

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

PROXENSE, LLC,

Plaintiff,

v.

INTEL CORPORATION,

Defendant.

Case No. 6:24-cv-00283-ADA

JURY TRIAL DEMANDED

INTEL CORPORATION'S PRELIMINARY INVALIDITY CONTENTIONS

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I. INTRODUCTION

Defendant Intel Corporation (“Intel”) provides the following Invalidity Contentions with respect to U.S. Patent Nos. 8,219,129 (“’129 patent”); 8,457,672 (“’672 patent”); 9,265,043 (“’043 patent”); and 8,036,152 (“the ’152 patent”) (collectively, the “Asserted Patents”), which Plaintiff Proxense LLC (“Proxense”) has asserted against Intel and for which Proxense has served Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions.

Proxense’s Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions provided infringement contentions for the four Asserted Patents and 7 claims identified below (the “Asserted Claims”):¹

Patent	Claims
’129 Patent	1, 16, ² 18
’672 Patent	1
’043 Patent	1
’152 Patent	1, 7

¹ Intel has challenged the sufficiency of Proxense’s infringement contentions to date. Proxense has not addressed those deficiencies and Intel reserves all rights, including to strike Proxense’s contentions and preclude Proxense from attempting to later modify its infringement theories.

² The cover pleading to Proxense’s Preliminary Infringement Contentions only identified claims 1 and 18 of the ’129 patent. *See* Preliminary Infringement Contentions at 2. However, Exhibit A to Proxense’s Preliminary Infringement Contentions also included claim 16 of the ’129 patent. *See, e.g.*, Preliminary Infringement Contentions Exhibit A at 6. Intel notified Proxense of this discrepancy (*see* October 8, 2024 letter from Jordan L. Hirsch to David L. Hecht), but Proxense has refused to address this issue (*see* October 16, 2024 letter from David L. Hecht to Jordan L. Hirsch). Proxense’s Amended Preliminary Infringement Contentions Exhibit A, provided on October 23, 2024 continue to include claim 16, but Proxense has not yet served an amended cover pleading identifying claim 16. Intel addresses the invalidity of claim 16, but reserves all rights including the right to seek to preclude Proxense from asserting claim 16 should Proxense expand or otherwise alter its theories.

Intel accordingly provides its Preliminary Invalidity Contentions for the Asserted Patents and Asserted Claims. Intel reserves the right to amend these contentions if Proxense were permitted by the Court to further amend its Preliminary Infringement Contentions in any manner.

With respect to each Asserted Claim and based on its investigation to date, Intel's Preliminary Invalidity Contentions: (1) identify each statutory section relied upon for any assertion of invalidity; (2) identify items of prior art that anticipate and/or render obvious each asserted claim; (3) specify whether each such item of prior art (or a combination of the same) anticipates each asserted claim and/or renders it obvious; (4) include charts identifying where each element in each asserted claim is disclosed, described, taught, or otherwise inherent in the prior art (at least under Proxense's apparent interpretation of the claims as shown in its Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions); and (5) identify grounds for invalidating the asserted claims based on 35 U.S.C. § 112. *See* D.I. 18.

II. RESERVATIONS

Intel reserves the right to amend these Preliminary Invalidity Contentions as permitted by the Federal Rules of Civil Procedure, the Court's Standing Order Governing Proceedings (OGP) 4.4—Patent Cases and the Scheduling Order (D.I. 18), including to the extent Proxense seeks to add to or amend its Preliminary Infringement Contentions or Amended Preliminary Infringement Contentions in any way or seeks to present evidence not contained in its Preliminary Infringement Contentions.

Proxense's Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions are deficient in several material respects, which were outlined in

Intel's October 8, 2024 letter from Jordan L. Hirsch to David L. Hecht, which is incorporated herein by reference.

Intel reserves the right to revise, amend, and/or supplement the information provided herein if and when Proxense amends or supplements its Preliminary Infringement Contentions or Amended Preliminary Infringement Contentions. Intel further reserves the right to present additional invalidity evidence and arguments if Proxense is permitted to present infringement evidence beyond that contained in its Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions.

The references discussed in the claim charts attached hereto may disclose the elements of the asserted claims explicitly, implicitly, or inherently, or under Proxense's infringement theories, or they may be relied upon to show the state of the art in the relevant time frame.

Intel's claim charts cite particular teachings and disclosures of the prior art as applied to features of the Asserted Claims. However, persons having ordinary skill in the art generally may view an item of prior art in the context of other publications, literature, products, and understanding. As such, the cited portions are only examples, and Intel reserves its right to rely on uncited portions of the prior art references and on other publications and expert testimony as aids in understanding and interpreting the cited portions, as providing context thereto, and as additional evidence that the prior art discloses a claim limitation. Intel further reserves its right to rely on uncited portions of the prior art references, other publications, and testimony to establish bases for combinations of certain cited references that render the Asserted Claims obvious.

Nothing in these Preliminary Invalidity Contentions shall be treated as an admission that the Intel technology Proxense has accused meets any limitations of the Asserted Claims. Intel

denies that it infringes any claim of the Asserted Patents. Nothing stated herein shall be construed as an admission or a waiver of any particular construction of any claim term. Intel expressly reserves the right to contest any claim construction asserted by Proxense and expressly reserves all non-infringement arguments.

Intel has provided Preliminary Invalidity Contentions that apply the Asserted Claims in the way that Proxense has applied the Asserted Claims in its Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions. To the extent that any prior art reference identified by Intel contains a claim element that is the same as or similar to an element in the Intel products at issue, inclusion of that reference in Intel's Preliminary Invalidity Contentions is intended to show that the Asserted Claims are invalid at least under Proxense's apparent interpretation of the claims and infringement positions and shall not be deemed a waiver by Intel of any claim construction or non-infringement position. By including prior art that invalidates the claims of the Asserted Patents based on Proxense's apparent infringement theories, Intel is neither adopting nor acceding in any manner to Proxense's infringement theories or any claim construction that Proxense may propose pursuant to those theories. Nothing stated herein shall be treated as an admission or suggestion that Intel agrees with Proxense regarding the alleged scope of any of the Asserted Claims.

Fact discovery has not yet begun, and Proxense has opposed Intel's attempts to initiate claim construction discovery. Intel reserves the right to supplement these Preliminary Invalidity Contentions in light of Proxense's disclosure of its claim construction positions and any evidence it identifies as support, including any extrinsic support. Intel further reserves the right to supplement and amend these contentions after Proxense provides responses to the discovery that Intel has served to date—and that Proxense has thus far refused to respond to. Intel further

reserves its right to revise, supplement, or amend its Preliminary Invalidity Contentions to reflect any additional information learned during the course of fact and expert discovery, including public or confidential information uncovered about prior art products from third parties. For example, under the Court's OGP subpoenas to third parties regarding prior art cannot be served until after the *Markman* hearing. Intel requested that Proxense agree that Intel could serve third party prior art subpoenas, including relating to product prior art, before these Preliminary Invalidity Contentions were due. *See* November 8, 2024 Letter from Makenzi Herbst to David L. Hecht. Proxense did not reply and has not agreed that Intel can pursue third party prior art discovery at this stage. Intel thus has not had an opportunity to seek information regarding many of the product prior art systems discussed below and expressly reserves the right to supplement these contentions after having an opportunity to seek discovery regarding the system identified below.

In addition, Proxense has not identified any purported evidence of secondary considerations of non-obviousness. Intel reserves the right to amend its Preliminary Invalidity Contentions in the event that Proxense attempts to do so later in the case.

Intel also reserves the right to amend its Preliminary Invalidity Contentions in the event that Proxense contends that any item of prior art contained herein does not anticipate or render obvious one or more of the elements of the Asserted Claim. Intel also reserves the right to amend its Preliminary Invalidity Contentions in the event that Proxense contends that any item of prior art that Intel contends either anticipates or renders obvious an Asserted Claim does not describe or enable one or more of the elements of the Asserted Claim.

Finally, references to the preamble of a claim in these Preliminary Invalidity Contentions shall not be treated as an admission that the preamble is a limitation of a claim.

III. INVALIDITY BASED ON PRIOR ART

Subject to the reservation of rights above and based on Intel's present understanding of the Asserted Claims and Proxense's apparent interpretation of the Asserted Claims as applied in Proxense's Amended Complaint, Preliminary Infringement Contentions, and Amended Preliminary Infringement Contentions, the prior art identified in these contentions anticipates and/or renders obvious all of the Asserted Claims under 35 U.S.C. § 102 and/or § 103, including at least under Proxense's apparent infringement theories and/or under any reasonable interpretation of the Asserted Claims. The patents/applications, publications, devices, methods, and systems identified are also relevant for their showing of the state of the art and reasons and motivations for making improvements, additions, and combinations.

As indicated below, for certain of these references, Intel has provided claim charts (numbered Exhibits A1-A24 for the '129 patent, '672, and '043 patents and B1-B16 for the '152 patent) identifying where each element of the Asserted Claims can be found in the prior art, including at least under Proxense's apparent infringement theories.

A. Identification of Prior Art References

Prior Art Patents ³					
Exhibit No.	Short Name	Patent Number	Date	Patentee	Bates No.
A10	Ward	WO 2002/067009	2/21/2001 2/19/2002 8/29/2002	AT&T Laboratories- Cambridge LTD	INTEL_PROX_00006 744- INTEL_PROX_00006 769

³ For published patent applications, Intel may identify the application and a patent that subsequently issued from that application and vice versa. For any citation to a published application, Intel reserves the right to cite to the corresponding disclosure in the subsequently issued patent and vice versa.

A11	Odman	US 2003/0152059	1/22/2002 1/22/2003 8/14/2003	XtremeSpectrum , Inc.	INTEL_PROX_00006 079- INTEL_PROX_00006 110
A12	Lan	US 2004/0214582	10/28/2004	NTT DoCoMo, Inc	INTEL_PROX_00006 111- INTEL_PROX_00006 154
	Nakagawa	US 2006/0205408	9/22/2003 9/2/2004 7/14/2006	Masao Nakagawa, Riaz Esmailzadeh	INTEL_PROX_00006 155- INTEL_PROX_00006 170
A8	Brawn	US 2007/0016637	7/18/2005 1/18/2007	Hewlett Packard Development Co LP	INTEL_PROX_00006 171- INTEL_PROX_00006 197
A13	Marko	US 5,325,405	6/28/1994	Motorola, Inc.	INTEL_PROX_00006 198- INTEL_PROX_00006 213
B8	Abreu	US 5,754,956	5/19/1998	Motorola, Inc.	INTEL_PROX_00006 214- INTEL_PROX_00006 248
A14	Brown	US 6,011,784	1/4/2000	Motorola, Inc.	INTEL_PROX_00006 249- INTEL_PROX_00006 267
A15	Turina	US 6,031,832	11/27/1996 2/29/2000	Telefonaktiebolaget L M Ericsson	INTEL_PROX_00006 268- INTEL_PROX_00006 279
A16	Rabenko	US 6,834,057	12/21/2004	Broadcom Corp.	INTEL_PROX_00006 280- INTEL_PROX_00006 319
A17	Ben-Eli	US 7,099,682	8/1/2002 8/29/2006	Intel Corp.	INTEL_PROX_00006 320- INTEL_PROX_00006 326
A6	Livet	US 7,170,877	7/9/2003 7/8/2004	InterDigital Technology Corp.	INTEL_PROX_00006 327-

