0099] ("The clear to transmit message may provide information regarding a start time and a duration of a transmission opportunity during which the stations 120 a-d are granted permission to transmit data."); *see also id*. at [0079] ("The duration of the UL-MU-MIMO transmission 410 for user terminals utilizing the UL-MU-MIMO feature may be indicated in the CTX message 402 . . . ."), [0081] ("In one operation mode, the user terminals 120 may not transmit outside an UL-MU-MIMO transmission opportunity (TXOP)."); Li '643 at 4:23-26 ("In example embodiments, the SCH 202 is an indication of a stream and time when a HEW device 104 is scheduled for uplink transmission."); *see also id*. at 4:13-21, 11:26-35; Merlin '424 at [0067] ("For example, the wireless station 110-a may only decode the portion of the NDP frame 210 that the station 110-a

receives on its assigned channel."); Zhang '010 at 10:31-47 ("Further, depending on the particular embodiment, the synchronization frame 202 includes one or more of the following: an indication of which of the SUT-capable stations are expected to transmit uplink data during the SUT period 200, . . . a listing of space-time streams allocated to each individual SUT-capable station for the SUT period 200, bandwidth of SUT frames (e.g., 20 MHz, 40 MHz, 80 MHz), a respective modulation and coding scheme for each SUT-capable station expected to transmit during the SUT period 200 . . . ."); Jokela '468 at [0032] ("The PSMP frame (discussed below with reference to FIG. 2) may allow an AP 104 to provide sub-schedules to each of a plurality of stations 106, 108. These PSMP data transmission schedules, or sub-schedules, may indicate for example a downlink start time and duration (for a scheduled transmission from the AP 104 to a specified station 106), and/or an uplink start time and duration (for a scheduled transmission time where a specified station 106 may be permitted to transmit data to the AP 104)."); Kim '037 at 6:36-39 ("The PDCCH is used to carry downlink control information. The downlink control information can include downlink scheduling information, uplink scheduling information, an uplink power control command and the like."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "generating a second frame for a multi-user uplink transmission with the plurality of stations based on the scheduling information included in the scheduling extension" of Claim 1f, it would further have been obvious to modify the teachings of that reference to include such functionality in view of the teachings of at least Li '643, Jokela '468, U.S. Patent No. 9,253,767 ("Wang '767"), Merlin '424, and/or Merlin '320, which teach generating and transmitting a second frame for a multi-user uplink transmission with the plurality of stations. *See, e.g.*, Li '643 at 4:31-32 ("In example embodiments, the SCH 202 includes a schedule for two or more HEW devices 104.1, 104.2."); *id*. at 6:6-9 ("In some

embodiments, the data 212, 216 are transmitted as part of a schedule during an up-link period for the HEW devices 104.1, 104.2 that may be OFDMA and/or MU-MIMO."); Jokela '468 at [0035] ("A PSMP sequence (discussed further with reference to FIG. 3) may include, for example, a PSMP frame 200 followed by a scheduled data transmission to (downlink) and/or from (uplink) one or more stations 106, 108, as indicated by the PSMP frame 200. PSMP sequence duration field 221 indicates the duration of the current PSMP sequence which is described by the PSMP frame 200."); Wang '767 at 6:54-58 ("On the other hand, for uplink transmission, each mobile station transmits (steps 413-416) UL feedbacks/ACKs sequentially back to AP 401 during corresponding uplink transmission periods."); Merlin '424 at [106] ("The AP 105-b sends a trigger frame 1205 to the wireless station 110-c. The trigger frame 1205 may trigger transmissions from multiple stations in uplink."); *id*. at [0113] ("The AP 105 may broadcast the CTX message 1505 to one or more wireless stations 110 that indicates which stations may participate in an uplink multiple-user MIMO or a multi0user orthogonal frequency division multiple access (OFDMA) scheme such as a UL MU-PPDU scheme."); Merlin '320 at [0108] ("Some aspects of block 1305 include transmitting one or more clear to transmit message(s) to one or more of the first, second, third, and fourth stations discussed above. In some aspects, the clear to transmit messages are generated to indicate a time when the first, second, third, and/or fourth messages may be transmitted to the device performing method 1300."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "transmitting the second frame as part of the multi-user uplink transmission with the plurality of stations" limitation of Claim 1g, it would further have been obvious to modify the teachings of that reference to include such functionality in view of the teachings of at least Li '643, Jokela '468, Wang '767, Merlin '424, and/or Merlin '320, which teach generating and transmitting a second frame for a

