

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ERICSSON INC., NOKIA OF AMERICA CORP., AT&T SERVICES, INC.,
CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, GOOGLE LLC, AND
T-MOBILE USA, INC.,
Petitioners,

v.

PEGASUS WIRELESS INNOVATION LLC,
Patent Owner.

Case IPR2025-00083
U.S. Patent No. 10,638,463

**DECLARATION OF DR. JACOB SHARONY
IN SUPPORT OF PATENT OWNER'S RESPONSE IN
INTER PARTES REVIEW OF U.S. PATENT NO. 10,638,463**

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I. INTRODUCTION

1. My name is Jacob Sharony. I have been retained by Pegasus Wireless Innovation LLC (“Patent Owner” or “Pegasus”) to provide expert assessment and technical opinions in connection with the above captioned *inter partes* review (“IPR”) of Ex. 1001, U.S. Patent No. 10,638,463 (the “’463 Patent”), titled “Apparatus and Method of Uplink Control Channel Resource Allocation for New Radio.” I am being compensated at my standard hourly rate for my work on this matter. My compensation is not dependent upon the outcome of the IPR.

II. QUALIFICATIONS

2. In this section I have summarized my educational background, career history, publications, and other relevant qualifications.

3. I have over 35 years of experience working in mobile and wireless technologies, which has resulted in over 50 issued patents and numerous publications in scientific journals and conferences. I have also served on various government expert panels, including for the National Science Foundation and National Institutes of Health.

4. Since 2010, I have been an Adjunct Professor in Electrical Engineering at Columbia University, teaching graduate level courses on advanced wireless

technologies including in the areas of wireless sensing and Auto ID technologies, mmWave communications, and applications for 5G wireless networks and systems.

5. I received a Bachelor's Degree (1979) and Master's Degree (1984) in Electrical Engineering from Tel Aviv University. I have a M. Phil. (1991) and Ph.D. (1993) Degrees in Electrical Engineering from Columbia University. I also have an M.B.A. Degree (1989) from Tel Aviv University.

6. I have been involved with mobile and wireless networking technologies since the mid-1990s, working as a researcher, developer, and educator on wireless wide, local, and personal area networks (WWAN, WLAN, and WPAN) infrastructure and mobile devices. Over these two decades, I have witnessed the change from voice-centric to data-centric networks and have worked on enterprise mobility products and solutions as early as the late 1990s.

7. After obtaining my Ph.D., I led the advanced mobile networking group at BAE Systems, developing tactical mesh-based wireless network systems for the United States Department of Defense. I also conducted research and development in advanced mobile and wireless networks. My work resulted in several issued patents including U.S. Patent No. 5,652,751, titled "Architecture for Mobile Radio Networks with Dynamically Changing Topology Using Virtual Subnets," and U.S.

Patent No. 5,742,593, titled “On-line Distributed TDMA/FDMA/CDMA Link Assignment in Mobile Radio Networks with Flexible Directivity.”

8. From 1997 to 2005, I held various positions at Symbol Technologies (acquired by Motorola Solutions). While working at Motorola/Symbol, I gained substantial experience in application-specific mobile devices and wireless networking and architecture solutions in several vertical applications, e.g., transportation and logistics, healthcare, warehousing, retail, and education. As Senior Director of Research and Development, I initiated and led several research and development programs in wireless LAN (local area network) technologies, including mobile device management and security. As Senior Director of Technology Strategy and Development, I was responsible for the research and development of new mobile applications for delivering multimedia-rich content to mobile devices connected over heterogeneous networks. That work resulted in several U.S. patents, including U.S. Patent No. 7,778,649, titled “System and Method for Asset Location in Wireless Networks,” U.S. Patent No. 7,039,358 titled “Coexistence Techniques in Wireless Networks,” U.S. Patent No. 6,925,094, titled “System and Method for Wireless Network Channel Management,” and U.S. Patent No. 7,668,201, titled “Bandwidth Management in Wireless Networks.”

9. In 2004, I founded Mobius Consulting, a consulting firm providing professional services in mobile wireless strategy, technologies, systems, and applications, including enterprise mobility, wireless communication networks, mobile embedded devices, device management, and mobile applications and services. In this capacity, I have worked with many companies in the mobile and wireless ecosystem, including service providers and operators, equipment vendors, and semiconductor companies. Since founding Mobius Consulting, I have worked with many enterprises interested in deploying mobile and wireless solutions to become more productive, efficient, and cost effective. These solutions spanned numerous industry sectors and involved various mobile and wireless technologies including 3G/4G/5G Cellular, Wi-Fi, Bluetooth, ZigBee, and RFID. That work resulted in several U.S. patents, including U.S. Patent No. 9,014,702, titled “Location Processing in Small Cells Implementing Multiple Air Interfaces,” U.S. Patent No. 9,088,923, titled “Small Cells Implementing Multiple Air Interfaces,” and U.S. Patent No. 10,080,177, titled “Unlicensed Spectrum Offload Architecture for Small-Cell Base Stations.”

10. In addition to this summary above, my full curriculum vitae, which contains my qualifications and a list of the litigations for which I have previously provided testimony, is attached as Exhibit A to this declaration.

III. SCOPE OF WORK

11. I have been asked to consider and provide my opinions on claims 1-9 of the '463 Patent, including the technical subject matter and the application of various references. In particular, I have been asked to consider what one of ordinary skill in the art would have understood from the claims and specifications of the '463 Patent, whether certain references disclose or suggest the features recited in the claims of the '463 Patent, and whether one of ordinary skill in the art would have had reason to combine certain references to arrive at the subject matter recited in claims 1-9 of the '463 Patent.

IV. MATERIALS CONSIDERED

12. In forming my opinions, I have reviewed the materials listed below, in addition to any other materials discussed in this Declaration.

Paper/Exhibit	Short Name	Description
7	IPR Petition	Petition for Inter Partes Review
18	IPR Decision	PTAB Decision Granting Institution
Ex. 1001	'463 Patent	U.S. Patent No. 10,638,463 B2
Ex. 1002	Roy declaration	Declaration of Dr. Sumit Roy
Ex. 1004	'463 File History	File History of U.S. Patent No. 10,638,463
Ex. 1007	Takeda	Certified Translation of International Publication No. WO 2019/030929 A1

Ex. 1010	Yan	US 10,736,085 B2
Ex. 1011	Marinier	US 2014/0056278
Ex. 1012	R1-1711853	3GPP T-Doc “Activation/deactivation of bandwidth part”
Ex. 1044	CC Order	District Court Claim Construction Order
Ex. 2006	Roy Deposition Transcript	Deposition of Dr. Sumit Roy, October 6, 2025

V. LEVEL OF ORDINARY SKILL IN THE ART

13. I understand the Petitioners have adopted September 29, 2017 as the priority date for the challenged claims in this IPR. Page 5 of the Petition states, “In this Petition, Petitioners assume that the earliest priority date for the ’463 Patent is September 29, 2017.”

14. I also understand that the Petition (page 10) sets forth the following standard for a person of ordinary skill in the art (“POSITA”): “A [POSITA] pertinent to the ’463 Patent would have had a bachelor’s degree in electrical engineering, computer engineering, or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications. Ex. 1002, ¶¶38-40. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. *Id.* A person with

less than 2 years of experience working in a field involving wireless communications could still qualify if the person has additional education that compensates for their lesser experience. *Id.*”

15. I have also reviewed the level of ordinary skill in the art proposed in the supporting declaration of Dr. Roy. Dr. Roy says that POSITA “would have had a bachelor’s degree in electrical engineering, computer engineering, or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications.” Ex. 1002, ¶ 40.

16. I agree that this description of the level of ordinary skill in the art generally comports with the level of skill necessary to understand and implement the teachings of the ’463 Patent and the asserted prior art. This description is approximate, thus additional education could make up for less field experience and vice versa.

17. It is my opinion that I would at least qualify as a POSITA at the relevant time, and that I exceeded this level of knowledge, experience, and education so that I am qualified to provide an expert opinion in this proceeding. I am personally familiar with the technology described in the ’463 Patent as of its earliest possible priority date of September 29, 2017.

18. The basis for my familiarity with the level of ordinary skill is my personal technical experience in the field and my interaction with large numbers of workers in the wireless field who were at this level of skill. In reaching this opinion as to the hypothetical person of ordinary skill in the art, I have considered the types of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level and professional capabilities of workers in the field.

19. Therefore, my opinions below are provided based on what a POSITA in the technical field of the claimed subject matter would have understood as of the priority date for the '463 Patent, which I will also assume to be September 29, 2017 as stated in the Petition. I have been informed and understand that the content of a patent and prior art should be interpreted the way a POSITA would have interpreted those references as of that date. I understand that the person of ordinary skill is a hypothetical concept referring to one who thinks along the lines of conventional wisdom at the time.

VI. RELEVANT LEGAL STANDARDS

20. Though I am not an attorney, my understanding of the legal standards relevant to this IPR is based on discussions with Patent Owner's counsel. I

understand that a patent or other publication must qualify as prior art before it can be used to invalidate a patent claim.

21. I understand a patent is invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious to a POSITA at the time the invention was made.

22. I have been informed and understand that subject matter claimed in a patent is obvious under 35 U.S.C. § 103 if a person of ordinary skill in the art at the time the alleged invention was made would have had reason to combine or modify the disclosures of one or more prior art references to arrive at the claimed subject matter. A claim may be unpatentable even if each and every claim limitation is not present or disclosed in a single prior- art item.

23. I have been informed and understand that, under the doctrine of obviousness, a claim is unpatentable if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. A person of ordinary skill in the art is presumed to have knowledge of the relevant prior art at the time of the claimed invention.

24. I have been informed and understand that obviousness is based on the scope and content of the prior art, the differences between the prior art and the claim,

the level of ordinary skill in the art and secondary indicia of non-obviousness to the extent such indicia exist.

25. I have been informed and understand the determination of whether the asserted claims would have been obvious to a person of ordinary skill in the art and, therefore, unpatentable, is not governed by any rigid test or formula. A determination that a claim is obvious is, instead, based on a determination that the claimed invention is merely a combination of known limitations to achieve predictable results.

26. I have been informed and understand that an analysis of whether a claimed invention is obvious must not rely on a hindsight combination of prior art. The analysis must proceed in the context of the time of the invention or claimed priority date and consider whether the invention as a whole would have been obvious to a person of ordinary skill in the art, taking into consideration any interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine any known elements in the fashion claimed by the patent at issue.