			2/24/2005 1/30/2007		INTEL_PROX_00006 340
A9	Mansfield	US 7,177,293	4/30/2002 2/13/2007	Intel Corp.	INTEL_PROX_00006 341- INTEL_PROX_00006 350
	Major	US 7,209,955	5/29/1998 4/10/2000 4/24/2007	Research In Motion Limited	INTEL_PROX_00006 351- INTEL_PROX_00006 376
B7	Liu '877	US 7,245,877	8/12/2003 2/17/2005 7/17/2007	Intel Corp.	INTEL_PROX_00006 377- INTEL_PROX_00006 384
B6	Liu '827	US 7,295,827	3/31/2004 10/6/2005 11/13/2007	Intel Corp.	INTEL_PROX_00006 385- INTEL_PROX_00006 395
B9	Kitchin	US 7,486,616	12/16/2003 6/16/2005 2/3/2009	Intel Corp.	INTEL_PROX_00006 396- INTEL_PROX_00006 405
B10	Tanach	US 8,441,971	12/21/2004 6/22/2006	Intel Corp.	INTEL_PROX_00006 406- INTEL_PROX_00006 416
	Parantainen	US 2003/0223394	5/28/2002 12/4/2003	Nokia Corp.	INTEL_PROX_00009 984- INTEL_PROX_00009 997
	Karaoguz	US 2004/0029620	10/2/2002 2/12/2004	Broadcom Corp.	INTEL_PROX_00009 998- INTEL_PROX_00010 017
	Yi	US 2005/0047386	8/17/2004 3/3/2005	Samsung Electronics Co., Ltd.	INTEL_PROX_00010 018-

					INTEL_PROX_00010033
	Smith	US 7,583,643	9/30/2003 5/31/2005	Motorola, Inc.	INTEL_PROX_00009970- INTEL_PROX_00009983
	Schloss	US 5,307,349	4/26/1994	Hughes Aircraft Co.	INTEL_PROX_00009942- INTEL_PROX_00009955
	Hoang	US 2006/0198337	3/7/2005 9/7/2006	Motorola, Inc.	INTEL_PROX_00010034- INTEL_PROX_00010044
	Tiedeman n	US 5,392,287	2/21/1995	Qualcomm Inc.	INTEL_PROX_00009956- INTEL_PROX_00009969

Prior Art Non-Patent Publications ⁴					
Exhibit No.	Short Name	Title	Author/ Institution	Date	Bates No.
A1, B1	802.15.3	802.15.3 - Part 15.3: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for High Rate Wireless Personal Area Networks (WPANs)	IEEE Computer Society	6/12/2003 9/29/2003 11/4/2004	INTEL_PROX_00002058 - INTEL_PROX_00002381

⁴ For prior art standards and specifications, Intel reserves the right to rely on additional documentation such as textbooks, articles, and/or standard committee documents describing the standard as evidence of inherent features, what a person of ordinary skill in the art would understand the standard to disclose, and/or what a person of ordinary skill in the art would have found obvious in light of the standard.

A1, B1	Gilb	Wireless Multimedia ... A Guide to the IEEE 802.15.3 Standard	James P. K. Gilb	3/1/2004	INTEL_PROX_00006417 - INTEL_PROX_00006743
A2, A24, B2, B16	802.15.4	802.15.4 - Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs)	IEEE Computer Society	5/12/2003 10/1/2003	INTEL_PROX_00002382 - INTEL_PROX_00003060
A3, A23, B3, B15	Bluetooth	Specification of the Bluetooth System (Version 1.1)	Bluetooth SIG, Inc.	2/22/2001 6/5/2003	INTEL_PROX_00003071 - INTEL_PROX_00004150
A4, B4	HomeRF	HomeRF Specification (Revision 2.01)	The HomeRF™ Technical Committee	7/1/2002	INTEL_PROX_00005392 - INTEL_PROX_00005917
A5, B5	802.11e	802.11e - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications - Amendment 8: Medium Access Control (MAC) Quality of Service Enhancements	IEEE Computer Society	9/22/2005 11/11/2005	INTEL_PROX_00001770 - INTEL_PROX_00001979
A5, B5	802.11-1999	802.11-1999, Part 11: Wireless LAN Medium Access Control	IEEE Computer Society	8/20/1999	INTEL_PROX_00001032 - INTEL_PROX_00001559

		(MAC) and Physical Layer (PHY) Specifications			
A20	Pallassini	Packet Loss Performance and MAC Design for Estimation in Wireless Sensor Networks	David Pallassini	2005	INTEL_PROX_00005948 - INTEL_PROX_00006043
A7	Kim	Multi-level Service Differentiation Scheme for the IEEE 802.15.4 Sensor Networks	Euijik Kim, Meejoung Kim, Sungkwan Youm, Seokhoon Choi, and Chul-Hee Kang	November 2005	INTEL_PROX_00005371 - INTEL_PROX_00005381
B11	Duong	Proactive Context Transfer and Forced Handover in IEEE 802.11 Wireless LAN Based Access Networks	Ha Duong, Arek Dadej, Steven Gordon	7/1/2005	INTEL_PROX_00005358 - INTEL_PROX_00005370
A18	Huang	AGA: Adaptive GTS Allocation with Low Latency and Fairness Considerations for IEEE 802.15.4	Yu-kai Huang; Ai-chun Pang; Tei-wei Kuo	June 11-15, 2006	INTEL_PROX_00005918 - INTEL_PROX_00005923
A4, B4	Lansford	The Design and Implementation of HomeRF: A Radio Frequency Wireless	Jim Lansford and Paramvir Bahl	October 2000	INTEL_PROX_00001017 - INTEL_PROX_00001031

		Networking Standard for the Connected Home			
B14	Ye	An Energy-Efficient MAC Protocol for Wireless Sensor Networks	Wei Ye, John Heidemann, Deborah Estrin	June 23-27, 2002 November 7, 2002	INTEL_PROX_00003061 - INTEL_PROX_00003070

Prior Art Systems					
Exhibit No.	Short Name	System	Date ⁵	Evidenced By ⁶	Bates No.
A22, A24, B13, B16	Mote 2	Intel Mote 2 / Stargate	At least by 11/2/2005 ⁷	BP Training Module 1, January 24-25, 2006	INTEL_PROX_00000351- INTEL_PROX_00000378
				BP Training Module 2, January 24-25, 2006	INTEL_PROX_00000393- INTEL_PROX_00000419
				BP Training Module 3, January 24-25, 2006	INTEL_PROX_00000431- INTEL_PROX_00000465
				BP Training Module 4, January 24-25, 2006	INTEL_PROX_00000523-

⁵ Date refers to the date by which the system was known or used, in public use, and/or on sale in the United States.

⁶ The list of documents evidencing these products in this chart is not exclusive. For example, Intel reserves the right to rely on the standard implemented by a particular prior art system as well as textbooks, articles, and/or standard committee documents describing the standard as evidence of inherent features, what a person of ordinary skill in the art would understand the standard to disclose, and/or what a person of ordinary skill in the art would have found obvious in light of the standard.

⁷ See Accompanying document production at Bates ranges INTEL_PROX_00006920 - INTEL_PROX_00006921, INTEL_PROX_00006872 - INTEL_PROX_00006872, and INTEL_PROX_00007615 - INTEL_PROX_00007619 as well as the evidence identified in the chart above.

					INTEL_PROX_00000547
				BP Training Module 5, January 24-25, 2006	INTEL_PROX_00000559- INTEL_PROX_00000588
				BP Training Module 6, January 24-25, 2006	INTEL_PROX_00000654- INTEL_PROX_00000730
				BP Training Module 7, January 24-25, 2006	INTEL_PROX_00000793- INTEL_PROX_00000817
				BP Training Module 8, January 24-25, 2006	INTEL_PROX_00000819- INTEL_PROX_00000853
				Network Protocols, last modified December 15, 2005	INTEL_PROX_00000225- INTEL_PROX_00000244
				Intel SensorNet BP Pilot Deployment Application Technical Documentation ("SensorNet BP")	INTEL_PROX_00000876- INTEL_PROX_00000938
				Imote-SNO, last modified April 14, 2009	INTEL_PROX_00000338- INTEL_PROX_00000338
				Intel Motes and Sensor Networks ("Intel Motes"), last modified July 5, 2005	INTEL_PROX_00000294- INTEL_PROX_00000316
				Kling et al., Advanced Platforms for High Performance Sensor Networks, last modified September 9, 2005	INTEL_PROX_00000008- INTEL_PROX_00000037
A21, A23, B12, B15	Mote 1	Intel Mote 1		The Intel Mote, Bluetooth Based Sensor Network for Industrial Monitoring, last modified April 27, 2005	INTEL_PROX_00000245- INTEL_PROX_00000281

			At least by 5/2/2005 ⁸	ImoteSoftwareDescription, last modified March 24, 2005	INTEL_PROX_00000988- INTEL_PROX_00000995
				Kling et al., Advanced Platforms for High Performance Sensor Networks, last modified September 9, 2005	INTEL_PROX_00000008- INTEL_PROX_00000037
				Chhabra et al., Demo Abstract: Sensor Networks in Intel Fabrication Plants, November 3-5, 2004	INTEL_PROX_00000203- INTEL_PROX_00000203
				Chaintreau et al., Pocket Switched Networks: Real-world mobility and its consequences for opportunistic forwarding, February 2005	INTEL_PROX_00000177- INTEL_PROX_00000202
				Krishnamurthy et al., Design and Deployment of Industrial Sensor Networks: Experiences from a Semiconductor Plant and the North Sea, November 2-4, 2005	INTEL_PROX_00000165- INTEL_PROX_00000176

As explained above, because fact discovery has not yet begun, and Proxense has not agreed to Intel's request to serve third party prior art subpoenas, Intel has not yet been able to seek information regarding other prior art products and systems, including prior art systems that implement the various wireless specifications/standards identified in Exhibits A1-A5, A23, A24,

⁸ See Accompanying document production at Bates ranges INTEL_PROX_00005350 - INTEL_PROX_00005357 and INTEL_PROX_00006783 - INTEL_PROX_00006784 as well as the evidence identified in the chart above. See also INTEL_PROX_00007653 - INTEL_PROX_00007653, INTEL_PROX_00006916- INTEL_PROX_00006917, INTEL_PROX_00000077 - INTEL_PROX_00000114, INTEL_PROX_00006853 - INTEL_PROX_00006865, INTEL_PROX_00007579 - INTEL_PROX_00007584, INTEL_PROX_00007629 - INTEL_PROX_00007634, INTEL_PROX_00006878 - INTEL_PROX_00006878, and INTEL_PROX_00010045 - INTEL_PROX_00010045.

B1-B5, B15, and/or B16 and that contain additional invalidating information, including details with respect to how the products implemented those specifications/standards. On information and belief, one or more of the products identified below, either alone or as sold, used, demonstrated or otherwise made available in the United States as part of a broader system, anticipates and/or renders obvious at least one of the Asserted Claims, at least under Proxense's apparent interpretation of the claims. Intel thus puts Proxense on notice that it intends to rely on the prior art systems below and that it will seek discovery regarding these systems and supplement and/or amend these Preliminary Invalidity Contentions with evidence regarding these systems or other systems that are prior art to the Asserted Patents as soon as that evidence is available.