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multi-user uplink transmission with the plurality of stations. *See, e.g.*, Li '643 at 4:31-32 ("In example embodiments, the SCH 202 includes a schedule for two or more HEW devices 104.1, 104.2."); *id*. at 6:6-9 ("In some embodiments, the data 212, 216 are transmitted as part of a schedule during an up-link period for the HEW devices 104.1, 104.2 that may be OFDMA and/or MU-MIMO."); Jokela '468 at [0035] ("A PSMP sequence (discussed further with reference to FIG. 3) may include, for example, a PSMP frame 200 followed by a scheduled data transmission to (downlink) and/or from (uplink) one or more stations 106, 108, as indicated by the PSMP frame 200. PSMP sequence duration field 221 indicates the duration of the current PSMP sequence which is described by the PSMP frame 200."); Wang '767 at 6:54-58 ("On the other hand, for uplink transmission, each mobile station transmits (steps 413-416) UL feedbacks/ACKs sequentially back to AP 401 during corresponding uplink transmission periods."); Merlin '424 at [106] ("The AP 105-b sends a trigger frame 1205 to the wireless station 110-c. The trigger frame 1205 may trigger transmissions from multiple stations in uplink."); *id*. at [0113] ("The AP 105 may broadcast the CTX message 1505 to one or more wireless stations 110 that indicates which stations may participate in an uplink multiple-user MIMO or a multi0user orthogonal frequency division multiple access (OFDMA) scheme such as a UL MU-PPDU scheme."); Merlin '320 at [0108] ("Some aspects of block 1305 include transmitting one or more clear to transmit message(s) to one or more of the first, second, third, and fourth stations discussed above. In some aspects, the clear to transmit messages are generated to indicate a time when the first, second, third, and/or fourth messages may be transmitted to the device performing method 1300."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Furthermore, to the extent that it is determined that any of the above references do not disclose the "scheduling extension corresponds to a control extension subfield that contains the scheduling information" limitations of Claim 2, Claim 17a, and Claim 18a, it would further have been obvious

to modify the teachings of that reference to includes this functionality in view of the teachings of at least Merlin ’320 and Merlin ’424, which teach the existence of scheduling information located in an extension portion such as a control extension. *See, e.g.*, Merlin ’424 at [0083] (“In some examples, the extension portion 530 may include one or more of an allocation of uplink MU resources for a sounding response or per-STA parametrization of required CIS.”); Merlin ’320 at [0090] (“The RTX frame 900 includes a frame control (FC) field 910 . . . The FC field 910 indicates a control subtype or an extension subtypes.”); *id*. at [0091] (“the CTX frame 1000 is a control frame that includes a frame control (FC) field 1005…. The FC field 1205 indicates a control subtype or an extension subtype.”). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the “control extension subfield includes scheduling information for a trigger-based response frame that carries an immediate acknowledgement” limitation of Claim 3, it would further have been obvious to modify the teachings of that reference to include that functionality in view of the teachings of at least Merlin ’424, Merlin ’320, Li ’643 and/or Jokela ’468, which teach trigger-based response frames with immediate acknowledgement frames. *See, e.g.*, Merlin ’424 at [0113] (“FIG. 15 shows a block diagram of an example NDP clear to transmit (CTX) frame, in accordance with various aspects of the present disclosure. An AP 105 may transmit a clear to transmit (CTX) message 1505, which may take the form of an NDP trigger. The AP 105 may broadcast the CTX message 1505 to one or more wireless stations 110 that indicates which stations may participate in an uplink multiple-user MIMO or a multi-user orthogonal frequency division multiple access (OFDMA) scheme such as a UL MU-PPDU scheme. Once a station receives the CTX message 1505, the station may transmit a UL MU-PPDU message 1510.”); Merlin ’424 at [0122] (“FIG. 17 shows a block diagram of an example NDP frame 1700 including block ACK/ACK information in an extension field 530-u . . . .”); Merlin ’320 at [0085]