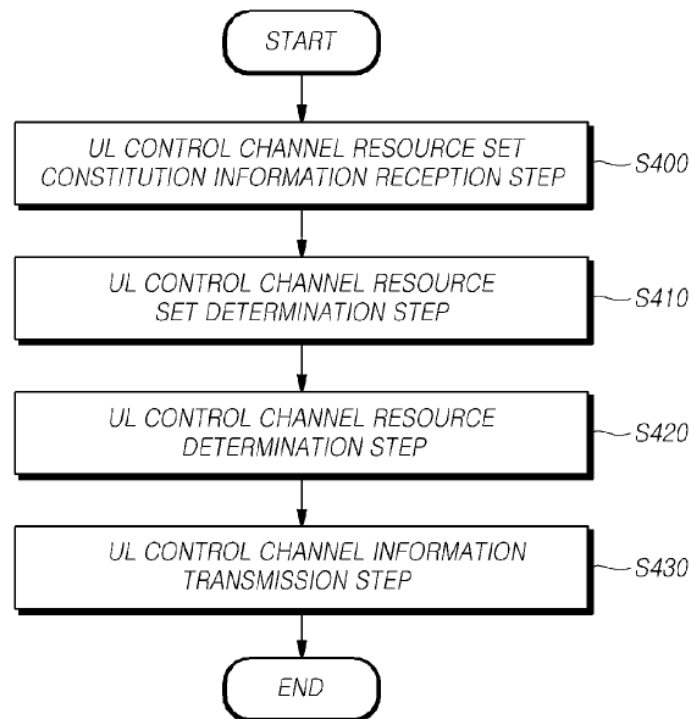
27. I understand that a patent claim is not invalid as obvious if the proposed combination or modification of the prior art does not teach or suggest to a POSITA at the time of the invention every limitation of the claim.

VII. OVERVIEW OF THE '463 PATENT

28. The '463 Patent is titled "Apparatus and Method of Uplink Control Channel Resource Allocation for New Radio." Ex. 1001.

29. The '463 Patent describes "a method of transmitting an uplink control information in next - generation / 5G radio access network." *Id.* at Abstract. The method may include "receiving uplink control channel resource set configuration information to transmit the uplink control information from a base station, determining one of uplink control channel resource sets contained in the uplink control channel resource set configuration information, determining one of uplink control channel resources configuring the determined uplink control channel resource set, and transmitting the uplink control information through the determined uplink control channel resource." *Id.* at Abstract. An exemplary sequence of steps is illustrated in Fig. 4 below.

FIG.4



Ex. 1001 at Fig. 4

30. The '463 Patent addresses challenges associated with uplink (UL) resource allocation in the context of next-generation/5G wireless communication, also referred to as New Radio (NR). The invention aims to address a core problem: avoiding ambiguity between uplink control channel resource configuration and its interpretation by the base station and user equipment during BWP switching in the

context of dynamic bandwidth part (BWP) and resource allocation in variable bandwidths.

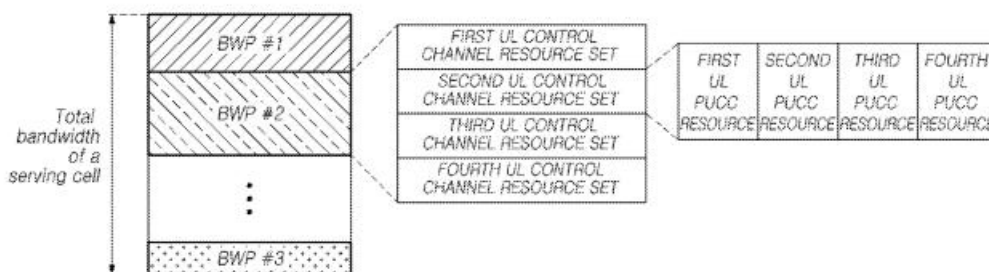
31. Methods for uplink control information exchange are proposed where the said information is transmitted by a user equipment, and received by a base station where the UE and BSs may be fitted by transmitter and receiver entities responsible for uplink/downlink control channel resource set configuration information. The '463 Patent explains "... it may prevent ambiguity between indication and interpretation of an uplink control channel transceiving resource of a base station and a user equipment, resulted from UL BWP switching in the NR". *Id.* at 2:26-40.

32. In one embodiment a method for allocating PUCCH (Physical Uplink Control Channel) resources in a New Radio (NR) system is described. This method primarily facilitates HARQ ACK/NACK feedback and aperiodic CSI (Channel State Information) reporting by a user equipment (UE). While the focus is on these applications, the method is versatile and can also support other uplink control tasks. *Id.*, 8:28-34.

33. Also disclosed and claimed in each challenged independent claim is the requirement that the "UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment." *Id.*, 21:15-17. An

exemplary embodiment of this concept is illustrated and described with respect to FIG. 3B, also reproduced below.

FIG.3B



34. As described with respect to FIG. 3B, the '463 patent discloses that “the BS may configure total N groups of one or multiple PUCCH resource sets *per each BWP* for a UE.” *Id.*, 9:61-63 (emphasis added). Further, “each PUCCH resource may be defined as PUCCH format configuration information, time/frequency domain PUCCH resource configuration information (or additionally code domain resource configuration information) in the UL BWP, or the like.” *Id.*, 10:6-10.

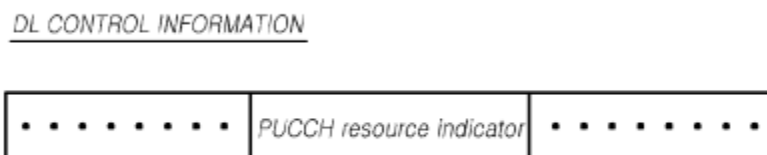
35. While the '463 patent discloses and claims that the “UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment,” the '463 patent distinguishes the concept of configuration of a BWP for a user equipment (also referred to herein as a “UE” or “user terminal”) and

activation of a BWP for a UE. The '463 patent discloses that under 5G NR ("New Radio"), "it is required to configure one or more bandwidth parts (BWPs) constituting bandwidths obtained by subdividing an NR CC and to support a wider and flexible bandwidth operation" *Id.*, 6:67-7:3. While many BWPs may be configured for a UE at a given, the '463 patent makes clear that only one BWP for a serving cell is activated for uplink and/or downlink at a given time. "The UE may transmit and/or receive UP/DL data by activating one DL BWP and one UP BWP, in the serving cell." *Id.*, 7:8-9. The '463 patent also discloses that under the standards governing 5G NR, Release 15, "the NR rel-15 defines that only one DL BWP and one UL BWP are activated and used in an UE at any time." *Id.*, 7:25-27; *see also id.*, 8:28-32 ("The NR defines a BS to activate and use only one DL BWP and one UL BWP at a predetermined time for each UE in order for transmitting and receiving each of DL/UL radio channel and signal (e.g. PDCCH/PDSCH, PUSCH/PUCCH etc.).").

36. In my opinion, the claimed requirement that the "UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment" applies to all BWPs configured for a UE, without addressing whether any of those BWPs are activated for uplink. Under 5G NR standards, a UE

may have up to four UL BWPs configured, but only one active UL BWP at any given time.

37. Finally, the challenged independent claims also require that “each UL BWP is activated through downlink (DL) control information.” *Id.*, 21:18-19. The ’463 patent explains that “when the UL BWP indication information for the transmission of the PUCCH is included in the DL allocation DL control information, the UL BWP indication information may be additionally used as UL BWP activation information of the UE and UL BWP switching indication information resulted therefrom.” *Id.*, 11:25-30. An exemplary embodiment of DL control information, or DCI, is illustrated and described with respect to FIG. 3C, also reproduced below.



38. The ’463 patent discloses that “DL allocation DL control information may contain PUCCH resource indication information (PUCCH resource information or a PUCCH resource indicator).” *Id.*, 11:1-4. The PUCCH resource indicator “indicates one UL control channel resource, for the transmission of UL control

information,” from among the UL control channel resources in the UL control channel resource set. *Id.*, 11:4-7.

39. Claim 1 of the '463 Patent recites the following limitations, each numbered in the manner presented in the Petition:

1[pre] A method of transmitting uplink (UL) control information by a user equipment, the method comprising:

1[a]: receiving, from a base station, UL control channel resource set configuration information for UL control information transmission; 1[b] determining one of UL control channel resource sets contained in the UL control channel resource set configuration information;

1[c]: determining one of UL control channel resources contained in the determined UL control channel resource set;

1[d]: transmitting UL control information through the determined UL control channel resource,

1[e]: wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment, and

1[f]: wherein the each UL BWP is activated through downlink (DL) control information.

40. Independent claims 4 and 7 also include identical “wherein” clauses, *i.e.*, clauses 1[e] and 1[f], as claim 1. Therefore, while I provide substantial opinions and analysis as to claim 1 below, these opinions and analysis regarding the patentability of claim 1 based on clauses 1[e] and 1[f] also apply to claims 4 and 7.

41. I also reviewed the prosecution history of the '463 patent and note certain arguments and amendments that are relevant to clauses 1[e] and 1[f].

42. During prosecution, the as-filed claims were originally rejected over a combination of asserted art. Ex. 1004, 159-167. In response, the application amended the independent claims to incorporate these features and to distinguish over the prior art relied upon by the examiner—including a reference identified as Yiu—in the stated rejections. Ex. 1004, 68-74.

43. The applicant convincingly argued to the examiner that Yiu “merely teaches about BWP but fails to teach i) receiving any information about each UL BWP” Ex. 1004, 73 (emphasis in original). The applicant also argued that Yiu “does not teach activating each UL BWP through DL control information.” Id. (emphasis in original).

44. In these arguments, which were accepted by the examiner as sufficient to overcome the rejections (Ex. 1004, 50-51), the applicant focused on and emphasized the “each” language in these amendments.

VIII. PETITION GROUNDS

45. The petition asserts the following grounds of unpatentability, each on the basis of obviousness under 35 U.S.C. §103(a).

Ground 1: Claims 1-9 are challenged as obvious over Takeda (Ex. 1007) in view of Yan (Ex. 1010).