- CC2420 manufactured by Chipcon, Inc., which implemented the 802.15.4 and/or Zigbee standards.
- MFR24J40 manufactured by Microchip Technology Inc., which implemented the 802.15.4 and/or Zigbee standards.
- The open source XYZ Platform developed at Yale University, which implemented the 802.15.4 and/or Zigbee standards.
- The Mica and/or MICAz devices developed by Crossbow Technology, Inc. and/or the University of California Berkely, which implemented the 802.15.4 and/or Zigbee standards.
- The Telos series developed by Moteiv Corporation, which implemented the 802.15.4 and/or Zigbee standards.
- MPR400CB and/or MPR2400CA manufactured by Amtel, which implemented the 802.15.4 and/or Zigbee standards.

- RC2200AT-SPPIO manufactured by Radiocrafts AS, which implemented the 802.15.4 and/or Zigbee standards.
- The Transparent Radio manufactured by Apparent Technologies Inc., which implemented the 802.15.3 standard.
- TNETW1130 manufactured by Texas Instruments Inc., which implemented the 802.11g and/or 802.11b standards.
- AR5414 manufactured by Atheros Communications, Inc., which implemented the 802.11g and/or 802.11b standards.
- BCM94712 manufactured by Broadcom Corporation, which implemented the 802.11g and/or 802.11b standards.
- RTL8187L and/or RTL8187L-LF manufactured by Realtek Semiconductor Corp., which implemented the 802.11g and/or 802.11b standards.
- WRT-414 manufactured by PLANET Technology Corp., which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- NCAP 3e560i manufactured by 3E Technologies International Inc., which implemented the 802.11g and/or 802.11b standards.
- Model 524490 manufactured by Intellinet Network Solutions, which implemented the 802.11g and/or 802.11b standards.
- Libertas 88W8000G manufactured by Marvell Technology, Inc., which was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).

- HWUG1 manufactured by Hawking Technology, Inc., which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- RaLink RT3070, which implemented the 802.11n, 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- WG602 manufactured by NETGEAR, Inc., which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- WG3022 manufactured by NETGEAR, Inc., which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- Wireless 150N Model 524445 manufactured by Intelligent Network Solutions, which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- DWL-2100AP manufactured by D-Link Systems, Inc., which implemented the 802.11g and/or 802.11b standards and was certified for Wi-Fi Multimedia (WMM) and/or Wireless Multimedia Extension (WME).
- The Symphony HomeRF base stations, adapters, and wireless cards manufactured by Proxim Wireless Corp., which implemented the HomeRF standard.
- The DI-634M manufactured by D-Link Systems, Inc., which implemented the HomeRF standard.
- The SIMpad and/or Gigaset product lines, which implemented the HomeRF standard.

- The Parthus Bluestream by Parthus Technologies PLC and products encompassing the same, which implemented the Bluetooth standard.
- Various Mac OS X products by Apple Inc., which implemented the Bluetooth standard.
- The HDW-1, HDW2, HS-4W, HS12W, and BH-800 headsets by Nokia Corp., which implemented the Bluetooth standard.
- The BlueMoon chip by Infineon Technologies AG and products encompassing the same, which implemented the Bluetooth standard.
- The TNETW1100B, TNETW1130, BRF6100, and BRF6150 chips by Texas Instruments Inc. and products encompassing the same, which implemented the Bluetooth standard.
- The BlueCore series chips by CSR plc and products encompassing the same, which implemented the Bluetooth standard.
- The OneTouch 500 GSM and OneTouch 700 products by Alcatel SA, which implemented the Bluetooth standard.
- The T36 by Telefonaktiebolaget L M Ericsson, which implemented the Bluetooth standard.
- The H8S/2214F chip by Hitachi, Ltd. and products encompassing the same, which implemented the Bluetooth standard.
- The BCM2033 chip by Broadcom Corporation and products encompassing the same, which implemented the Bluetooth standard.
- The Leadtek Wireless GPS Receiver (model GPS 9537) by Leadtek Research, Inc., which implemented the Bluetooth standard.
- The AeroScout Visibility System by AeroScout, Inc., which implemented at least the 802.11b standard.

- The AwarePoint Indoor Position System by AwarePoint Corp., which implemented at least the 802.15.4 standard.
- The Ekahau Positioning Engine by Ekahau, Inc., which implemented at least the 802.11a/b/g standards.
- The TrueRadio by Mobillian Corp., which implemented at least the 802.11b and Bluetooth standards.

B. Priority Date of Asserted Patents

The Asserted Patents refer to the filing dates of one or more earlier-filed utility applications and/or provisional applications (collectively “Priority Applications”)⁹ under 35 U.S.C. § 119(e) and/or 120. However, Proxense has not set forth any evidence that the Asserted Claims are entitled to the benefit of the filing dates of their respective Priority Application(s) or that the Priority Application(s) enable and provide written description support for the Asserted Claims per 35 U.S.C. §§ 112 ¶ 1, 119, and 120. In fact, Proxense expressly represented in its October 4, 2024 4:13 PM email from David L. Hecht to Makenzi G. Herbst that “Proxense will only rely on the priority date indicated, as set forth in our contentions.” The dates indicated in Proxense’s Preliminary Infringement Contentions are as follows:

Asserted Patent	Earliest Priority Date Proxense Will Rely On
’129 Patent	January 6, 2007
’672 Patent	January 6, 2007
’043 Patent	May 2, 2013
’152 Patent	January 6, 2007

⁹ The “Priority Application(s)” for any given Asserted Claim includes the earliest-filed Priority Application in the “priority chain” of applications, as well as any intervening applications filed between the earlier-filed Priority Application and the application issuing as the Asserted Patent containing the Asserted Claim.

Proxense further represented in its October 4, 2024 6:47 PM email from David L. Hecht to Makenzi G. Herbst that “Proxense does have any knowledge regarding the (prior) existence of any documents relating to conception or reduction to practice of the patents-in-suit.”

Accordingly, the Asserted Patents are not entitled to a priority date earlier than the dates listed above. Intel reserves the right to seek to preclude Proxense from relying on an earlier priority date for any of the Asserted Patents, and further reserves the right to supplement or amend these Preliminary Invalidity Contentions should Proxense attempt or be permitted to do so.

In addition, as explained in Section IV below, various limitations in the Asserted Claims lack written description support, at least under Proxense’s apparent interpretation of the claims. Accordingly, at most, the Asserted Claims of the Asserted Patents are entitled to a priority date as of the date the claims were presented during prosecution. Discovery has not yet begun, and Intel reserves the right to rely on these later priority dates in the event that intervening prior art arises.

C. Overview of Basic Concepts and Features Known in the Prior Art

The Asserted Patents are directed to old and well-known concepts and features. Intel identifies below a non-exhaustive list of such concepts and features, including representative references that show that these concepts and features were well known in the prior art at the time of the alleged inventions of the Asserted Patents. Additional concepts and features that were well known are detailed in Intel’s claim charts submitted as Exhibits as part of these Preliminary Invalidity Contentions. The below descriptions are intended to be representative examples, not exhaustive, and to provide a high-level overview of certain relevant concepts that were well known. Intel incorporates by reference the accompanying invalidity charts, which identify additional disclosures that show these basic concepts were well known in the prior art. In

addition, to the extent that discovery reveals that Proxense published, publicly disclosed or used, sold, or otherwise made known or available the TruProx specification, any product based on the TruProx specification, or any other Proxense product before the alleged priority dates of the Asserted Patents, Intel reserves the right to Amend these Preliminary Invalidity Contentions and rely on those disclosures to show that show these basic concepts were well known in the prior art.

1. Wireless Communications/Wireless Networks

Wireless communications and wireless networks, for example between and connecting routers, base stations, gateways, coordinator nodes, readers, client devices, mobile stations/devices, radios and other similar devices were well known at the time of the alleged invention(s) of the Asserted Patents.

- *See, e.g.*, 802.15.3 at Introduction (“IEEE Std 802.15.3-2003 was designed to enable wireless connectivity of high-speed, low-power, low-cost, multimedia-capable portable consumer electronic devices. This standard provides data rates from 11 to 55 Mb/s at distances of greater than 70 m while maintaining quality of service (QoS) for the data streams. In addition, this standard is designed to provide simple, ad-hoc connectivity that allows the devices to automatically form networks and exchange information without the direct intervention of the user. Privacy and integrity are provided for data and commands with 128-bit AES encryption used in CCM mode. This standard has also provided a variety of techniques that can be used to enhance the coexistence of 802.15.3 piconets with other wireless networks.”); 8 (“A piconet is a wireless ad hoc data communications system which allows a number of independent data devices (DEVs) to communicate with each other.”), (“An 802.15.3 piconet consists of several components, as shown in Figure 1. The basic component is the DEV. One DEV is required to assume the role of the piconet coordinator (PNC) of the piconet. The PNC provides the basic timing for the piconet with the beacon. Additionally, the PNC manages the quality of service (QoS) requirements, power save modes and access control to the piconet.”), FIG. 1.
- *See, e.g.*, 802.15.4 at 1 (“The scope of this project is to define the physical layer (PHY) and medium access control (MAC) sublayer specifications for low data rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements typically operating in the personal operating space (POS) of 10 m. It is foreseen that, depending on the

application, a longer range at a lower data rate may be an acceptable trade-off. ... The purpose of this document is to provide a standard for ultra-low complexity, ultra-low cost, ultra-low power consumption, and low data rate wireless connectivity among inexpensive devices. The raw data rate will be high enough (maximum of 250 kb/s) to satisfy a set of simple needs such as interactive toys, but scalable down to the needs of sensor and automation needs (20 kb/s or below) for wireless communications.”), 13-14 (“Depending on the application requirements, the LR-WPAN may operate in either of two topologies: the star topology or the peer-to-peer topology. Both are shown in Figure 1. In the star topology the communication is established between devices and a single central controller, called the PAN coordinator. A device typically has some associated application and is either the initiation point or the termination point for network communications. A PAN coordinator may also have a specific application, but it can be used to initiate, terminate, or route communication around the network. The PAN coordinator is the primary controller of the PAN. All devices operating on a network of either topology shall have unique 64 bit extended addresses. This address can be used for direct communication within the PAN, or it can be exchanged for a short address allocated by the PAN coordinator when the device associates. The PAN coordinator may be mains powered, while the devices will most likely be battery powered. Applications that benefit from a star topology include home automation, personal computer (PC) peripherals, toys and games, and personal health care. The peer-to-peer topology also has a PAN coordinator; however, it differs from the star topology in that any device can communicate with any other device as long as they are in range of one another. Peer-to-peer topology allows more complex network formations to be implemented, such as mesh networking topology. Applications such as industrial control and monitoring, wireless sensor networks, asset and inventory tracking, intelligent agriculture, and security would benefit from such a network topology. A peer-to-peer network can be ad hoc, self-organizing and self-healing. It may also allow multiple hops to route messages from any device to any other device on the network. Such functions can be added at the network layer, but are not part of this standard.”).