("In this embodiment the user terminal 120 may determine during the setup phase which data frames (e.g., RTS, PS-poll, QoS null, etc.) will trigger a UL-MU-MIMO transmission when the bits 8-15 of the QoS control field indicate a non-empty queue."); Li '643 at 4:53-60, 11:26-35; Jokela '468 at [0045]. Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "control extension subfield of the first frame includes length information that is indicative of a length of the second frame to be transmitted by the station in response to the first frame" limitations of Claim 4 and Claim 17b, it would further have been obvious to modify the teachings of that reference to include that functionality in view of the teachings of at least Merlin '320 and/or Zhang '010, which teach a first frame indicating the maximum duration of a second frame. *See, e.g.*, Merlin 320 at [0099] ("The clear to transmit message may provide information regarding a start time and a duration of a transmission opportunity during which the stations 120 a-d are granted permission to transmit data."); *see also id*. at [0079]; Zhang '010 at 10:31-47 ("Further, depending on the particular embodiment, the synchronization frame 202 includes one or more of the following: . . . the maximum duration of an SUR frame that can be transmitted during the SUT period 200, etc."). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Additionally, to the extent that it is determined that any of the above references do not disclose the "determining that the scheduling extension exists when the control extension indication is set to a first value; and determining that the scheduling extension does not exist when the control extension indication is set to a second value different from the first value" limitation of Claim 8, it would further have been obvious to modify the teachings of that reference to include this functionality in view of the teachings of at least Merlin '424, Jokela '468 and/or U.S. Patent Pub. No. 2010/0260060 ("Abraham '060"), which teach the existence of fields of different values that indicate the existence of scheduling

information. *See, e.g.*, Merlin ’424 at [0082] (“In some examples, an NDP frame may be identified by one or more bits (e.g., a single bit in some implementations) in HE-SIG-A 510 and/or by the value of a LENGTH field in L-SIG 415 or RL-SIG 505.”); Jokela ’468 at [0034] (“Frame body 204 may also include an Action field 212 set to a value indicating a PSMP frame 200.”); Abraham ’060 at [0059] (“The AP 502 may initiate the calibration procedure, for example, by sending a Protocol Data Unit (QoS Null PPDU) message 506. To indicate a start of the calibration procedure, the message 506 may include a High Throughput Control (HTC) field with a calibration position field set to 1.”); *id*. at [0060] (“As illustrated, the STA may send the ACK as a PPDU message 512 including an HTC field to the AP from each of its antennas. The AP may estimate the channel HAP RL based on the received ACK PPDU messages and send another PPDU message 508 with sounding information from all of its antennas, in which the HTC calibration position field is set to 3 as an indication of the sounding information.”). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

Furthermore, to the extent that it is determined that any of the above references do not disclose the “control extension subfield of the first frame indicates one or more sub-bands assigned to the station” limitation of Claim 9, it would further have been obvious to modify the teachings of that reference to includes this functionality in view of the teachings of at least Merlin ’424, which teaches that the control extension indicates an allocation of uplink resources for the station. Merlin ’424 at [0083] (“In some examples, the extension portion 530 may include one or more of an allocation of uplink MU resources for a sounding response or per-STA parametrization of required CSI.”); *id*. at cl. 19 (“The method of claim 18, wherein the third HE signal field comprises an allocation of uplink multi-user resources for a response to the NDP frame.”). Therefore, a person of ordinary skill in the art would be motivated to make such a combination.