Ground 2: Claims 1-9 are challenged as obvious over Marinier (Ex. 1011) in view of Yan (Ex. 1010) and further in view of R1-1711853 (Ex. 1012).

IX. CLAIM CONSTRUCTION

46. I have been informed that claim terms are generally given their ordinary and customary meaning as understood by one of ordinary skill in the art in light of the claims themselves, the specification and the prosecution history pertaining to the patent.

47. I understand that Petitioners consider “a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set” to be a means-plus-function term. Petition, 5. In contrast, the Patent Owner proposes a plain and ordinary meaning for that term.

48. I note that the District Court construed “configured to” to mean “capable of performing the function without modification.” Ex. 1044, 8. In my opinion, this construction is accurate and reflects a POSITA’s understanding of the plain and ordinary meaning of “configured to” without needing to resort to a means-plus-function interpretation. Consistent with the District Court’s order, it is my opinion that the proper construction, if one needs to be adopted, is “a controller

[capable of performing the function without modification, to] determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set.”

49. I also note that configuring a UL BWP and activating a UL BWP are different concepts. This bears on claim construction, namely the claimed requirement of “each UL bandwidth part (BWP) configured for the user equipment.” Under 5G NR, there may be up to four bandwidth parts configured for a user equipment, but under 5G NR, only one bandwidth part may be activated for a user equipment. This is consistent with the ’463 patent’s discussion of BWP activation under 5G NR. *See* ’463 patent, 16:65-17:11. The difference between an UL BWP configured for a UE and an UL BWP that is activated for a UE also appears expressly in the claims. As introduced above, the challenged claims expressly recite, “each UL bandwidth part (BWP) configured for the user equipment.” Additionally, the challenged claims also expressly recite, “the each UL BWP is activated through downlink (DL) control information,” thus calling back through antecedent basis “the each UL BWP” that is configured for a UE, as identified in the prior “wherein” clause. Thus, the plain language of the challenged claims distinguishes between the concept of a UL BWP being configured for a UE and a UL BWP that is activated

for a UE. Simply put, “activated” and “configured for” are different concepts, and should not be viewed as identical. Multiple UL BWPs can be configured for a UE, and one of those UL BWPs can be, but does not have to be, activated.

50. As I will discuss below, the concept of BWP is not disclosed in Yan, and the concept of a UL BWP that is configured for a UE, but not activated, is not disclosed or suggested in Yan or Marinier. These references are directed to 4G LTE technologies, as Dr. Roy agreed, and the concept of a configured-but-not-activated UL BWP was not in the technology vernacular as of 4G LTE.

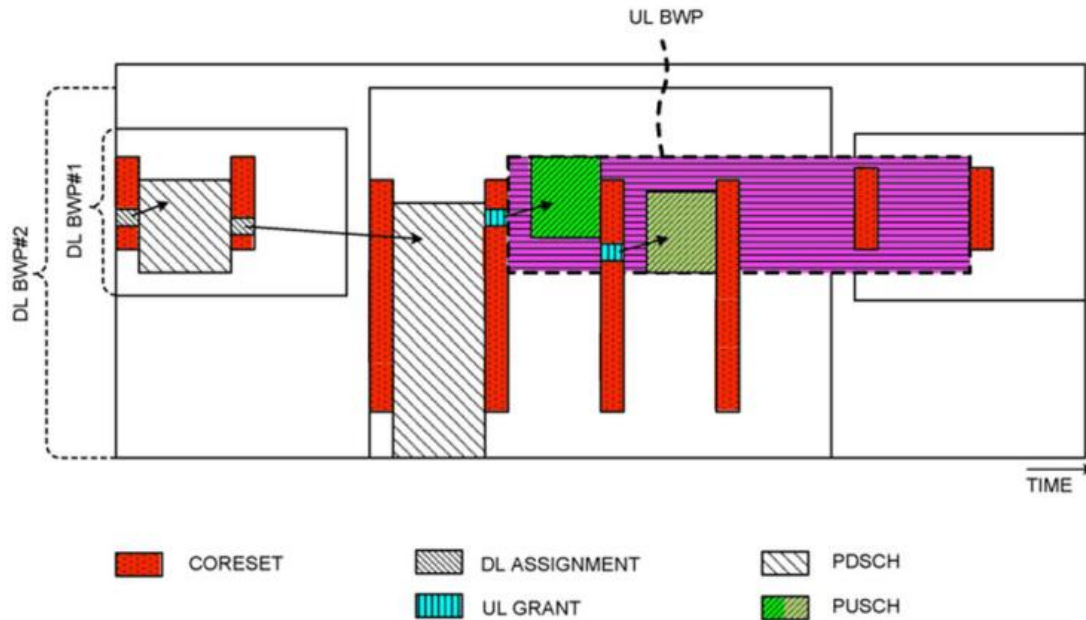
51. In my opinions expressed in this declaration I use the plain and ordinary meaning for the terms of the ’463 patent claims.

X. SUMMARY OF PRIOR ART

A. Takeda

52. Takeda discloses BWP-dependent resource mapping, but Takeda does not disclose distinct UE-specific control channel resource sets for each UL BWP. Further, Takeda emphasizing transmitting according to the uplink grants via PUSCHs, or physical uplink shared channels. Per Takeda, a “user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.” Takeda, [0107]. Petitioner’s annotated version of Takeda’s FIG. 8 is reproduced below:

Ex. 1007, FIG. 8 (annotated)



53. As shown in FIG. 8, the UL BWP is identified in purple, and the green and yellow hashed areas represent the PUSCH, in which Takeda includes the UCI. The user equipment in Takeda monitors the CORESET. The PUSCH transmission is ordered by the base station in the CORESET and UL Grant. Takeda, [0107] (“The user terminal activates the UL BWP based on the UL grant detected in the CORESET. The user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.”).

54. I also note Takeda’s paragraph [0008], which includes a goal of “reduc[ing] the processing load (for example, the processing load due to blind

decoding of each frequency band) in a user terminal,” particularly when using BWPs in a carrier. Takeda, [0008]. In my opinion, a POSITA would consider this goal of reducing a UE’s processing load and energy or power savings when considering whether to modify Takeda or combine Takeda with another reference’s teachings.

B. Yan

55. Yan is directed to 4G LTE scheme (Ex. 2006, 61:21-22 (“Yan was written intended to LTE”)) and does not disclose or suggest to a POSITA the concept of UL BWPs that may be configured, separately from being activated, for a user equipment. Yan fails to disclose any BWPs, and also therefore fails to disclose a concept of a BWP that is configured but not activated for a user terminal. In my opinion, Yan teaches a POSITA to have resource sets for the active spectrum, or component carrier, that is usable by a user terminal. In other words, even if Yan were combinable with a reference that discloses BWPs, the teaching of Yan that would be understood by a POSITA would be to have resource groups for the BWP that is to be activated and used by the user terminal. Yan discloses a scheme that adjusts resources capacity (to match the UCI size) that might increase the UE’s processing load and energy or power consumption. Also, Yan aims to minimize signaling overhead and simplify control channel configuration, which contrasts with

adding UL control channel resource set configuration information supporting multiple BWPs.

C. Marinier

56. Marinier describes multi-MAC-instance uplink operation from a wireless transmit/receive unit (WTRU) to multiple serving sites and is directed to 4G LTE technology, not 5G NR technology. Marinier does not use the BWP concept at all in the 5G NR sense, because Marinier's BW parts used in the LTE multi-carrier context are frequency partitions, but do not include an activation/deactivation mechanism. Also, Marinier uses frequency partitioning to avoid collisions, which is different from 5G NR's use of BWPs. Marinier does not mention UL control channel resource sets or determining one of the UL control channel resource sets based on a size of the UCI, and also omits any disclosure regarding the 5G NR concept of activating a BWP.

57. Marinier's relevant disclosure regarding bandwidth parts appears in [0130], quoted below:

58. "In an example, the bandwidth (BW) utilized by the different serving sites may be divided into a plurality of BW parts. Each serving site may be configured to utilize one or more of the BW parts for communicating with the WTRU. For example, *each BW part may be treated as a component carrier in*

carrier aggregation. For example, each BW part may include corresponding PUCCH and PUSCH resources. Some bandwidth parts may include PUCCH without a PUSCH (e.g., for CSI reporting to a serving site) and/or PUSCH without PUCCH.” Marinier, [0130].

D. R1-1711853

59. R1-1711853 is a general proposal under 5G to activate/deactivate bandwidth parts using such mechanisms as higher level signaling, DCI, a timer, or a configured time pattern. Looking at R1-1711853 alone, it is not possible to know whether 3GPP adopted the disclosures of this reference as industry standard practices.

E. Summary of Opinions

60. Petitioners’ primary references, Takeda and Marinier, are each relied upon in the Petition to disclose BWPs. But in my opinion, neither Takeda nor Marinier discloses or suggests the claimed requirement of uplink *control channel resource sets* that are *configured for each uplink BWP* that is configured for the user equipment. As I explained above, while Takeda discloses BWP-dependent resource mapping, Takeda does not disclose distinct UE-specific PUCCH (physical uplink control channel) resource sets for each configured UL BWP. Petitioner proposes combining each of these primary references with Yan in order to

incorporate Yan's use of resource sets with Takeda's and Marinier's BWPs, but in my opinion, the basis set forth in the Petition for these combinations is tainted by hindsight. The Petition lacks credible motivation to recreate the challenged claims specifically as claimed.

61. The Petition relies on Yan's disclosure that its method avoids UCI mismatch, namely allocating UCI transmission resources that are excessive or insufficient to carry the quantity of bits required in the UCI transmission. As a result of this mismatch, Yan discloses that "utilization of the uplink channel is relatively low or UCI bits are discarded." Yan, 1:63-2:6. But a POSITA reading primary reference Takeda would understand that Takeda does not suffer from this problem of UCI mismatch, and already contains and adopts 5G NR solutions that avoid the 4G LTE-specific problem of UCI mismatch that Yan was trying to solve. At minimum, because Takeda adopts BWPs as used in 5G NR, a POSITA would have looked to 5G NR concepts for addressing UCI efficiencies, not to previous generation (4G LTE) technology disclosed by Yan that increases the UE processing burden unnecessarily. Therefore, in my opinion, a POSITA would not view Takeda as requiring the solutions taught by Yan to avoid UCI mismatch. There is simply no reason to modify Takeda in view of Yan, as alleged in the Petition.