- *See, e.g.,* Bluetooth at 259 (“The protocol complexity should be acceptable to personal computers, PDAs, digital cellular phones, wireless headsets, joysticks and other wireless devices supported by Bluetooth. Furthermore, the protocol should be designed to achieve reasonably high bandwidth efficiency.”), 397-398 (“RFCOMM is intended to cover applications that make use of the serial ports of the devices in which they reside. In the simple configuration, the communication segment is a Bluetooth link from one device to another (direct connect), see Figure 1.2. Where the communication segment is another network, Bluetooth wireless technology is used for the path between the device and a network connection device like a modem. RFCOMM is only concerned with the connection between the devices in the direct connect case, or between the device and a modem in the network case. RFCOMM can support other configurations, such as modules that communicate via Bluetooth wireless technology on one side and provide a wired interface on the other side, as shown in Figure 1.3. These

devices are not really modems but offer a similar service. They are therefore not explicitly discussed here.”).

- *See, e.g.,* HomeRF at 13 (“The HomeRF architecture is a unique combination of data transport via best-effort asynchronous, priority asynchronous, and isochronous mechanisms. The isochronous mechanism is intended for services with strict jitter and latency requirements, such as interactive voice. The priority asynchronous mechanism is intended for streaming services, such as audio and video. The best-effort asynchronous mechanism provides traditional data networking. The HomeRF specification has been optimized to provide the kinds of service that are most needed from untethered devices in the home. ... The connection Point may be connected to a PC 2 or may be an integral part of a PC. It can also have a connection to the PSTN. It is capable of performing data transfers to and from other data devices using an asynchronous, contention-based protocol. The Connection Point manages the network to provide priority access to the radio medium for isochronous devices and streaming devices.”), 20 (“Asynchronous-node: A HomeRF device that provides asynchronous data services. This type includes wireless network interface cards (NICs). ... Isochronous-node: A HomeRF device that provides isochronous data (mainly interactive voice) services. This type includes cordless handsets.”), 323 (“HomeRF radio signals are not restricted to a well defined area, as it is the case for wired technologies. A radio device can hear any other device within range transmitting on the same frequency.”).
- *See, e.g.,* Livet at Abstract (“A method and system for managing radio resources in a time-slotted wireless communication system is based on the quality of service (QoS) information of a user. A plurality of time slots of a radio resource are sorted into a plurality of different categories, such as high QoS time slots, high capacity time slots, and balanced time slots. Each category is associated with a different level of QoS. QoS information with respect to a user is obtained in response to a radio resource request received from the user. The user is associated with a particular category of time slots based on the QoS information of the user.”).
- *See, e.g.,* Kim at 694-695 (“In this section, we propose two mechanisms, differentiation by the contention window size and differentiation by the backoff exponent, to provide the service differentiation by multiple different level priorities in the IEEE 802.15.4 wireless sensor networks. Priority of a device is chosen through the proposed two service differentiation mechanisms and all devices are divided into multiple different priority classes. Even though it can be also considered the combined mechanism of the proposed mechanisms, we describe the mechanisms separately in this paper. Before describing the mechanisms in detail, we first state our assumptions. The 802.15.4 sensor network model that we are considering operates in beacon-enable mode with slotted CSMA-CA algorithm. In this paper we only consider the contention access period (CAP) and analyze the proposed mechanisms in the saturation mode. When the transmitted packet meets the collision, the packet is dropped and the device tries

to transmit the new packet in the head of the queue. In the following we describe the proposed mechanisms in detail.”).

- *See, e.g.,* Liu '827 at 1:50-2:3 (“FIG. 1 shows a diagram of a wireless network. Wireless network 100 includes access point (AP) 102 and mobile stations (STA) 110, 120, and 130. In some embodiments, wireless network 100 is a wireless local area network (WLAN). For example, one or more of mobile stations 110, 120, and 130, or access point 102 may operate in compliance with a wireless network standard such as ANSI/IEEE Std. 802.11, 1999 Edition, although this is not a limitation of the present invention. As used herein, the term “802.11” refers to any past, present, or future IEEE 802.11 standard, including, but not limited to, the 1999 edition. Mobile stations 110, 120, and 130 may be any type of mobile station capable of communicating in network 100. For example, the mobile stations may be computers, personal digital assistants, wireless-capable cellular phones, or the like. As explained below, in some embodiments, mobile stations 110, 120, and 130 operate in compliance with an 802.11 standard, and are also capable of saving power by entering one of many different possible power savings modes.”).
- *See, e.g.,* 802.11-1999 at vi (“This standard defines the protocol and compatible interconnection of data communication equipment via the “air”, radio or infrared, in a local area network (LAN) using the carrier sense multiple access protocol with collision avoidance (CSMA/CA) medium sharing mechanism. The medium access control (MAC) supports operation under control of an access point as well as between independent stations. The protocol includes authentication, association, and reassociation services, an optional encryption/decryption procedure, power management to reduce power consumption in mobile stations, and a point coordination function for time-bounded transfer of data.”).
- *See, e.g.,* 802.11e at 1 (“Defines the medium access control (MAC) procedures to support local area network (LAN) applications with quality of service (QoS) requirements, including the transport of voice, audio, and video over IEEE 802.11 wireless LANs (WLANs).”).
- *See, e.g.,* Ye at 1567 (“Wireless sensor networking is an emerging technology that has a wide range of potential applications including environment monitoring, smart spaces, medical systems and robotic exploration. Such a network normally consists of a large number of distributed nodes that organize themselves into a multi-hop wireless network. Each node has one or more sensors, embedded processors and low-power radios, and is normally battery operated. Typically, these nodes coordinate to perform a common task.”).
- *See, e.g.,* Ward at [0038] (“The system comprises a plurality of transponders which are actuated in turn by the computer 9 over a radio communication link and which respond by emitting a pulse of ultrasonic energy. For example, transponders 14 and 15 are located on and associated with the computer 9 and another computer or terminal 16 forming part of a local area network served by

the computer 9. The locations of such transponders 14 and 15 do not, in general, vary frequently with time. However, these transponders serve to determine the locations of the apparatuses to which they are attached.”).

- *See, e.g.*, Turina at 5:20-34 (“FIG. 1 is a simplified schematic block diagram of a telecommunications system that can be used to implement a method of transferring packet data with a VIP Mobile Station, in accordance with the preferred embodiment of the present invention. System 10 includes a communications network 12. Network 12 includes a base station/transceiver section 14. Network 12 can be a local or wide area network (LAN or WAN), or a Public Land Mobile Network (PLMN) such as the cellular network in the GSM. Generally, network 12 can be any type of communications network that provides packet data services using shared packet data channels. In the preferred embodiment shown (for illustrative purposes only), network 12 is a digital TDMA cellular mobile radio network.”).
- *See, e.g.*, Odman at Abstract (“A method is provided for transmitting wireless signals in a network comprising a network coordinator and one or more remote devices. The available transmission time is divided into a plurality of superframes, each of which is further divided up into a beacon duration, one or more management time slots, one or more guaranteed time slots, and one or more asynchronous time slots. Each of the management time slots, guaranteed time slots, and asynchronous time slots are assigned to one of the one or more remote devices. The network coordinator sends a beacon to the one or more remote devices during the beacon duration. The device or coordinator assigned to the current guaranteed time slot sends frames of isochronous data in the current guaranteed time slot. The device or coordinator assigned to the current asynchronous time slot sends frames of asynchronous data in the current asynchronous time slot.”).
- *See, e.g.*, Lan at [0023-0028] (“[0023] The above first object of the present invention is achieved by a timeslot selection method of selecting a transmitting timeslot used by a mobile station in a wireless packet transmission system where the mobile station communicates with a base station, the timeslot selection method comprising the steps of: [0024] obtaining a propagation loss; [0025] receiving an occupation state and an interference amount of an uplink timeslot from the base station; [0026] obtaining a desired wave (or carrier) power from the propagation loss; [0027] obtaining a ratio between the desired wave power and the propagation loss for the uplink timeslot in which the occupation state is idle; and [0028] selecting the transmitting timeslot by using the ratio between the desired wave power and the propagation loss among uplink timeslots.”).
- *See, e.g.*, Brown at 2:46-55 (“Referring now to FIG. 1, a communication system 100 includes at least one base station 102 and at least one mobile station, such as mobile station 104, mobile station 106, mobile station 108, mobile station 110 and mobile station 112. The communication system 100 may include any number of base stations and any number of mobile stations. The number illustrated in FIG. 1

is arbitrarily chosen to illustrate one embodiment of such a system. The communication system 100 is configured for radio communication between the base station 102 and each of the mobile stations.”).

- *See, e.g., Ben-Eli at Abstract* (“Network resources such as in a wireless system may be allocated to user devices on the network based upon at least one or more minimum user requirements being satisfied. A user may be determined as satisfied when minimum requirements of rate and delay are reached or maintained. The network may optimize throughput on the network by allowing a maximum number of users on the network to be satisfied. Users may be ranked according to signal quality, and network resources may be allocated to users according to rank to satisfy users until the resources of the network are allocated.”).
- *See, e.g., Huang at Abstract* (“IEEE 802.15.4 is a new standard uniquely designed for low-rate wireless personal area networks. It targets ultra-low complexity, cost, and power for low-rate wireless connectivity among inexpensive, portable, and moving devices. IEEE 802.15.4 provides a Guaranteed Time Slots (GTS) mechanism to allocate a specific duration within a superframe for time-critical transmissions. In this paper, we propose an adaptive GTS allocation (AGA) scheme for IEEE 802.15.4 with the considerations of low-latency and fairness. The scheme is designed based on the existing IEEE 802.15.4 medium access control protocol without any modification. A simulation model validated by the developed mathematical analysis is presented to investigate the performance of our AGA scheme. The capability of the proposed AGA scheme is evaluated by a series of experiments. It is shown that the proposed scheme significantly outperforms the existing IEEE 802.15.4 implementations.”).
- *See, e.g., Pallassini at Abstract* (“Recent advances in wireless communications and electronics has enabled the development of low-cost sensor networks. Wireless sensor networks can be used for various application areas (e.g., military, home, environment). Each application poses its own particular technical issues. One key problem that arises in many applications is how to organize the computation and communication in a sensor network to enable accurate estimation of the state of a dynamic system. As a starting point in this thesis, we demonstrate that packet loss and delays have a strong influence on the performance of optimal estimators. Thus, when we want to use a sensor network platform to collect and forward measurements to a data collector for estimation, it is critical to understand the loss performance of current hardware platforms and, possibly, to design MAC schemes that eliminate losses and minimize data collection latency. We investigate on the problem of packet loss, with practical experiments on a real wireless sensor network built up with Telos platform. The experiments in this thesis are made with single hop and multi-hop protocols in a star and linear network topology. To solve the problem of data delay and to avoid the collisions that lead to packet losses, we propose an overlay TDMA over CSMA. The underlying idea is to have a distributed protocol which is able to schedule the transmission of the nodes in order to have a data flow that converges

from the furthest nodes toward the fusion center. To show the benefits of our protocol we simulate the behavior of a network in which nodes are randomly scheduled by the fusion center. Our protocol permits to obtain, in a distributed way, the optimal solution of such a network giving a strong improvement over a casual schedule.”).