4. Invalidity of the ’851 Patent Based on 35 U.S.C. § 112, ¶ 1 (Enablement and Written Description)

Based on Defendants’ present understanding of Plaintiff’s asserted scope of the claims of the ‘851 Patent, to the extent such positions can be understood from Plaintiff’s Infringement Contentions, Defendants assert that the Asserted Claims of the ‘851 Patent are invalid for failure to provide a written description that enables the full scope of the Asserted Claims based on at least the following claim terms, phrases, or limitations:

- “obtaining a control extension indication from a control field included in the first frame” (claim 1)
- “determining whether the control extension indication included in the first frame indicates whether the control field includes a scheduling extension” (claim 1)
- “obtaining scheduling information from the control field when the control extension indication indicates that the control field includes the scheduling extension” (claim 1)
- “determining whether a scheduling extension exists based on a setting of the control extension indication” (claim 7)
- “determining that the scheduling extension exists when the control extension indication is set to a first value; and determining that the scheduling extension does not exist when the control extension indication is set to a second value different from the first value” (claim 8)
- “wherein the control extension subfield includes an identification subfield that indicates what subset of the one or more subfields are carried in a specific instance of the control extension subfield in the downlink frame” (claim 19)
- “wherein the downlink frame comprises a control field including a control extension indication” (claim 16)
- “wherein the control extension indication indicates whether the control field includes a scheduling extension” (claim 16)
- “wherein the scheduling extension includes scheduling information for one or more stations of the plurality of stations to transmit a corresponding uplink frame as part of a multi-user uplink transmission” (claim 16)
- “wherein the multi-user frame comprises a control field including a control extension indication” (claim 20)

- "wherein the control extension indication indicates whether the control field includes a scheduling extension" (claim 20)
- "wherein the scheduling extension includes scheduling information for one or more stations of the plurality of stations to transmit a corresponding uplink frame as part of a multi-user uplink transmission" (claim 20)

Based on Defendants' present understanding of Plaintiff's Infringement Contentions and apparent interpretation of the scope of the Asserted Claims, at least one or more of these claim terms, phrases, and limitations are not described in the specification of the Asserted Patents and do not enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

5. Invalidity of the '851 Patent Based on 35 U.S.C. § 112, ¶ 2 (Indefiniteness)

Based on Defendants' present understanding of Plaintiff's asserted scope of the claims of the '851 Patent, to the extent such positions can be understood from Plaintiff's Infringement Contentions, Defendants assert that the Asserted Claims of the '851 Patent are invalid for reciting at least the following claim terms, phrases, or limitations:

- "scheduling extension" (claims 1-2, 7-8, 16-18, 20)
- "receiving a first frame of a downlink transmission for a plurality of stations" (claim 1)
- "generating a second frame for a multi-user uplink transmission with the plurality of stations based on the scheduling information included in the scheduling extension" (claim 1)
- "generating a downlink frame of a downlink transmission for a plurality of stations" (claim 16)
- "wherein the scheduling extension includes scheduling information for one or more stations of the plurality of stations to transmit a corresponding uplink frame as part of a multi-user uplink transmission" (claim 16)
- "generating a multi-user frame for downlink transmission directed to a plurality of stations" (claim 20)
- "wherein the scheduling extension includes scheduling information for one or more stations of the plurality of stations to transmit a corresponding uplink frame as part of a multi-user uplink transmission" (claim 20)

These claim terms, phrases, and limitations, as apparently construed by Plaintiff, violate the definiteness requirements of 35 U.S.C. § 112.

Based on Defendants' present understanding of Plaintiff's Infringement Contentions, at least one or more of these claim terms, phrases, and limitations are indefinite because they are inconsistent with and broader than the alleged invention disclosed in the specification and during prosecution, and given Plaintiff's apparent constructions of the claims, any person of ordinary skill in the art at the time of the invention would not understand what is claimed with reasonable certainty, even when the claims are read in light of the specification and prosecution history.

III. DOCUMENT PRODUCTION

Defendants have produced copies of the invaliding references (*e.g.*, publications and patents) and technical documents concurrently with service of these Invalidity Contentions.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that I caused the foregoing document and Exhibits A-1 through A-10, B-1 through B-18, C-1 through C-12, D-1 through D-9, E-1 through E-15, F-1 through F-13, G-1 through G-19, H-1 through H-7, and I-1 through I-7 to be transmitted to counsel for Plaintiff via electronic service on June 15, 2023.

/s/ Victoria Hao
Victoria Hao