62. Further, in my opinion, Yan and Takeda address different, unrelated problems. Yan addresses inefficiencies in control signaling for UCI to avoid underutilizing uplink resources. Yan, 2:1-6; 2:64-3:3. Yan aims to minimize signaling overhead and simplify control channel configuration. Yan, 2:10-15 (“to reduce consumption of downlink channel resources”). Takeda on the other hand is concerned with reducing UE power consumption and blind decoding overhead by activating or deactivating bandwidth parts (BWPs). Takeda, [0029], Abstract. Takeda introduces added signaling complexity, such as control signaling to support multiple BWPs. Combining Takeda with Yan would require substantial modification to Yan, including introducing BWP-level partitioning into Yan’s resource model. Thus, a POSITA aiming to reduce signaling, as Yan proposes, would be disincentivized from adopting Takeda’s complex signaling approach. In addition, Yan requires additional UE processing to adjust resources capacity (to match UCI size), thus resulting in extra UE power consumption, in contrast to Takeda’s reduced UE power consumption goal associated with use of BWPs.

63. The asserted combination of Marinier and Yan suffers from different—but also fatal—problems. While Petitioners contend that Marinier discloses the concept of BWPs, even Petitioners also acknowledge that Marinier does so in the environment predating 5G NR, e.g., 4G LTE, which does not adopt BWPs within

the standard. Therefore, a POSITA would understand that Marinier is directed to a precursor to 5G NR that does not recognize the 5G NR-based concept of BWPs, and also that Marinier adopts frequency segregation for the purpose of avoiding conflicts and collisions in transmissions. Like Marinier, Yan is exclusively directed to 4G LTE. This is important because the challenged claims include and claim the concept of BWPs being configured for a user equipment. Under 5G NR, BWPs that are configured for a user equipment do not have to be active for uplink or downlink, and therefore may be configured but inactive. Neither Marinier nor Yan disclose or suggest this concept, and therefore do not disclose or suggest the '463 patent's claimed concept of configuring multiple resource sets for every BWP that is configured for a user equipment, regardless of whether those BWPs are active. Indeed, a POSITA reading Yan would not have a reason to configure multiple resource sets for each BWP that is configured for a user equipment, and instead at best would instruct a POSITA to only configure resource sets for the component carrier (i.e., the active channel). Thus, even if combined, Yan and Marinier fail to disclose or suggest the claimed concept of multiple BWPs that are configured for a UE.

64. Additionally, it is my opinion that a POSITA would understand that Marinier, Yan, and R1-1711853 address different problem domains. Marinier

describes uplink operation from a wireless transmit/receive unit (WTRU) to multiple serving sites. Since this operation might cause uplink collisions (if some transmissions use the same uplink resources), Marinier teaches frequency/time separation to avoid such uplink collisions. There is no reason that a POSITA would attempt to combine references directed to multi-site uplink conflict resolution (Marinier), reduced signaling overhead for PUCCH resource set selection (Yan), and BWP activation/deactivation (R1-1711853). Marinier does not use BWPs in a 5G NR context, and instead selects uplink resources to avoid uplink collisions, which is unrelated to BWPs and UL control channel resource sets or determining one of the UL control channel resource sets based on a size of the UCI.

XI. ANALYSIS OF ASSERTED GROUNDS

A. Yan is Not Applicable to 5G NR and BWPs

65. Petitioners allege that Yan's teachings for avoiding UCI mismatch support a reason to combine Yan with Takeda in Ground 1, and Yan with Marinier and R1-1711853 in Ground 2. Yan is directed to 4G LTE scheme (Ex. 2006, 61:21-22 ("Yan was written intended to LTE")) and does not disclose or suggest to a POSITA to even consider which BWPs may be configured for a user equipment. While Yan's component carrier is activated for a user terminal, Yan fails to disclose

any BWPs, and also fails to disclose the concept of a BWP that is configured—rather than activated—for a user terminal.

66. Yan teaches a POSITA to have resource sets for the active spectrum that is usable by a user terminal. In other words, even if Yan were combinable with Takeda and Marinier/R1-1711853, the teaching that would be understood by a POSITA would be to have resource groups for the BWP that is to be activated and used by the user terminal.

67. Having resource groups for *each* UL BWP that is configured for a user equipment requires a knowledge of how many and which UL BWPs are configured for the user equipment. This is not something that Yan teaches or suggests because Yan only recognizes an active component carrier, not BWPs that may be configured for a user equipment.

B. Ground 1: This Ground Fails for Lack of Credible Motivation to Combine Takeda and Yan

68. In Ground 1, the petition asserts that claims 1-9 are obvious over the combination of Takeda in view of Yan. The Petition specifically proposes to combine Yan's resource sets and Takeda's BWPs. But while Takeda discloses BWP-dependent resource mapping, Takeda does not disclose distinct UE-specific control channel resource sets for each UL BWP. Takeda emphasizes transmitting

according to the uplink grants via PUSCHs. Per Takeda, a “user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.” Takeda, [0107].

69. The Petition proposes to combine Takeda with Yan to avoid UCI mismatch, but Petitioners also fail to realize that Takeda does not suffer the problems of UCI mismatch because 5G NR already includes efficient techniques for UCI transmission. A POSITA either would have understood that Takeda already incorporates 5G NR solutions, or at least would have recognized that adopting Yan’s 4G LTE-specific solution into a 5G NR system like Takeda’s would have been undesirable since Yan fails to account for use of BWPs. Yan’s proposal is applicable to 4G LTE, while Takeda is based on the 5G NR framework; combining Yan and Takeda in the manner asserted would be technically inconsistent due to standard-generation differences. In Takeda, the PUSCH transmission is ordered by the base station in the CORESET and UL Grant. Takeda, [0107] (“The user terminal activates the UL BWP based on the UL grant detected in the CORESET. The user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.”). There is no indication in Takeda that its 5G NR system would suffer from UCI mismatch. Also, Dr. Roy testified during deposition that he could not tell whether Takeda suffers from UCI mismatch based on the drawings in Takeda. Ex. 2006, 91:20-92:4 (“Q: So there's nothing about Figure 9 that would tell you whether there's

a mismatch of the UCI information and uplink resources in uplink bandwidth part number 2. Is that right? ... A: No, I couldn't tell.”).

70. In my opinion, it has been well-known to POSITAs that 5G NR adopted a different solution than Yan for avoiding UCI mismatch. Specifically, 5G NR supports multiple UCI formats (short/long; ≤ 2 -bit vs > 2 -bit) for that exact reason. An example might be HARQ feedback ACK/NAK bits fitting into a small UCI format, whereas HARQ feedback ACK/NAK with a scheduling request (SR) for an uplink grant, or channel state information (CSI) may require a larger payload and associated UCI format. Further, the type of uplink transmission, and the information to be transmitted (e.g. HARQ ACK/NAK, CSI), is specifically requested by the base station via DCI and/or RRC, thus avoiding UCI mismatch. A POSITA would readily understand that 5G NR UCI formats reflect how Takeda would have avoided UCI mismatch, and would not have looked to Yan for some other solution for a problem that did not exist in 5G NR.

71. Based on Dr. Roy's deposition testimony, it appears that he is creating a scenario where the base station in 5G NR does not know how many bits a user equipment will transmit in the UCI. Dr. Roy testified about a scenario where “the UE has decided to send traffic on the uplink that the base station, when it sent in the request [for UCI], was not aware of.” Ex. 2006, 60:2-17. But this fails to

acknowledge 5G NR's existing solution of the base station requesting exactly what it wants from the user equipment, with the user equipment determining the correct resources for that transmission, and the user equipment only sending what was requested. He seemed to acknowledge a more accurate view of how 5G NR works earlier in his deposition. Ex. 2006, 38:3-10 (Dr. Roy testifying that "the size of the UCI is dependent on various factors *which are sent from the base station to the UE*. And as a result, the -- the type and the form of *what is being asked for the UE to report* determines the bandwidth -- the portion of the bandwidth resources, the frequency resources that set -- that will be used.") (emphasis added). In 5G NR, each configured resource set is targeted at specific UCI size ranges. This ensures that the UE selects a resource set that fits the UCI without truncation or excessive padding, i.e., avoiding UCI mismatch. In my opinion, Yan's prior-generation solution would not have been desired or needed in Takeda.

72. I also note that Dr. Roy conceded that he did not know whether Yan's solution for avoiding UCI mismatch was ever adopted within the 4G LTE standard, and therefore could not answer whether Yan's solution was considered desirable within the 3GPP standards community or even within 4G LTE. Ex. 2006: 92:5-22 ("But if you're asking whether the specific steps of Yan ever made it into a TS, I do not know."); *id.*, 93:1-5 (testifying that he does not know "whether the specific steps

of Yan ever made it into a TS or technical specification for 5G new radio”). In fact, I confirmed that Yan’s uplink resources resizing/adjusting solution has not been adopted or included in both the 4G LTE and 5G NR specifications to avoid increasing UE processing load.

73. The Petition also argue that Yan’s methodology would somehow reduce power consumption in Takeda. But this theory is unsupported as well. Takeda already adopts BWPs as an improvement in power consumption over Yan’s prior generation component carrier technology, and there is no credible argument in the Petition that Yan’s 4G LTE solution would somehow improve power usage in a 5G NR system. Dr. Roy’s declaration states, “from the UE perspective, a POSITA would have been motivated to modify Takeda’s method for transmitting UL signals to incorporate Yan’s resource allocation method to more efficiently use UE power reserves. Using Yan’s resource allocation method would further Takeda’s stated goal of reducing UE power consumption when transmitting UL signals.” Ex. 1002, ¶107 (citing Takeda, [0013]). However, the user equipment in Takeda monitors the CORESET, which (per Takeda’s FIG. 8 and FIG. 9) occupies less than all the available spectrum of the BWP, and occupies even less than the DL BWP that is activated at a given time. Further, the BWP is not consumed completely by control, but instead includes both control and data in the PUSCH. In any event, the portion

of the BWP that is actually monitored by the UE and used for uplink control data is already efficient in Takeda and does not compel a combination with Yan.