- *See, e.g.,* Gilb at 3 (“The 802.15.3 Task Group was formed to create a standard that would enable wireless connectivity of high-speed, multimedia-capable portable consumer devices. The goals were to get greater than 20 Mb/s data rate while maintaining quality of service (QoS) for the data streams, low-power, and low-cost. IEEE Std 802.15.3, which is the subject of this book, was approved by the IEEE-SA in June 2003.”).
- *See, e.g.,* Lansford at 1662 (“The HomeRF1 Working Group (WG) is a consortium of more than 100 companies from the computer, telecommunications, and consumer electronics industries. This group has developed an open specification called the Shared Wireless Access Protocol-Cordless Access (SWAP-CA) that enables radio frequency (RF) wireless connectivity between a diverse set of devices and computing resources in and around a typical home. Built around an RF spectrum with worldwide availability, SWAP-CA includes operational support for both managed and ad hoc networks of devices. It combines and extends wireless networking and cordless telephony into a single unified protocol allowing mobile devices to communicate via both voice and data traffic simultaneously over the Internet and/or over the public switched telephone network (PSTN). For battery-operated devices, it includes a power management mechanism that ensures connection longevity. The technology has been specifically optimized for consumer applications and price points, and, consequently, the HomeRF WG has the broad backing of the major corporate stakeholders interested in enabling tetherless networking within the home.”).
- *See, e.g.,* Nakagawa at [0011] (“In order to achieve the above objective, a radio communications apparatus according to the present invention is, as described in claim 1, a radio communications apparatus which constructs an ad-hoc network with other radio communications apparatuses existing therearound to wirelessly communicate with the other radio communications apparatuses using a TDD-CDMA system, and wirelessly communicates with base station equipment of a mobile communications network using the TDD-CDMA system; the radio communications apparatus having a first communications path for directly communicating with the base station equipment and a second communications path for communicating with the base station equipment via another radio communications apparatus within the ad-hoc network, as communications paths to the base station equipment, and communicating with the base station equipment using a communications path specified by the base station equipment among the first communications path and the second communications paths.”).
- *See, e.g.,* Major at 7:65-920 (“In the example of FIG. 1, a wireless gateway 20 is connected to the Internet for communicating via wireless link 22 to a plurality of

wireless mobile data communication devices 24. Also shown in FIG. 1 is machine 30, which could be a FAX machine, a printer, a system for displaying images (such as video) or a machine capable of processing and playing audio files, such as a voice mail system. The present invention includes the ability to redirect certain message attachments to such an external machine 30 if the redirector program configuration data reflects that the mobile device 24 cannot receive and process the attachments, or if the user has specified that certain attachments are not to be forwarded to mobile device 24, even if such device can process those attachments. By way of example, consider an E-mail sent to a user that includes three attachments—a word processing document, a video clip and an audio clip. The redirection program could be configured to send the text of the E-mail to the remote device, to send the word processing document to a networked printer located near the user, to send the video clip to a store accessible through a secure connection through the internet and to send the audio clip to the user's voice mail system. This example is not intended to limit the breadth and scope of the invention, but rather to illustrate the variety of possibilities embodied in the redirection concept.”).

- *See, e.g., Parantainen at [0001]* (“The invention relates to a method for transmitting data for a multimedia broadcast/multicast service (MBMS) from a radio access network of a cellular communication network via a radio interface to mobile terminals located in a radio cell supplied by the radio access network. The employed radio access network can be in particular a GERAN, i.e. a GSM (Global System for Mobile Communications) EDGE (Enhanced Data-rates for GSM) RAN (Radio Access Network). The invention relates equally to a corresponding network entity, to a corresponding mobile terminal, and to a corresponding communication system.”).
- *See, e.g., Karaoguz at [0025]* (“The base stations or access points 12-16 are operably coupled to the network hardware 34 via local area network connections 36, 38 and 40. The network hardware 34, which may be a router, switch, bridge, modem, system controller, etc., provides a wide area network connection 42 for the communication system 10. Each of the base stations or access points 12-16 has an associated antenna or antenna array to communicate with the wireless communication devices in its area. Typically, the wireless communication devices register with a particular base station or access point 12-16 to receive services from the communication system 10. For direct connections (i.e., point-to-point communications), wireless communication devices communicate directly via an allocated channel.”).
- *See, e.g., Smith at 4:56-5:15* (“FIG. 1 shows an enhanced passive scanning system for a wireless local area network (WLAN), in accordance with one embodiment of the present invention at 100. WLAN 100 includes one or more wireless communication devices referred to herein as mobile stations 110, 112, 114 and 116, and one or more access points 120 and 124. Access points 120 and 124 may be connected to an infrastructure network 130, which in turn may be connected to other wired and wireless networks (not shown). Mobile stations 110, 112, 114 and

116 include radio transmitters and receivers for transmitting and receiving signals such as voice over IP, data packets, control frames, and network management frames. Mobile stations 110, 112, 114 and 116 can communicate wirelessly with access points 120 and 124, and can be set to communicate with each other. In one embodiment, two mobile stations 110 and 112 form an ad hoc network with the ability to establish communications when in close proximity to each other. Often, one or more mobile stations 110, 112 and 114 will connect wirelessly to an access point 120, using standardized protocols such as IEEE 802.11, commonly referred to as Wi-Fi. These industry standards allow communication channels to be established and maintained between combinations of mobile stations and access points for the transmission of digital information by using techniques such as carrier-sense multiple access protocol with collision avoidance (CSMA/CA) to help provide rapid, equitable connectivity for all stations.”).

- *See, e.g.*, Schloss at Abstract (“A TDMA network for reader-transponder communications including a receiver having an antenna for receiving and transforming radiated energy to a first RF signal and a detector for demodulating and converting the first RF signal to a digital signal. A protocol logic device is provided for decoding the digital signal and for executing a protocol. The protocol comprises a plurality of randomly selected time slots to gain admission to the TDMA network and a plurality of assigned time slots to transmit messages during the reader-transponder communications. In a transponder implementation, an oscillator is provided for converting protocol formatted digital signals from the logic device to a second RF signal. Thereafter, the antenna transforms the second RF signal to radiated energy and transmits the radiated energy. In a preferred embodiment, the TDMA network includes a transmit/receive switch for directing the first and second RF signals along the receive and transmit paths, respectively. A digital memory which communicates with the protocol logic device is provided for storing data unique to a transponder. The protocol also includes a reader control message time slot for interrogating the transponder and an acknowledgment time slot for indicating the reception of a message.”).
- *See, e.g.*, Hoang at [0011] (“Turning now to the drawings, wherein like numerals designate like components, FIG. 1 illustrates communication system 100 in accordance with the preferred embodiment of the present invention. Communication system 100 preferably utilizes a communication system protocol defined by the 802.15.3 Wireless Personal Area Networks for High Data Rates standard, or the IEEE 802.15.4 Low Rate Wireless Personal Area Networks standard. One of ordinary skill in the art will recognize that other communication system protocols may be utilized without varying from the scope of the invention. For example, communication system 100 may utilize communication system protocols such as, but not limited to, Ad-hoc On Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally-Ordered Routing Algorithm (TORA), Bluetooth™ standard (IEEE Standard 802.15.1), . . . , etc. As shown, communication system 100 includes a number of piconets, each comprising a coordinating device 10 and a larger number of slave nodes 20 in communication with coordinating device 10. Nodes 20 represent devices that

communicate with each other through synchronization provided by coordinating devices 10. Nodes 20 can be transportable (mobile) or they can be fixed in a given place.”).

- *See, e.g.,* Tiedemann at Abstract (“A system for reducing receiver power consumption in communication system having a transmitter and one or more receivers schedules periodic messages in “slots.” Each receiver is assigned a slot during which it monitors the transmissions. The transmitter transmits messages to the receiver only during the assigned slots. The receiver is in an “active state” during its assigned slot. It may remain in the active state after its assigned slot if the message requires the receiver to perform additional actions. During the “inactive state,” which is the time period between successive occurrences of its assigned slot, the receiver may perform any action not requiring coordination with the transmitter. It may conserve power during this time by removing power from one or more components such as those used for monitoring the transmissions. At a time during the inactive state shortly before the assigned slot, the receiver applies power to these components and performs initializations. Such initializations may include requiring a pilot channel signal to which the receiver may synchronize itself if its timing signals have drifted out of synchronization with those of the transmitter during the preceding inactive state.”).
- *See, e.g.,* Mansfield at 2:45-57 (“Referring to FIG. 1, a preferred embodiment of a wireless communication system 100 may support both switched circuit message transmissions and packet data message transmissions to a subscriber of system 100, and may support a variety of applications, such as, e.g., packet data, voice, fax, security, network management, subscriber management, and billing communications. System 100 comprises a plurality of base stations (BS) 102 for communicating with terminals or user devices 104 via Code Division Multiple Access (CDMA) channels 106. A low data rate link, and thus communication, may be maintained between user device 104 and base station 102 regardless of whether data is flowing through CDMA channels 106.”).

2. Proximity-Based Devices

Proximity-based devices were well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g.,* Bluetooth at 335 (“Service Discovery in the Bluetooth environment, where the set of services that are available changes dynamically based on the RF proximity of devices in motion, is qualitatively different from service discovery in traditional network-based environments. The service discovery protocol defined in this specification is intended to address the unique characteristics of the Bluetooth environment. See “Appendix A – Background Information,” on page 378, for further information on this topic.”).

- *See, e.g.*, 802.15.3 at 285 (“Open communications medium: Since the data being transmitted will be able to be received by any other entity that is sufficiently close and has a sufficiently good receiver, it is assumed that transmissions are heard by entities that are not part of the piconet.”).
- *See, e.g.*, 802.15.4 at 13 (“A LR-WPAN is a simple, low-cost communication network that allows wireless connectivity in applications with limited power and relaxed throughput requirements. The main objectives of an LR-WPAN are ease of installation, reliable data transfer, short-range operation, extremely low cost, and a reasonable battery life, while maintaining a simple and flexible protocol.”).
- *See, e.g.*, Gilb at 19 (“Another application would be to enable handheld games to interact with each other wirelessly. Multiplayer games that could be formed whenever a group of people with handheld gaming devices was in range. The gaming devices are taking on new roles as well, such as providing playback of digital music. Having wireless connection in the handheld game would allow the user to upload music, videos or images from kiosks, computers, or the game console. Because the handheld game has a screen as well as buttons, it can serve as the interface for this transaction. Not only that, but new applications will be found for the device using the display and controls to provide input to and feedback from another 802.15.3 device that, for cost reasons, does not have a user interface.”).
- *See, e.g.*, Smith at 4:56-5:15 (“FIG. 1 shows an enhanced passive scanning system for a wireless local area network (WLAN), in accordance with one embodiment of the present invention at 100. WLAN 100 includes one or more wireless communication devices referred to herein as mobile stations 110, 112, 114 and 116, and one or more access points 120 and 124. Access points 120 and 124 may be connected to an infrastructure network 130, which in turn may be connected to other wired and wireless networks (not shown). Mobile stations 110, 112, 114 and 116 include radio transmitters and receivers for transmitting and receiving signals such as voice over IP, data packets, control frames, and network management frames. Mobile stations 110, 112, 114 and 116 can communicate wirelessly with access points 120 and 124, and can be set to communicate with each other. In one embodiment, two mobile stations 110 and 112 form an ad hoc network with the ability to establish communications when in close proximity to each other. Often, one or more mobile stations 110, 112 and 114 will connect wirelessly to an access point 120, using standardized protocols such as IEEE 802.11, commonly referred to as Wi-Fi. These industry standards allow communication channels to be established and maintained between combinations of mobile stations and access points for the transmission of digital information by using techniques such as carrier-sense multiple access protocol with collision avoidance (CSMA/CA) to help provide rapid, equitable connectivity for all stations.”).
- *See, e.g.*, Hoang at [0002] (“Ad-hoc wireless transmission technology offers very high rate throughput but within a limited distance, typically 10 meters or less between devices in each piconet. To extend network coverage (e.g., to provide

whole house coverage), additional piconets must be added and linked (meshed) together. Meshing typically requires all transmissions to use the same radio channel. Using the same radio channel for all transmissions allows for a single transceiver to operate within each node, reducing costs. This simple scheme is not scalable beyond a few piconets since each additional piconet further reduces the average available channel time to each device in the overall network. For example, it has been shown that as the node density increases, the network performance is rapidly degraded due to channel contention. This is because when two nodes in close proximity are communicating, use of the common channel has the effect of preventing multiple surrounding nodes from communicating amongst them. This creates a ripple effect on the congestion in the network. Therefore, a need exists for a method and apparatus for operating a node in an ad-hoc communication system that alleviates congestion caused by the use of a common channel.”).