74. Dr. Roy conceded at deposition that comparing power efficiencies in 4G LTE and 5G NR are challenging at best. Ex. 2006, 41:10-13 (“So I don't believe you can make a direct, you know, efficiency comparison to 4G LTE because there are various parameters that are different, notably the carrier bandwidths are different.”); *id.*, 39:9-41:17. Further complicating Petitioners’ process of trying to compare power efficiencies by looking solely at bandwidths, the 4G LTE carrier bandwidth is different from a BWP bandwidth in 5G NR, and the DL bandwidths actually used for CORESET monitoring and UCI transmissions in Takeda occupy a fraction of the available BWPs.

75. In my opinion, the Petition advances no meaningful argument that using Yan’s resource set mechanism applicable to 4G LTE could somehow yield a power savings for either CORESET monitoring or UCI transmission in Takeda’s 5G-specific technology. Further, I note that Yan’s adjustable scheme (which may also dynamically increase or decrease resources capacity to fit the UCI, per Yan, 22:26-50) requires more processing in the UE and therefore more power consumption.

76. Dr. Roy characterizes “reducing UE power consumption when transmitting UL signals” as a “stated goal” of Takeda (Ex. 1002, ¶107), but he overlooks another “stated goal” in [0008] of Takeda. There, Takeda discloses the desire of “reduc[ing] the processing load (for example, the processing load due to blind decoding of each frequency band) in a user terminal,” particularly when using BWPs in a carrier. Takeda, [0008]; Ex. 2006, 54:7-14 (“Q: Do you believe that one of Takeda's stated goals is reducing a processing load of the user terminal? A: So if your stated goal maps to problem addressed or solved by the invention, yes.”).

77. While the 5G NR solution for UCI mismatch serves this goal of reducing UE processing load by identifying the resources to be used for UCI transmissions and identifying exactly what control data the UE should send via the UCI, the Petition’s combination of Yan with Takeda pushes additional determinations to the UE and contradicts this goal by increasing the UE processing load. Thus, in my opinion, the Petition’s proposed modification of Takeda is directly contrary to Takeda’s “stated goal” of reducing the UE’s processing load.

78. Finally, Petitioners argue that a “POSITA would have been motivated to modify Takeda with the teachings of Yan to provide backwards network compatibility” Pet., 13. Petitioners continue, “a POSITA would have recognized benefits for 5G-capable UEs to continue to connect with 4G LTE BSs.”

Pet., 14. They then assert that “[t]o facilitate backwards compatibility, a POSITA would recognize efficiencies in implementing Yan’s method of allocating UL channel resource sets (e.g., the steps of Yan’s FIG. 4) with Takeda’s 5G NR BWPs.”

Pet., 15. But this is illogical. Backwards compatibility is achieved by having a user equipment that is able to comply with multiple standards, such as both 5G NR and 4G LTE, such that it could comply with either standard.

79. For example, a router that is 802.11ac-compatible and therefore operates strictly on a 5Ghz band would also need to include a 2.4Ghz radio to comply with 802.11g, which operates strictly on a 2.4Ghz band. But a router that includes only a 5GHz radio and programming to only comply with the 802.11g standard would not be able to function according to either standard.

80. Ensuring backwards compatibility does not mean that a POSITA would be motivated to incorporate previous generation, 4G LTE-standards solutions into a system designed to operate according to newer 5G NR standards. Mixing standards and behaviors does not ensure backwards compatibility, and instead creates a risk that the user equipment might not comply with either standard because it is not fully compliant with either standard.

81. For these reasons, it is my opinion that the Petition fails to advance a credible reason to combine Takeda and Yan as asserted. Takeda (power reduction

via BWPs) and Yan (dynamic resource adjustment) are directed to inconsistent goals because Yan requires UE-side runtime calculations, thus increasing processing load and power draw, contrary to Takeda's goal of power reduction at the UE. Therefore, it is my opinion that the challenged claims are not unpatentable at least because the proposed combination of prior art is unsupported by the necessary motivation.

C. Ground 1: The proposed combination of Takeda and Yan fails to teach or suggest at least limitation 1[e]

82. It is also my opinion that the proposed combination of Takeda and Yan fails to teach or suggest limitation 1[e].

83. As I discussed above, Takeda discloses BWP-dependent resource mapping, but does not disclose distinct UE-specific UL control channel resource sets for each UL BWP, as required by the claim. Takeda discloses transmitting according to the uplink grants via PUSCHs. Per Takeda, a “user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.” Takeda, [0107].

84. The Petition proposes that a POSITA would have been motivated to combine Yan and Takeda such that Yan's UL resource sets would have been configured for each UL BWP configured for the user equipment. Pet., 34 (“When incorporating Yan's teachings for allocating UL resources, including the inclusion of UL control channel resource sets, with Takeda's BWP based UL transmission method ..., the resulting UL resources and the UL control channel resource sets that

include those resources would have been configured for BWPs that are configured for the UE.”). But this manner of combining Takeda and Yan in an attempt to cover all claimed features is flawed given that Takeda transmits UCI via shared channel for one active uplink BWP at a time, and Yan only sends resource sets for the active component carrier. Even if Takeda and Yan could be combined, Petitioners advance no credible reason why a POSITA would have been motivated to configure UL control channel resource sets for each UL BWP configured for the user equipment when only one UL BWP would be active according to Takeda’s disclosures.

85. Further, I note the Petitioners’ theory regarding Takeda, which fails to adequately address how Takeda allegedly discloses the claimed “each” features in the elements 1[e] and 1[f]. In addressing element 1[f], “wherein the each UL BWP is activated through downlink (DL) control information,” Petitioners’ challenge is limited to quoting two sentences from Takeda without analysis. Pet., 35. Petitioners quote Takeda’s sentences: “[t]he user terminal may control activation and/or deactivation of one or more UL BWPs configured for the user terminal based on the explicit or implicit indication information. The explicit indication information may be, for example, DCI [downlink control information] (UL grant).” Pet., 35. But a POSITA would know that “one or more” is not the same as “each.” This brief quotation of Takeda fails to explain how Takeda allegedly discloses that “the *each*

UL BWP is activated through downlink (DL) control information” in element 1[f]. (emphasis added).

86. Petitioners also fail to address the “each” aspect of element 1[e]. Initially, Petitioners contend that Takeda “teaches multiple UL control channels ... are scheduled for transmission within each particular bandwidth part.” Pet., 32. But the cited portions of Takeda provide no disclosures supporting this contention as it relates to “each UL bandwidth part (BWP)” as claimed. Petitioners quote Takeda’s [0117], which addresses contents of “UL BWP #1.” Continuing their limited focus on only one BWP, Petitioners state that “FIGS. 8-9 of Takeda show that multiple UL resources are configured for a *single UL BWP*.” Pet., 32 (emphasis added). Petitioners continue, concluding that “Takeda discloses that sets (encompassing multiple UL resources) are configured for a BWP.” Pet., 33.

87. Petitioners acknowledge that “BWPs are configured for the user terminal,” Pet., 34 (emphasis omitted), but fail to identify which BWPs are configured for a user terminal. Rather, Petitioners simply rely on Takeda’s vague disclosure regarding “one or more BWPs configured for the user terminal” without addressing the claim requirements that must be satisfied for *each* UL BWP configured for a user terminal. Because the Petitioners are not specific about the number or identity of BWPs configured for a user terminal, Petitioners also fail to

establish that Takeda teaches the claimed features of element 1[e] for *each* UL BWP configured for a user terminal. Indeed, a user terminal with four configured UL BWPs but without resource sets configured for each of those four configured UL BWPs would fail to satisfy the claim language.

88. Therefore, even if Takeda and Yan were combined, it is my opinion that the combination would still fail to disclose or suggest element 1[e], which requires that “UL *control channel* resource sets are configured for *each UL bandwidth part (BWP) configured* for the user equipment.” (emphasis is mine).

D. Ground 2 also fails to teach a BWP that is configured for a user equipment and therefore fails to demonstrate that the challenged claims are obvious

89. As noted above, it is undisputed that Yan fails to disclose any BWPs, and also therefore fails to disclose a concept of a BWP that is configured for a user terminal. While Petitioners propose to combine Marinier with Yan, even Marinier fails to disclose a concept of a BWP that is configured but not activated for a user terminal.

90. Marinier uses frequency partitioning to avoid collisions in transmissions, and refers to these partitions as BW parts in [0130]. Each BWP of Marinier may be treated as a component carrier, meaning that each BWP includes PUCCH and/or PUSCH resources to be used for transmissions. Marinier does not

use the BWP concept at all in the 5G NR sense, because Marinier's BW parts used in the LTE multi-carrier context are frequency partitions, but do not include an activation/deactivation mechanism or control resource sets. Rather, Marinier's entire purpose is to avoid collisions and interference between concurrent transmissions in different frequency bands that are activated and used for transmission. Marinier discloses that "[w]hen used herein the term concurrent transmission to multiple serving sites may refer to one or more of simultaneous transmission to multiple serving sites at the same time (e.g., transmitting to multiple serving sites in the same subframe using the same and/or different frequency resources), transmission to multiple serving sites using the same frequency resources within a specified amount of time (e.g., transmitting to multiple transmissions to different serving sites using the same frequency within a relatively close amount of time and/or during the same RRC Connected session), and/or the like." Marinier, [0100]. Marinier's paragraph [0103] specifically discusses an example of "concurrent transmission to multiple serving sites," and Marinier's paragraph [0129] discloses an example where "physical channels associated with different MAC instances may be used in the same subframe if the transmission/reception of the physical channels occurs in different frequency channels and/or frequency bands" This informs a POSITA that Marinier is directed to frequency channels or

frequency bands that are activated specifically for handling concurrent transmissions to avoid interference and collisions.

91. Marinier's DCI controls UL scheduling but never activates a BWP entity. The Petition relies on an unsupported theory of inherency to argue that "a POSITA would further recognize that a bandwidth part 'containing' the PUCCH used for UL transmission *would need to be activated* to perform the UL transmission." Pet., 53 (emphasis added). But this conclusion assumes that Marinier would have BW parts that are not activated, and this is not accurate. There is no disclosure in Marinier of inactive BW parts, and certainly no disclosure of "activation through DL control information." Like Yan, Marinier also does not disclose or suggest a BWP as a component carrier that is configured but not activated for a user terminal. As I discussed above, Marinier's frequency segregation is designed specifically to enable concurrent transmissions in multiple frequency channels or bands.

92. Petitioner's proposed motivation to combine Marinier and Yan is set forth beginning at p. 44 of the Petition, and proposes "to incorporate Yan's UL channel resource allocation methods to determine the most efficient UL channel resource based on a size of the UCI." Pet., 44-45 (citing Ex1002, ¶201). Without citing to any expert support, Petitioners allege that Yan's disclosure of "mismatch

of UL channel resource capacity and UCI size is applicable for Marinier's BWP-based UL signaling configuration." Pet., 45 (no citation to evidence). Concluding, Petitioners assert that "[u]sing Yan's resource allocation methodology within UL BWPs of Marinier would ensure that UL resources are used efficiently by UEs." Pet., 45.

93. In my opinion, a POSITA reading Yan and Marinier would conclude that ensuring efficient use of UL resources is only relevant for the BWPs that are actually used for UE transmissions. A POSITA familiar with both Yan and Marinier would not have been motivated to combine these references to disclose or suggest having control channel resource sets for each UL BWP configured for a UE, and then activating an UL BWP via DCI. Rather, even if Yan were combined with Marinier/R1-1711853, the teaching that would be understood by a POSITA would be to have resource groups for the BWP that is actively used by the user terminal. Yan does not disclose and does not suggest to a POSITA to even consider which BWPs may be configured for a user equipment, such that resource sets would be configured for all configured BWPs regardless of activation status.

94. Petitioners proposed combination of Yan and Marinier in an effort to have resource sets for each BWP configured for a UE, without regard for whether a BWP is active and used for transmission, is unsupported because neither Yan nor

Marinier would suggest having resource sets based on configuration status rather than activation status of a BWP. Even in the Petitioners' combination of Marinier, Yan, and R1-1711853, element 1[e] is absent and would be neither disclosed nor suggested.

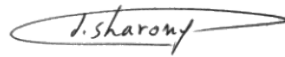
95. Additionally, Petitioners rely on Marinier to disclose the “use of BWPs for communicating between a WTRU and a serving site.” Pet., 52. Marinier discloses that “[e]ach serving site may be configured to utilize one or more of the BW parts for communicating with the WTRU,” and “each BW part may include corresponding PUCCH and PUSCH resources.” Pet., 52 (quoting Marinier, [0130]). Petitioners then point to a different section of Marinier, which discloses that “BWPs may be specifically configured for each WTRU.” Pet., 52 (citing Marinier, [0147]). But these citations are not explained by Petitioners, and in my opinion they miss the point of establishing the claimed characteristics of “each UL bandwidth part (BWP) configured for the user equipment” in element 1[e]. In particular, while Marinier discloses that BWPs may be specifically configured for each WTRU, Marinier fails to disclose that “UL control channel resource sets are configured for each” such UL BWP configured for a user equipment.

XII. CONCLUSION

For the reasons expressed above, it is my opinion that the Petition and its supporting materials fail to demonstrate that challenged claims 1-9 would have been obvious to a POSITA at the time of the invention.

I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.

Executed on: 10/27/2025

A handwritten signature in black ink, appearing to read "J. Sharony", enclosed within a horizontal oval shape.

DR. JACOB SHARONY

Seasoned professional with over 35 years experience and expertise in information communications technologies (ICT), wireless networks, mobile devices/applications, data capture and sensing; visionary, creative and innovative with strong technology and business skills.

EXPERIENCE

MOBIUS CONSULTING, Huntington Station, NY

2004 –

Founder, Principal Consultant

- Professional consulting services in mobile wireless strategy, technologies, systems and applications.
- “Trusted Advisor” role facing large clients in telecom, vertical enterprises and government, building trust and relationships.
- Expertise includes WiFi, 4G LTE and 5G, WiMAX, picocell/femtocell, DAS, mesh networking, Internet of Things (IoT), M2M, RFID, RTLS, smart antennas, MIMO/beamforming, cloud computing, mobile crowd sourcing/sensing, enterprise mobility, security protocols, mobile embedded devices, device management, mobile applications/services, LBS, VoIP, video streaming, Zigbee, Bluetooth, sensor networks, RTLS, smart grid, m-health, m-learning, smart home networking.
- System and network protocol analysis, modeling and simulations of wireless systems (e.g., WiFi, LTE) for network performance assessment and optimization.
- Participated in a lead role in several medium-large projects in various vertical, enterprise and government/military markets, e.g., smart grid, mobile health, WiFi and 4G deployments.
- Selected consulting engagements are listed below: Lattice Semiconductor, SiBEAM, Powerwave Technologies, Time Warner Cable, and Corning-MobileAccess.

COLUMBIA UNIVERSITY, New York, NY

2010 –

Adjunct Professor

- Professor of Electrical Engineering. Teaching graduate courses on advanced wireless technologies: mmWave Wireless Communications and Applications for 5G/6G, Wireless Sensing (RFID, RTLS, M2M communications, smart grid/energy, smart infrastructure, intelligent transportation, m-health).

LATTICE SEMICONDUCTOR, Sunnyvale, CA

2014 – 2016

CTO Office Senior Advisor

Developing 5G solutions using mmWave and Phased Array Antenna technologies. Applications include ‘wireless fiber’ backhaul/front-haul, connected cars, in-home connectivity.

SIBEAM, Silicon Valley

2014 – 2016

Technology Strategy Senior Consultant

Developing intelligent millimeter wave (60 GHz) technologies for wireless communications (802.11ad) and fixed access solutions for 5G.

POWERWAVE TECHNOLOGIES, Santa Ana, CA

2011 – 2013

CTO Office Senior Principal Consultant / VP Innovation

- Leading innovation, strategy and development of HetNets, DAS and small cells (picocell) solutions using 4G LTE and WiFi technologies to enhance coverage and capacity of wireless network infrastructure.

CENTER OF EXCELLENCE IN WIRELESS & IT, SUNY, Stony Brook, NY

2006 – 2010

Director, Network Technologies Research Division

- Leading network technologies research, development and commercialization efforts
- Industry liaison, working on smart energy, wireless healthcare and intelligent transportation solutions.
- Deployed mobile WiMAX pico/femto solution as part of the 4G-campus initiative.
- Key contributor to the Long Island Broadband Wireless Access Initiative using WiFi and 4G.

TIME WARNER CABLE, Stamford, CT

2007 – 2008

Wireless Strategy & Development Senior Consultant

- Worked on a large wireless project involving WiFi, WiMAX and 3G with advanced mobile devices.
- Developed concept and product requirements documents, architecture and RF design, and test plans.
- Supported the business development group on femtocells models, MVNO's models and services, etc.

MOBILE-ACCESS (Acquired by Corning), Vienna, VA

2006 – 2008

CTO Office DAS Strategy & Development Senior Consultant

- Worked with the CTO and senior engineers to develop WiFi DAS systems.
- Developed detailed analysis and novel method to support MIMO (802.11n) in DAS systems.

MOTOROLA (formerly Symbol Technologies), Holtsville, NY

1997 – 2005

Senior Director, Technology Strategy and Development

2003 – 2005

- Served as “the eyes of the company” – Charter was to identify and evaluate emerging/disruptive technologies, and conduct technology/business due diligence of possible partners/acquisitions. Team leader.
- Guided the company technology roadmap by generating Technology Position Statements (TPS). Selected topics include: 802.11a/b/g migration strategy, 802.11e (QoS), Broadband Wireless Access - 802.16d/e fixed and mobile WiMAX, mesh networks, RFID, RTLS, and MIMO. These TPS were fact based and relied on results obtained through modeling, analysis and simulations.
- Explored a new family of products based on multi-point MIMO architecture in mesh wireless networks.
- Investigated VoIP capacity in 802.11a/b/g networks and initiated work on admission control algorithms/policies.
- Researched and developed new mobile applications delivering multimedia-rich content to heterogeneous networked mobile devices.
- Developed strategic alliances and led technology initiatives with technology/business partners.
- Participated actively in IEEE 802.11, 802.15 and 802.16 standards meetings.
- Awarded several patents.

Senior Director, Research and Development

1997 – 2003

- Initiated and led several R&D programs in wireless LAN technologies: intelligent access point, reliable multicast video streaming, mobile device management/security and spatial wireless switching.
- Conceived, investigated and developed a novel wireless switching architecture based on MIMO technology.
- Conducted innovative research in WLAN QoS, Bluetooth interference mitigation, multicast video streaming, mobile security, RFID, RTLS - location tracking (RSSI/TDOA), VoIP and smart antennas.
- Participated in strategic planning and impacted the technology/business direction of the company.
- Awarded several patents.

BAE SYSTEMS, Greenlawn, NY

1994 – 1997

Research Scientist

- Led the advanced mobile networking group.
- Developed tactical mesh-based wireless network systems for DoD.
- Worked on advanced antenna techniques including beam steering/switching.
- Awarded several patents.

NEC RESEARCH INSTITUTE, Princeton, NJ

1992 – 1994

Research Fellow

- Worked on optical interconnects for parallel processing.
- Investigated multi-dimensional switches using wavelength, space and time.
- Designed a wavelength router/switch using free-space optics.

IBM RESEARCH CENTER, Hawthorne, NY

1990 – 1992

Research Associate

- Developed and prototyped a gigabit switch.
- Built a testbed of multi-wavelength optical network.
- Developed algorithms for WDMA using AO tunable filters.

Head of Fiber-optics Systems Engineering

- Pioneered security products using fiber optic sensors.
- Conducted research & development in fiber optic sensors.
- Co-developed and deployed a large fiber optic data communications network.

EDUCATION

COLUMBIA UNIVERSITY, New York, NY

- Ph.D., Electrical Engineering, 1993.
- M.Phil, Electrical Engineering, 1991.

TEL AVIV UNIVERSITY, Tel Aviv, Israel

- MBA, Recanati Business School, 1989.
- MSc., Electrical Engineering, 1984.
- BSc., magna cum laude, Electrical Engineering, 1979.

PUBLICATIONS / PATENTS / OTHER

- Numerous publications in proceedings and conference papers.
- Numerous US and international patents issued.
- Served on several government agencies expert panels (NSF, NIH).
- IEEE Life Senior Member.
- Featured speaker on several industry sponsored webinars.
- Served as an expert witness/consultant in District Court, IPR, PGR, ITC, FRAND, PCA, AAA cases.