3. *Fixed Routers*

Fixed routers, base stations, coordinator nodes, readers, and other similar devices fixed in place were well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g.*, 802.15.3 at 1 (“This standard defines the PHY and MAC specifications for high data rate wireless connectivity with fixed, portable and moving devices within or entering a personal operating space.”).
- *See, e.g., See, e.g.*, 802.15.4 at 1 (“The scope of this project is to define the physical layer (PHY) and medium access control (MAC) sublayer specifications for low data rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements typically operating in the personal operating space (POS) of 10 m.”).
- *See, e.g.*, Bluetooth at 41 (“Bluetooth is a short-range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. Key features are robustness, low complexity, low power, and low cost.”).
- *See, e.g.*, HomeRF at 26 (“Fixed networks are likely to include a CP, and so will not be ad-hoc networks.”), 440 (“A Connection Point (CP) is a HomeRF device that provides management of a HomeRF network, and can provide (depending on its class) a connection between the On-Air interface, the public telephone network and a personal computer.”), FIGs. 1-3, 5-6.
- *See, e.g.*, Livet at 2:39-54 (“The present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout. Hereafter, a base station includes but is not limited to a Node-B, site controller, access point or any other type of interfacing device in a wireless

environment. FIG. 1 is a block diagram of a wireless communication system 100, wherein a plurality of WTRUs 105 communicate with base stations 110. The base stations 110 are controlled by a radio network controller (RNC) 115. The RNC 115 is connected to a core network 120. Either the RNC 115 or the base stations 110 include a means for sorting a plurality of time slots of a radio resources into a plurality of different categories, and a means for mapping a user to a particular designation of time slots based on QoS information of the user which is obtained from a core network 120, as described in more detail below.”).

- *See, e.g.*, 802.11-1999 at 14 (“All data from non-IEEE 802.11 LANs enter the IEEE 802.11 architecture via a portal. The portal provides logical integration between the IEEE 802.11 architecture and existing wired LANs. It is possible for one device to offer both the functions of an AP and a portal; this could be the case when a DS is implemented from IEEE 802 LAN components.”).
- *See, e.g.*, Ward at [0037] (“The room also contains part of a transponder location system. This system comprises a computer 9 connected by any suitable communication link, such as wiring, to ceiling-mounted transducers 10 to 13 which convert ultrasonic acoustic energy into corresponding electrical signals and supply these signals to the computer 9.”).
- *See, e.g.*, Turina at 5:20-34 (“FIG. 1 is a simplified schematic block diagram of a telecommunications system that can be used to implement a method of transferring packet data with a VIP Mobile Station, in accordance with the preferred embodiment of the present invention. System 10 includes a communications network 12. Network 12 includes a base station/transceiver section 14. Network 12 can be a local or wide area network (LAN or WAN), or a Public Land Mobile Network (PLMN) such as the cellular network in the GSM. Generally, network 12 can be any type of communications network that provides packet data services using shared packet data channels. In the preferred embodiment shown (for illustrative purposes only), network 12 is a digital TDMA cellular mobile radio network.”).
- *See, e.g.*, Odman at [0015] (“The various non-coordinator devices 320 are confined to a usable physical area 350, which is set based on the extent to which the coordinator 310 can successfully communicate with each of the non-coordinator devices 320. Any non-coordinator device 320 that is able to communicate with the coordinator 310 (and vice versa) is within the usable area 350 of the network 300. As noted, however, it is not necessary for every non-coordinator device 320 in the network 300 to communicate with every other non-coordinator device 320.”).
- *See, e.g.*, Lan at [0167] (“FIG. 7 shows a plurality of mobile stations in a cellular system. FIGS. 8A and 8B show an example of timeslot occupation states and interference amounts in a cell A. In the following, the operation of timeslot selection according to the first embodiment will be described with reference to FIGS. 7, 8A, 8B and 5.”).

- *See, e.g.,* Brown at 3:1-18 (“The base station 102 provides an interface between radio communication with the mobile stations and wireline communication with a telephone network, local area network or other data source. The base station 102 includes a wireline interface 114, a controller 116, a memory 118, a user interface 120, a base receiver or a receiver circuit 122, a base transmitter or a transmitter circuit 124, an antenna switch 126 and an antenna 128. The wireline interface 114 is coupled to an input 130 which is configured for coupling to external data sources, such as a public switched telephone network PSTN 103 or local area network or LAN 105. The wireline interface 114 provides functions such as tone generation for dual tone, multi-frequency (DTMF) dialing and detection of an incoming ringing signal from the telephone network. The wireline interface 114 also communicates signals representative of speech between the telephone network and the controller 116 and communicates signals representative of asynchronous data between the local area network and the controller 116.”).
- *See, e.g.,* Ben-Eli at 1:54-64 (“In one embodiment, at least one or more of devices 112–114 may be transportable by a user, such as a hand held device, and may be operated by a user while being hand held or otherwise on the person of the user, such as in a pocket, attached to a belt or holster, and so on. Base station 110 may allow devices 112–114 to communicate with other devices 112–114, and may allow devices 112–114 to communicate via network 120. In one embodiment, network 120 may be a wide area network or world wide network such as the Internet, although the scope of the present invention is not limited in this respect.”).
- *See, e.g.,* Lansford at 1663 (“Fig. 1. In this scenario, the main home PC is linked to an Internet gateway that might be a 56K, xDSL, or cable modem. This link may be a simple cable, a wired network connection, or a wireless SWAP-CA network connection. This main home PC would likely have a variety of built-in or peripheral resources such as a printer, a scanner, a CD drive, a DVD drive, etc. For most home PCs today and looking forward, it is likely that the universal serial bus (USB) [6] would be the bus of choice for many peripherals that do not need to be mobile or remote from the PC. For video applications, which require connection to devices such as camcorders and video players, the IEEE 1394 [7] is the expected choice. For sharing resources amongst multiple PCs, options such as conventional 10/100-BaseT Ethernet [4], home phone line networks [3], and AC power line networks [9] will exist. (This last option is particularly well suited for many home automation applications where very low data rates are acceptable.) As of this writing, there are no viable RF networking alternatives at consumer price points that can be used as a networking technology for home networks. The goal of the HomeRF WG is to fill this void.”).
- *See, e.g.,* Nakagawa at [0042] (“The second radio communications apparatus 20 is a radio communications apparatus without the function of connecting to a mobile communications network and is configured, for example, by an information terminal (for example, a personal computer or a workstation) which is wiredly or wirelessly connected to a fixed communications network such as a LAN (local

area network) and peripheral equipment of the information terminal (for example, a headset, a printer and a mouse).”).

- *See, e.g.,* Major at 7:65-920 (“In the example of FIG. 1, a wireless gateway 20 is connected to the Internet for communicating via wireless link 22 to a plurality of wireless mobile data communication devices 24. Also shown in FIG. 1 is machine 30, which could be a FAX machine, a printer, a system for displaying images (such as video) or a machine capable of processing and playing audio files, such as a voice mail system. The present invention includes the ability to redirect certain message attachments to such an external machine 30 if the redirector program configuration data reflects that the mobile device 24 cannot receive and process the attachments, or if the user has specified that certain attachments are not to be forwarded to mobile device 24, even if such device can process those attachments. By way of example, consider an E-mail sent to a user that includes three attachments—a word processing document, a video clip and an audio clip. The redirection program could be configured to send the text of the E-mail to the remote device, to send the word processing document to a networked printer located near the user, to send the video clip to a store accessible through a secure connection through the internet and to send the audio clip to the user’s voice mail system. This example is not intended to limit the breadth and scope of the invention, but rather to illustrate the variety of possibilities embodied in the redirection concept.”).
- *See, e.g.,* Karaoguz at [0025] (“The base stations or access points 12-16 are operably coupled to the network hardware 34 via local area network connections 36, 38 and 40. The network hardware 34, which may be a router, switch, bridge, modem, system controller, etc., provides a wide area network connection 42 for the communication system 10. Each of the base stations or access points 12-16 has an associated antenna or antenna array to communicate with the wireless communication devices in its area. Typically, the wireless communication devices register with a particular base station or access point 12-16 to receive services from the communication system 10. For direct connections (i.e., point-to-point communications), wireless communication devices communicate directly via an allocated channel.”).
- *See, e.g.,* Hoang at [0011] (“Turning now to the drawings, wherein like numerals designate like components, FIG. 1 illustrates communication system 100 in accordance with the preferred embodiment of the present invention. Communication system 100 preferably utilizes a communication system protocol defined by the 802.15.3 Wireless Personal Area Networks for High Data Rates standard, or the IEEE 802.15.4 Low Rate Wireless Personal Area Networks standard. One of ordinary skill in the art will recognize that other communication system protocols may be utilized without varying from the scope of the invention. For example, communication system 100 may utilize communication system protocols such as, but not limited to, Ad-hoc On Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally-Ordered Routing Algorithm (TORA), Bluetooth™ standard (IEEE Standard 802.15.1), . . . , etc. As

shown, communication system 100 includes a number of piconets, each comprising a coordinating device 10 and a larger number of slave nodes 20 in communication with coordinating device 10. Nodes 20 represent devices that communicate with each other through synchronization provided by coordinating devices 10. Nodes 20 can be transportable (mobile) or they can be fixed in a given place.”).

4. *Avoiding Collisions in Wireless Communications*

Techniques for avoiding collisions between wireless transmissions at the same/overlapping frequencies were well known at the time of the alleged invention(s) of the Asserted Patents. Such techniques included, but were not limited to, contention-based protocols such as listen before talk operations/carrier sense multiple access (CSMA) with collision avoidance (CSMA/CA) or with collision detection (CSMA/CD), time division multiple access (TDMA) systems, and frequency division multiple access (FDMA)/orthogonal FDMA (OFDMA).