COURSES TAUGHT

- Introduction to Auto ID and Data Capture (AIDC) Technologies (State University NY, Stony Brook)
- Wireless Sensing Networks (Columbia University)
- mmWave Communications and Applications for 5G/6G (Columbia University)

RECENT EXPERT WITNESS CONSULTING¹

- 2025: Brightsky LLC v. Plover Bay Technologies LTD. et al. (Litigation)
- 2025: Samsung Electronics v. KPN (IPR)
- 2025: Pegasus Wireless v. Verizon Wireless et al. (Litigation)
- 2024: Cisco Systems Inc. v. Video Solutions (IPR)
- 2024: S.M.R Innovations LTD and Y.M.R Tech LTD v. Apple (Litigation)
- 2024: Zebra Technologies v. OnAsset Intelligence (Litigation)
- 2023: Varia Holdings v. Apple (Litigation)
- 2023: Maxell Ltd. v. Samsung Electronics (Litigation)
- 2023: Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions (IPR)
- 2023: OZMO Licensing v. Dell Technologies (Litigation/IPR)
- 2022: Howlink Global v. AT&T (Litigation)
- 2022: Cleveland Medical Devices v. ResMed Corp (Litigation/IPR)
- 2022: Lone Star Systems v. Zebra Technologies (Litigation/IPR)
- 2022: Telecom Network Solutions v. AT&T, Verizon, and T-Mobile (Litigation/IPR)
- 2021: BillJCo v. Apple (Litigation/IPR)
- 2021: BillJCo v. Cisco Systems et al. (Litigation)
- 2021: Zebra Technologies v. OnAsset Intelligence (ITC)
- 2021: CellSpin Soft v. Under Armour (Litigation)
- 2021: CellSpin Soft v. Nike (Litigation)

¹ Represented parties are underlined.

- 2021: Intellectual Ventures v. Hewlett Packard Enterprise (Litigation/IPR)
- 2021: AEGIS v. Hisense (Litigation)
- 2020: Soter Technologies v. IP Video Corp. et al (Litigation)
- 2020: Intellectual Tech v. Zebra Technologies (Litigation)
- 2020: Uniloc v. Apple (Litigation)
- 2020: American Patents v. Juniper Networks (Litigation)
- 2020: Proxicom Wireless v. Target Corporation (Litigation)
- 2020: Sol IP v. AT&T et al. (Litigation)
- 2019: Cellular Evolution v. AT&T et al. (Litigation)
- 2019: Philips v. HTC (Litigation, UK)
- 2019: Ericsson v. Tishman Interiors (AAA Arbitration)
- 2019: Uniloc v. Samsung, Huawei (Litigation)
- 2018: Intel et al. v. Hera Wireless (IPR)
- 2018: Deutsche Telecom v. The Republic of India (UNCITRAL Arbitration, Paris Tribunal)
- 2017: Devas v. The Republic of India (UNCITRAL Arbitration, The Hague Tribunal)
- 2017: RPX Corp. et al. v. Iridescent Networks (IPR)
- 2017: Intellectual Ventures v. FedEx (Litigation)
- 2017: FedEx v. Intellectual Ventures (IPR)

PREVIOUS TESTIMONY

- *Deutsche Telekom AG v. The Republic of India*, PCA Case No. 2014-10 (UNCITRAL) Expert Reports + Arbitration Hearing.
- *Devas (Mauritius) Ltd. et al v. The Republic of India*, PCA Case No. 2013-09 (UNCITRAL) Expert Reports + Arbitration Hearing.
- *Philips v. HTC*, Claim HP-2015-000063 (UK) Expert Report.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01419 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01736 (PTAB) Expert Declaration.
- *Intel Corporation v. Hera Wireless S.A.*, Case IPR2018-01702 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01418 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01739 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01700 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01701 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01732 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01737 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01686 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01420 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01687 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01738 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc. (McEwen, Kathy, inventor)*, Case IPR2018-00254 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc. (McEwen, Kathy, inventor)*, Case IPR2017-01661 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc.*, Case IPR2017-01662 (PTAB) Expert Declaration.
- *Intellectual Ventures II LLC v. FedEx Corp.*, (2:16-cv-00980), Expert Report + Deposition + Trial (Texas Eastern District Court).
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-00729 (PTAB) Expert Declaration.
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-02030 (PTAB) Expert Declaration.
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-00741 (PTAB) Expert Declaration.
- *Uniloc USA, Inc., Uniloc Luxembourg, S.A., and Uniloc 2017 LLC (Uniloc) v. Samsung*, (2:18-cv-00042) Expert Report + Deposition.
- *Uniloc USA, Inc., Uniloc Luxembourg, S.A., and Uniloc 2017 LLC (Uniloc) v. Samsung*, (2:18-cv-00044) Expert Report + Deposition.
- *Sol IP v. AT&T et al.*, (2:18-cv-00526), Expert Report + Deposition.

- *Juniper Networks v. American Patents*, Case IPR2020-01114 (PTAB) Expert Declaration.
- *Juniper Networks v. American Patents*, Case IPR2020-01115 (PTAB) Expert Declaration.
- *Intellectual Tech v. Zebra Technologies*, (6:19-cv-00628) Expert Declaration.
- *Aegis 11 S.A. v. Belkin Int'l, Inc.*, Civ. Nos. 19-1161-RGA, -1162-RGA, and 1163-RGA Expert Declaration.
- *Aegis 11 S.A. v. TTE Tech., Inc.*, Civ. No. 19-1165-RGA Expert Declaration
- *Aegis 11 S.A. v. Funai Electric Co.*, Civ. No. 20-03890
- *AEGIS v. Hisense*, (1:20-cv-03891) Expert Declaration.
- *Soter Technologies, LLC v. IP Video Corp. et al*, SDNY 20-cv-05007(LJL) Expert Declaration.
- *Soter Technologies, LLC v. IP Video Corp. et al*, EDNY 2:20-cv-02989(GRB)(AKT) Expert Declaration + Deposition.
- *Cellspin Soft, Inc. v. Nike, Inc.*, NDCA 4:17-cv-05931YGR Expert Report.
- *Cellspin Soft, Inc. v. Under Armour, Inc.*, NDCA 4:17-cv-05932YGR Expert Report.
- *BillJCo, LLC v. Cisco Systems, Inc. et al.*, EDTX 2:21-cv-181, 183-JRG Expert Reports + Deposition.
- *BillJCo, LLC v. Apple, Inc.*, WDTX 6:21-cv-528-ADA Expert Declaration.
- *Zebra Technologies v. OnAsset Intelligence, Inc.*, ITC Washington DC, Investigation No. 337-TA-1278 Expert Reports on Infringement & Validity + Deposition + Trial/Hearing.
- *Intellectual Tech LLC v. Zebra Technologies*, WDTX 6:19-cv-00628-ADA Expert Reports + Deposition.
- *Hewlett Packard Enterprise v. Intellectual Ventures II LLC*, Case IPR2021-01377 (PTAB) Expert Declaration + Deposition.
- *Hewlett Packard Enterprise v. Intellectual Ventures II LLC*, Case IPR2022-00096 (PTAB) Expert Declaration + Deposition.
- *Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions LLC*, Case IPR2022-1572 (PTAB) Expert Declaration.
- *Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions LLC*, Case IPR2022-1573 (PTAB) Expert Declaration.
- *Zebra Technologies v. Lone Star Systems*, Case IPR2022-01374-01377 (PTAB) Expert Declarations + Deposition.
- *Howlink Global v. AT&T*, EDTX 2:22-cv-00040-JRG, Expert Report + Deposition.
- *Unified Patents LLC v. OZMO Licensing LLC*, Case IPR2023-02060 (PTAB) Expert Declaration.
- *Cisco Systems Inc. v. Video Solutions PTE LTD.*, Case IPR2024-00194 (PTAB) Expert Declarations + Deposition.
- *Varia Holdings v. Apple*, EDNY 1:23-cv-07477-RPK-VMS, Expert Declarations + Depositions.
- *Unified Patents v. BSD Crown*, Ex Parte Reexamination of U.S. Patent No. 6,389,473, Expert Declaration.
- *Zebra Technologies v. OnAsset Intelligence*, NDTX 3:21-cv-00055-K Inc., Expert Report + Deposition.
- *ResMed Corp v. Cleveland Medical Devices*, Case IPR2023-00565 (PTAB) Expert Declaration + Deposition.
- *Cleveland Medical Devices v. ResMed Corp*, DE 1:22-cv-00794-GBW, Expert Declaration.
- *S.M.R Innovations LTD and Y.M.R Tech LTD v. Apple*, WDTX 6:23-cv-479-ADA, Expert Declaration.
- *Samsung Electronics, LTD v. Maxell, LTD*, Case IPR2024-00735/00777 (PTAB) Expert Declarations.
- *Samsung Electronics, Inc. v. KPN N.V.*, Case IPR2025-00503/00512 (PTAB) Expert Declarations.
- *Pegasus Wireless Innovation v. Verizon Communications et al.*, EDTX 2:23-cv-00640-JRG, Expert Report + Deposition.
- *Brightsky LLC v. Plover Bay Technologies LTD. et al.*, SDFL 9:25-cv-80704, Expert Declaration.