- *See, e.g.*, 802.15.3 at 170 (“The basic medium access mechanism during the CAP is carrier sense multiple access with collision avoidance (CSMA/CA). ... To minimize collisions, a transmitting DEV is required to first sense that the medium is idle for a random length of time. The MAC shall use the CCA capabilities of the PHY to detect whether the channel is busy or idle. Only if the medium is idle after that time shall the DEV start its transmission. This process of waiting before transmission is termed “backoff.” The backoff procedure shall not be applied to the transmission of the beacon that is transmitted by the PNC at the beginning of the superframe.”); 172 (“The PNC divides the CTAP into channel time allocations (CTAs). A DEV that is given a directed CTA is guaranteed that no other DEVs will compete for the channel during the indicated time duration of the CTA.”).
- *See, e.g.*, 802.15.4 at Introduction (“This standard defines the protocol and interconnection of devices via radio communication in a personal area network (PAN). The standard uses carrier sense multiple access with a collision avoidance medium access mechanism and supports star as well as peer-to-peer topologies. The media access is contention based; however, using the optional superframe structure, time slots can be allocated by the PAN coordinator to devices with time critical data. Connectivity to higher performance networks is provided through a PAN coordinator.”), 18 (“For low-latency applications or applications requiring specific data bandwidth, the PAN coordinator may dedicate portions of the active superframe to that application. These portions are called guaranteed time slots (GTSs). The GTSs form the contention-free period (CFP), which always appears at the end of the active superframe starting at a slot boundary immediately

following the CAP, as shown in Figure 5. The PAN coordinator may allocate up to seven of these GTSs, and a GTS may occupy more than one slot period. However, a sufficient portion of the CAP shall remain for contention-based access of other networked devices or new devices wishing to join the network. All contention-based transactions shall be complete before the CFP begins. Also each device transmitting in a GTS shall ensure that its transaction is complete before the time of the next GTS or the end of the CFP. More information on the superframe structure can be found in 7.5.1.1.”).

- *See, e.g., Bluetooth at 109* (“For the inquiry operation, there is only a slave response, no master response. The master listens between inquiry messages for responses, but after reading a response, it continues to transmit inquiry messages. The slave response routine for inquiries differs completely from the slave response routine applied for pages. When the inquiry message is received in the inquiry scan substate, a response message containing the recipient’s address must be returned. This response message is a conventional FHS packet carrying the unit’s parameters. However, a contention problem may arise when several Bluetooth units are in close proximity to the inquiring unit and all respond to an inquiry message at the same time. First of all, every Bluetooth unit has a free running clock; therefore, it is highly unlikely that they all use the same phase of the inquiry hopping sequence. However, in order to avoid collisions between units that do wake up in the same inquiry hop channel simultaneously, the following protocol in the slave’s inquiry response is used. If the slave receives an inquiry message, it generates a random number RAND between 0 and 1023. The slave then returns to the CONNECTION or STANDBY state for the duration of RAND time slots. Before returning to the CONNECTION or STANDBY state, the unit may go through the page scan substate; this page scan must use the mandatory page scan scheme. After at least RAND slots, the unit will return to the inquiry scan substate. On the first inquiry message received in this substate the slave goes into the inquiry response substate and returns an FHS response packet to the master 625 μ s after the inquiry message was received. If during the scan no trigger occurs within a timeout period of *inqrespTO*, the slave returns to the STANDBY or CONNECTION state. If the unit does receive an inquiry message and returns an FHS packet, it adds an offset of 1 to the phase in the inquiry hop sequence (the phase has a 1.28 s resolution) and enters the inquiry scan substate again. If the slave is triggered again, it repeats the procedure using a new RAND. The offset to the clock accumulates each time a FHS packet is returned. During a 1.28 s probing window, a slave on average responses 4 times, but on different frequencies and at different times. Possible SCO slots should have priority over response packets; that is, if a response packet overlaps with an SCO slot, it is not sent but the next inquiry message is awaited.”), 45 (“The SCO link is a symmetric, point-to-point link between the master and a specific slave. The SCO link reserves slots and can therefore be considered as a circuit-switched connection between the master and the slave. The SCO link typically supports time-bounded information like voice. The master can support up to three SCO links to the same slave or to different slaves. A slave can support up to three SCO links from the same master, or two SCO links if the links originate from different

masters. SCO packets are never retransmitted. The master will send SCO packets at regular intervals, the so-called SCO interval TSCO (counted in slots) to the slave in the reserved master-to-slave slots. The SCO slave is always allowed to respond with an SCO packet in the following slave-to-master slot unless a different slave was addressed in the previous master-to-slave slot. If the SCO slave fails to decode the slave address in the packet header, it is still allowed to return an SCO packet in the reserved SCO slot.”), 46 (“In the slots not reserved for SCO links, the master can exchange packets with any slave on a per-slot basis. The ACL link provides a packet-switched connection between the master and all active slaves participating in the piconet. Both asynchronous and isochronous services are supported. Between a master and a slave only a single ACL link can exist. For most ACL packets, packet retransmission is applied to assure data integrity. A slave is permitted to return an ACL packet in the slave-to-master slot if and only if it has been addressed in the preceding master-to-slave slot. If the slave fails to decode the slave address in the packet header, it is not allowed to transmit.”).

- *See, e.g.,* HomeRF at 114 (“The MAC uses two different medium access methods to provide these services. It uses time division multiple access (TDMA) to provide the isochronous services, and it uses carrier-sense multiple access, collision avoidance (CSMA/CA) to provide the asynchronous services (priority and non-priority). It also defines a time-based access mechanism (the service slot) that is used to manage I-nodes.”), 440 (“When a Connection Point is present, the network operates as a managed network. The Connection Point can also (depending on its class) manage the allocation of TDMA time slots thereby providing contention free access to the medium for isochronous data.”).
- *See, e.g.,* Livet at Abstract (“A method and system for managing radio resources in a time-slotted wireless communication system is based on the quality of service (QoS) information of a user. A plurality of time slots of a radio resource are sorted into a plurality of different categories, such as high QoS time slots, high capacity time slots, and balanced time slots. Each category is associated with a different level of QoS. QoS information with respect to a user is obtained in response to a radio resource request received from the user. The user is associated with a particular category of time slots based on the QoS information of the user.”).
- *See, e.g.,* Kim at 696-697 (“Fig. 1 describes the operation of the proposed scheme. In the figure, step (1) initialize the NB value as 0 and set the values of CW and BE according to the priority classes (one of the two or both of mechanisms can be selected depending on the requested service differentiation). In step (2), the algorithm attempts to avoid collisions by selecting a random waiting time in the range of $[0, 2^{BE} - 1]$.”).
- *See, e.g.,* 802.11-1999 at 72 (“The CSMA/CA protocol is designed to reduce the collision probability between multiple STAs accessing a medium, at the point where collisions would most likely occur. Just after the medium becomes idle

following a busy medium (as indicated by the CS function) is when the highest probability of a collision exists. This is because multiple STAs could have been waiting for the medium to become available again. This is the situation that necessitates a random backoff procedure to resolve medium contention conflicts.”), 88 (“All STAs in the BSS (other than the PC) set their NAVs to the CFPMaxDuration value at the nominal start time of each CFP. This prevents most contention by preventing non-pollled transmissions by STAs whether or not they are CF-Pollable.”), 71 (“The access priority provided by a PCF may be utilized to create a contention-free (CF) access method. The PC controls the frame transmissions of the STAs so as to eliminate contention for a limited period of time.”).

- *See, e.g.*, 802.11e at 3 (“3.132 enhanced distributed channel access (EDCA): The prioritized carrier sense multiple access with collision avoidance (CSMA/CA) access mechanism used by quality of service (QoS) stations (QSTAs) in a QoS basic service set (QBSS). This access mechanism is also used by the QoS access point (QAP) and operates concurrently with hybrid coordination function (HCF) controlled channel access (HCCA).”).
- *See, e.g.*, Ye at 1567 (“Like in all shared-medium networks, medium access control (MAC) is an important technique that enables the successful operation of the network. One fundamental task of the MAC protocol is to avoid collisions so that two interfering nodes do not transmit at the same time. There are many MAC protocols that have been developed for wireless voice and data communication networks. Typical examples include the time division multiple access (TDMA), code division multiple access (CDMA), and contention-based protocols like IEEE 802.11 [1].”).
- *See, e.g.*, Ward at [0004] (“The base system polls the transponders in accordance with a sequence with each transponder being polled in a time slot of finite duration. The polling signal is propagated electromagnetically and its propagation time from the base system to each transponder is so short in comparison with the speed of propagation of ultrasonic energy that it can be ignored. Each time slot must be sufficiently long to allow for the ultrasonic energy to propagate to all of the transducers within range and for the ultrasonic energy to decay below a threshold so as to avoid confusion with detection of the next ultrasonic burst. In a typical system, 40 milliseconds is sufficient to avoid false detection so that each time slot is 40 milliseconds in duration and hence the transducers can be polled at a maximum rate of 25 per second. There is thus a finite limit to the rate at which any transducer can be polled.”).
- *See, e.g.*, Turina at 1:14-33 (“Generally, in a conventional mobile packet radio communications system, a base station (BS) communicates with a plurality of mobile stations (MSs) over one or more shared packet radio channels. Downlink packet traffic is scheduled by the BS, whereby downlink contention between MSs is avoided. However, in order for the MSs to gain access to the BS on the uplink, the MSs compete using a random multiple access protocol, which inevitably leads

to contention and collisions on the uplink.

One multiple access type of protocol, which is suitable for use with a time division multiple access (TDMA) communications system (e.g., a TDMA cellular radio system), is a reservation slotted-ALOHA multiple access protocol. For example, on the uplink, a MS can transmit a random access request message over the air interface to the BS, in accordance with a conventional slotted-ALOHA multiple access protocol. If the BS successfully receives that random access request message, it allocates or reserves a traffic channel for that MS, and thereafter contention-free (e.g., uncontended) packet transfers can be made between that MS and the BS.”).

- *See, e.g., Rabenko at 4:42-61* (“In order to accomplish TDMA for upstream communication, it is necessary to assign time slots within which CMs having a message to send to the CMTS are allowed to transmit. The assignment of such time slots is accomplished by providing a request contention area in the upstream data path within which the CMs are permitted to contend in order to place a message which requests additional time in the upstream data path for the transmission of their message. The CMTS responds to these requests by assigning time slots to the CMs making such a request, so that as many of the CMs as possible may transmit their messages to the CMTS utilizing TDMA and so that the transmissions are performed without undesirable collisions. In other words, the CM requests an amount of bandwidth on the cable system to transmit data. In turn, the CM receives a “grant” of an amount of bandwidth to transmit data in response to the request. This time slot assignment by the CMTS is known as a “grant” because the CMTS is granting a particular CM permission to use a specific period of time in the upstream.”).
- *See, e.g., Odman at Abstract* (“A method is provided for transmitting wireless signals in a network comprising a network coordinator and one or more remote devices. The available transmission time is divided into a plurality of superframes, each of which is further divided up into a beacon duration, one or more management time slots, one or more guaranteed time slots, and one or more asynchronous time slots. Each of the management time slots, guaranteed time slots, and asynchronous time slots are assigned to one of the one or more remote devices. The network coordinator sends a beacon to the one or more remote devices during the beacon duration. The device or coordinator assigned to the current guaranteed time slot sends frames of isochronous data in the current guaranteed time slot. The device or coordinator assigned to the current asynchronous time slot sends frames of asynchronous data in the current asynchronous time slot.”).
- *See, e.g., Lan at [0184]* (“As mentioned above, according to the present invention corresponding to the first object, the base station notifies the mobile station of the occupation states and the interference amounts of idle timeslots. Then, the mobile station predicts each receive CIR for transmission in the case that each idle timeslot is used, and selects and sends a timeslot having an appropriate interference such that the predicted CIR is smallest on condition that the predicted

CIR satisfies the required CIR. Accordingly, the success rate of transmission is increased for the mobile station. In addition, when a plurality of mobile stations try to send data in a cell simultaneously, they select different timeslots according to propagation loss. Thus, collision rate decreases. Therefore, according to the present invention, a wireless packet transmission method which provides low delay and high throughput can be provided.”).