ADDENDUM

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- J. Sharony, V. Ramanna, "Self Learning Real Time Location Tracking in Wireless Sensor Networks," Accepted to WiCOM, The 5th International Conference on Wireless Communications, Networking and Mobile Computing, China, 2009.
- J. Sharony, "Introduction to Wireless MIMO – Theory and Applications", IEEE LI, November 2006.
- J. Sharony, M. Sen, "Bandwidth management in 802.11 wireless LANs," ICC 2004 - IEEE International Conference on Communications, vol. 27, no. 1, Paris, France, June 2004 pp. 3837-3843.
- L-T.Cheok, J.Sharony and A.Eleftheriadis, "A SMIL-enabled Mobile Shopping Mall Application," SMILEurope Conference, Paris, France, February 2003.
- L-T.Cheok, J.Sharony and A.Eleftheriadis, "Symshop: A Mobile Shopping Mall Application," International Conference on Mobile and Ubiquitous Multimedia (MUM), Oulu, Finland, December 2002.
- J. Sharony, "Effective Throughput of 802.11 Wireless LAN with Interference from Nearby Cells," Proc. of Mobile Multimedia Communications (MoMuC), 7th International Workshop, Tokyo, Japan, 2000.
- J. Sharony, "An Architecture for Mobile Radio Networks With Dynamically Changing Topology Using Virtual Subnets," Mobile Networks & Applications, vol. 1, no. 1, 1996 pp. 75-86.
- J. Sharony, "A Multi-Star Optical Backbone Network Suitable for Distributed Microcellular Wireless Systems," Proc. of IEEE GLOBECOM'96, London, UK, November, 1996.
- J. Sharony, A. C. Sevdinoglou, "On-line distributed TDMA/FDMA/CDMA Link Assignment in Mobile Radio Networks with Flexible Directivity," Hazeltine Technical Bulletin, 1996.
- Y. Li, T. Wang, Z. G. Pan, J. Sharony, "Minimum-Complexity Free-Space Optical Nonblocking Networks for Multicast Interconnect Applications," Optical Letters, vol. 19, no. 8, April 1994 pp. 515-517.
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- J. Sharony, T. Stern, Y. Li, "The universality of multidimensional switching networks," IEEE/ACM Transactions on Networking, vol. 2, no. 6, December 1994 pp. 602-612.
- J. Sharony, "Broadcast and switch – A new class of WDM networks for high switching-speed, high connectivity applications," in Photonics in Switching Topical Meeting'93 Digest, Palm Springs, CA, Mar. 1993.
- J. Sharony, K. W. Cheung, T. E. Stern, "The Wavelength Dilation Concept in Lightwave Networks – Implementation and System Considerations," Journal of Lightwave Technology, vol. 11, no. 5/6, May/June 1993 pp. 900-907.
- J. Sharony, "Architectures of Dynamically Reconfigurable Wavelength Routing/Switching Networks," Ph.D. Thesis, Columbia University, May 1993.
- J. Sharony, K. W. Cheung, T. E. Stern, "Wavelength Dilated Switches (WDS) – A New Class of Suppressed Crosstalk, Dynamic Wavelength-Routing Crossconnects," OFC'92, paper TuO3, San Jose, CA, Feb 1992.
- J. Sharony, C. Georgiou, "Wavelength Selective Optical Crossconnect," IBM Technical Disclosure Bulletin, vol. 34, no. 10A, March 1992.
- J. Sharony, S. Jiang, T. Stern, K. Cheung, "Wavelength Rearrangeable and Strictly Non-Blocking Networks," Electronics Letters, vol. 28, no. 2, March 1992 pp. 536-537.
- J. Sharony, K. W. Cheung, T. E. Stern, "The Wavelength Dilation Concept – Implementation and System Considerations," Proc. ICC'92, paper 330.3, Chicago, IL, June 1992.
- J. Sharony, K. W. Cheung, T. E. Stern, "Wavelength Dilated Switches (WDS) – A New Class of High Density, Suppressed Crosstalk, Dynamic Wavelength-Routing Crossconnects," IEEE Photonics Technology Letters, vol. 4, no. 8, August 1992 pp. 933-935.

- Y. Li, T. Jiang, J. Sharony, "Massively Parallel Free-Space Optical Clos Network Using Wavelength-Division Multiple Access," Electronics Letters, vol. 28, no.21, October 1992 pp. 2001-2002.
- J. Sharony, T. E. Stern, K. W. Cheung, "Extension of Classical Rearrangeable and Non-Blocking Networks to the Wavelength Dimension," Proc. of IEEE GLOBECOM'92, December, 1992.
- J. Sharony, "Bounds on Threshold Effects in Frequency Estimation," Master Thesis, Tel Aviv University, April 1984.

Issued U.S. Patents

- 10,200,924 - Small-cell gateway configured for multiple air interfaces
- 10,080,177 - Unlicensed spectrum offload architecture for small-cell base stations
- 10,028,188 - Location processing in small cells implementing multiple air interfaces
- 9,854,489 - Location processing in small cells implementing multiple air interfaces
- 9,807,657 - Small-cell gateway configured for multiple air interfaces
- 9,474,500 - Method and system for transfer of cardiac medical image data files
- 9,161,273 - Small cells implementing multiple air interfaces
- 9,148,835 - Small cells implementing multiple air interfaces
- 9,143,996 - Small cells implementing multiple air interfaces
- 9,125,121 - Small cells implementing multiple air interfaces
- 9,088,923 - Small cells implementing multiple air interfaces
- 9,014,702 - Wireless location processing in small cells implementing multiple air interfaces
- 7,827,610 - Wireless LAN intrusion detection based on location
- 7,778,649 - System and method for asset location in wireless networks
- 7,706,809 - RF tracking system and method
- 7,668,201 - Bandwidth management in wireless networks
- 7,596,388 - Sectorized wireless communication network operating under 802.11 specifications
- 7,426,383 - Wireless LAN intrusion detection based on location
- 7,373,154 - System and method for asset location in wireless networks
- 7,174,172 - System and method for asset location in wireless networks
- 7,164,929 - Method and apparatus for location tracking in a multi-path environment
- 7,069,024 - System and method for determining location of rogue wireless access point
- 7,039,358 - Coexistence techniques in wireless networks
- 7,019,663 - RF tracking system and method
- 6,990,587 - Cryptographic architecture for secure, private biometric identification
- 6,925,094 - System and method for wireless network channel management
- 6,853,293 - Wearable communication system
- 6,735,445 - System and method for medium access control in a wireless network
- 6,577,609 - Local addressing of mobile units in a WLAN with multicast packet addressing
- 6,411,608 - Method and apparatus for variable power control in wireless communications systems
- 5,953,143 - Multidimensional switching networks
- 5,742,593 - On-line distributed TDMA/FDMA/CDMA link assignment in mobile radio networks with flexible directivity
- 5,652,751 - Architecture for mobile radio networks with dynamically changing topology using virtual subnets
- 5,495,356 - Multidimensional switching networks
- 4,867,820 - Preparation of laminated structure containing an optical fiber
- 4,847,596 - Wallpaper comprising an optical fibre

Issued International Patents

- EP2974520 - Unlicensed spectrum offload architecture for small-cell base stations
- EP1906294 - Wearable communication system
- EP1851978 - System and method for asset location in wireless networks
- EP1678960 - System and method for determining location of rogue wireless access point
- EP0886981 - An architecture for mobile radio networks with dynamically changing topology using virtual subnets
- EP1552632 - Apparatus and method for wireless network channel management

- EP1207654 - Coexistence techniques in a gateway between Bluetooth and WLAN wireless networks
- CA2599012 - Sectorized wireless communication network operating under 802.11 specifications
- AU2011202551 - Sectorized wireless communication network operating under 802.11 specifications
- CA2599406 - System and method for asset location in wireless networks
- AU783921 - Coexistence techniques in wireless networks

Published U.S. Patent Applications

- 20180220347 - SMALL-CELL GATEWAY CONFIGURED FOR MULTIPLE AIR INTERFACES
- 20170150412 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20150382272 - UNLICENSED SPECTRUM OFFLOAD ARCHITECTURE FOR SMALL-CELL BASE STATIONS
- 20150365861 - SMALL-CELLS GATEWAY CONFIGURED FOR MULTIPLE AIR INTERFACES
- 20150257077 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130090119 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089077 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089072 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089071 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089070 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089069 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130084873 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20080201377 - Wireless LAN Intrusion Detection Based on Location
- 20080182593 - System and Method for Asset Location in Wireless Networks
- 20070105566 - System and method for asset location in wireless networks
- 20060221928 - Wireless device and method for wireless multiple access
- 20060221904 - Access point and method for wireless multiple access
- 20060221873 - System and method for wireless multiple access
- 20060211372 - Coexistence techniques in wireless networks
- 20060194616 - Sectorized wireless communication network operating under 802.11 specifications
- 20060194587 - System and method for asset location in wireless networks
- 20060194568 - System and method for determining location of rogue wireless access point
- 20060172756 - System and method for clustering mobile devices in a wireless network
- 20060125631 - RF tracking system and method
- 20050153713 - Method and apparatus for location tracking in a multi-path environment
- 20050136891 - Wireless lan intrusion detection based on location
- 20050135321 - Spatial wireless local area network
- 20050113090 - System and method for determining location of rogue wireless access point
- 20050096091 - Method and system for wireless communications using multiple frequency band capabilities of wireless devices
- 20050047343 - Bandwidth management in wireless networks
- 20040157604 - System and method for medium access control in a wireless network
- 20040057459 - System and method for wireless network channel management
- 20040038695 - SYSTEM AND METHOD FOR MEDIUM ACCESS CONTROL IN A WIRELESS NETWORK
- 20040027251 - RF tracking system and method
- 20030020629 - Wearable communication system
- 20020152391 - Cryptographic architecture for secure, private biometric identification
- 20020150098 - Local addressing of mobile units in a WLAN with multicast packet addressing
- 20020018451 - Method and apparatus for variable power control in wireless communications systems

Published International Patent Applications

- WO2013036487 - Small cells implementing multiple air interfaces

- WO0227989 - Logical addressing of mobile units in a wlan with multicast packet addressing
- WO2005046256 - Method and system for wireless communication using multiple frequency band capabilities of wireless devices
- WO2009146082 - Rfid monitoring of drug regimen compliance
- WO2004019539 - System and method for medium access control in a wireless network
- WO2005060172 - Wlan with a plurality of antennas in both access point and mobile unit
- WO2006093884 - Sectorized wireless communication network operating under 802.11 specifications
- WO2014140877 - Unlicensed spectrum offload architecture for small-cell base stations
- WO2006107538 - System and method for wireless multiple access
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- WO2006093710 - System and method for asset location in wireless networks
- WO2005046254 - System and method for determining location of rogue wireless access point
- WO2006083535 - System and method for clustering mobile devices in a wireless network
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- CA2602569 - System and method for wireless multiple access
- CA2543459 - Method and system for wireless communication using multiple frequency band capabilities of wireless devices
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- CA2602572 - Access point and method for wireless multiple access
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- EP1864396 - System and method for wireless multiple access
- EP1733511 - Wlan with a plurality of antennas in both access point and mobile unit
- EP1300029 - Method and apparatus for variable power control in wireless communications systems
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- EP0886981 - An architecture for mobile radio networks with dynamically changing topology using virtual subnets
- EP1906294 - Wearable communication system
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- AU2003272648 - System and method for wireless network channel management
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- AU2001294830 - Logical addressing of mobile units in a wlan with multicast packet addressing
- GB2319439 - Network Architecture for Linking Base Stations