- *See, e.g.*, Brown at 5:54-67 (“Referring now to FIG. 2, it shows the structure of a frame 200 for communication according to the DECT specification. DECT is a time division, multiple access (TDMA) system using time division duplexing (TDD). Each frame such as frame 200 is divided into 24 full slots as is shown in FIG. 2. Generally, full slots 0 through 11 are used for communication from a base station to a mobile station and full slots 12 through 23 are used for communication from the mobile station to the base station. A typical full duplex link is located on slots one-half frame apart. Thus, if a transmit full slot, such as slot 202 in FIG. 2 is located at slot 0, the receive full slot would be at full slot 12, designated slot 204 in FIG. 2. The frame 200 totals 11,520 bits and is typically 10 msec. in duration.”).
- *See, e.g.*, Ben-Eli at 3:36-55 (“In one embodiment of the invention, feedback may be gathered from users based on the signal quality at their slot, at block 312. In a shared environment, communication may be typically done in time periods of constant duration which may be referred to as slots. In the slots, transmission may be scheduled to 0 or more users. A scheduler may decide at which slots transmission occurs to the user, and then which resources are allocated to a user in a particular slot, for example how much power, how many codes, what portion of the frequency, and so on, according to the resources that may be shared. The scheduler also may determine how to deliver the data to the user, for example what modulation to use, what coding scheme to use, and so on, depending upon the physical layer capabilities. Signal quality may refer a measure of the quality of the link between the base station and the device, and may be, for example, the instantaneous Signal to Interference and Noise Ratio (SINR) at the device, or the achievable instantaneous rate at the device, although the scope of the present invention is not limited in this respect.”).
- *See, e.g.*, Huang at 3930 (“The IEEE standard, 802.15.4, defines the physical layer and medium access control (MAC) sublayer specifications for low-rate wireless personal area networks (LR-WPANs) [3]. It supports wireless communications between devices with minimal power consumption and typically operates in a personal operating space of 10 meter or less. The IEEE 802.15.4 defines two medium-access modes: beacon-enabled mode and nonbeacon-enabled mode. In the nonbeacon-enabled mode, arbitration of medium accesses is purely distributed among wireless devices based on CSMA(Carrier Sense Multiple Access)/CA(Collision Avoidance). In addition to CSMA/CA-based transmissions, the beacon-enabled mode provides a contention-free GTS (Guaranteed Time Slots) mechanism to support time-critical data deliveries. In this paper, we focus on the IEEE 802.15.4 beacon-enabled mode, and the details for the nonbeacon-

enabled mode can be found in [3]. Figure 1 shows a superframe structure adopted by the IEEE 802.15.4 beacon-enabled mode. A superframe begins with a beacon issued by a PAN coordinator, and consists of an active portion and an inactive portion. The duration (also called beacon interval) of a superframe ranges from 15ms to 245s. The coordinator and devices can communicate with each other during the active period and enter the low-power mode during the inactive period. ... The active portion with 16 time slots is composed of three parts: a beacon, a contention access period (CAP), and a contention free period (CFP). The beacon is transmitted by the coordinator at the start of slot 0, and the CAP follows immediately after the beacon. In the CAP, a slotted CSMA-CA mechanism is used for devices to access the channel. In addition to non-time-critical data frames, MAC commands such as association requests and GTS requests shall be transmitted in the CAP.”).

- *See, e.g.,* Pallassini at 82-83 (“The natural effect of increasing the number of packets per second results in an huge amount of traffic in the network. Telos motes use a CSMA/CA protocol to access the channel, i.e. there is not synchronization a priori, this results into a great collision probability. To solve the problem of data delay and to avoid the collisions that lead to packet losses, we propose an overlay TDMA over CSMA. Using a distributed algorithm, as it is our overlay TDMA, we can schedule the nodes to have the minimal latency and to avoid collisions. To show the benefits of our protocol we simulate the behavior of a general network in which nodes are randomly scheduled by the fusion center. Our protocol permits to obtain, in a distributed way, the optimal solution of such a network resulting in a strong improvement over a casual schedule.”).
- *See, e.g.,* Gilb at 33-34 (“The CTAP is composed of one or more CTAs that are allocated by the PNC to a pair of DEV identifiers (DEVIDs). Only the DEV that is listed as the source is allowed to transmit in a CTA, and so the access method for CTAs is time division, multiple access (TDMA). In the case where the CTA has the PNC identifier (PNCID) as either the source ID (SrcID) or destination ID (DestID), the CTA is called a management CTA (MCTA). In most cases, there is no difference between an MCTA and a CTA. The only exceptions to this are when the source address is either the unassociated ID (UnassocID) or the broadcast ID (BcastID). In this case, there are multiple DEVs that are allowed to send information in the MCTA. To handle potential collisions, a third type of access method, called slotted aloha, is used. Although this method is generally not as efficient as using the CAP for association, commands, and data, it was put in to allow for future PHYs that may not be able to perform clear channel assessment (CCA) efficiently.”).
- *See, e.g.,* Lansford at 1667 (“The SWAP-CA medium access control protocol is de-rived from the ETSI DECT standard [10]–[12] and from the popular WLAN standards such as IEEE 802.11 [14]. It is optimized specifically for the home environment. The MAC is designed to work over, and to take advantage of, the frequency hopping radio subsystem. It includes a time division multiple access (TDMA) service for delivery of real-time isochronous data, and a carrier sense

multiple access with collision avoidance (CSMA/CA) service for delivery of asynchronous data. The MAC's behavior depends on the devices that are in use in the network. Table 2 contains the functionality supported by the MAC for different device types.”).

- *See, e.g., Nakagawa at [0047]* (“The control section 14 controls the transmitter 11 and the receiver 12 based on various information stored in the storage section 15. Switching control between transmitting and receiving, transmit power control, switching control and synchronization control between an ad-hoc network and a mobile communications network and the like are performed by this control section 14. For example, when communication is performed with the base station 30 in the mobile communications network or another radio communications apparatus within the ad-hoc network, switching between transmitting and receiving is performed based on time slot assignment set in advance, and communication is performed in a TDD mode.”).
- *See, e.g., Parantainen at [0050]-[0053]* (“The fourth embodiment of the invention is presented for a constellation in which the cell employs two PCCCH time slots, but in which at least some mobile terminals in the cell capable of receiving MBMS are only able to receive on two time slots. In this case, the two PCCCH time slots are advantageously allocated one time slot apart from each other, and the PMBCH is allocated to the time slot between the two PCCCH time slots. An example for the allocation of channels according to the fourth embodiment of the invention is depicted in FIG. 6. FIG. 6 shows again a sequence of downlink time slots, which are numbered for each frame from 1 to 8. A first PCCCH time slot 3, which corresponds always to the PBCCH time slot, is spaced one time slot apart from a second PCCCH time slot 5. The PMBCH is allocated to the time slot that is located between the two PCCCH time slots 3 and 5, i.e. on time slot 4. The paging messages for a specific mobile terminal are provided by either of the two PCCCHs. With such an allocation, all mobile terminals in the GERAN cell which are capable of listening to at least two downlink time slot are able to decode paging messages and the MBMS data. Mobile terminals following the first PCCCH time slot 3, which contains also the PBCCH blocks, can receive with the presented allocation the PBCCH, the PCCCH providing the paging messages and the PMBCH without interruptions. Mobile terminals following the second PCCCH time slot 5 can receive the paging messages provided by the second PCCCH normally, but they have to quit reception on the PMBCH time slot 4 from time to time for a short period, when decoding system information messages from the PBCCH provided on time slot 3. Mobile terminals capable of receiving on three time slots are obviously able to receive MBMS data without interruptions also with the allocation of the fourth embodiment. With such mobile terminals, the fourth embodiment constitutes a special case of the third embodiment.”).
- *See, e.g., Karaoguz at [0038]* (“FIG. 3 is a timing diagram of a radio receiver operating in accordance with the present invention. Referring now to FIG. 3, an IEEE 802.15.3 Standard Defined communication for high data rate wireless personal area networks includes the transmission of periodic beacons that signal

the beginning of a communication signal that is, in turn, followed by a contention access period (CAP) and at least one allocated time slot for data communications. Under 802.15.3, the period between beacons is typically in the range of ten to a few hundred milliseconds. Typically, in a time division multiple access (TDMA) environment, a plurality of allocated time slots follow the CAP wherein each time slot is allocated for communications for a particular radio device. Thus, according to the protocol, a plurality of guaranteed time slots (GTS) follow the CAP. A particular radio knows which allocated time slot is allocated for its use and, therefore, how much time exists until that designated time slot begins.”).

- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.
- *See, e.g.,* Smith at 4:56-5:15 (“FIG. 1 shows an enhanced passive scanning system for a wireless local area network (WLAN), in accordance with one embodiment of the present invention at 100. WLAN 100 includes one or more wireless communication devices referred to herein as mobile stations 110, 112, 114 and 116, and one or more access points 120 and 124. Access points 120 and 124 may be connected to an infrastructure network 130, which in turn may be connected to other wired and wireless networks (not shown). Mobile stations 110, 112, 114 and 116 include radio transmitters and receivers for transmitting and receiving signals such as voice over IP, data packets, control frames, and network management frames. Mobile stations 110, 112, 114 and 116 can communicate wirelessly with access points 120 and 124, and can be set to communicate with each other. In one embodiment, two mobile stations 110 and 112 form an ad hoc network with the ability to establish communications when in close proximity to each other. Often, one or more mobile stations 110, 112 and 114 will connect wirelessly to an access point 120, using standardized protocols such as IEEE 802.11, commonly referred to as Wi-Fi. These industry standards allow communication channels to be established and maintained between combinations of mobile stations and access

points for the transmission of digital information by using techniques such as carrier-sense multiple access protocol with collision avoidance (CSMA/CA) to help provide rapid, equitable connectivity for all stations.”).

- *See, e.g.*, Schloss at Abstract (“A TDMA network for reader-transponder communications including a receiver having an antenna for receiving and transforming radiated energy to a first RF signal and a detector for demodulating and converting the first RF signal to a digital signal. A protocol logic device is provided for decoding the digital signal and for executing a protocol. The protocol comprises a plurality of randomly selected time slots to gain admission to the TDMA network and a plurality of assigned time slots to transmit messages during the reader-transponder communications. In a transponder implementation, an oscillator is provided for converting protocol formatted digital signals from the logic device to a second RF signal. Thereafter, the antenna transforms the second RF signal to radiated energy and transmits the radiated energy. In a preferred embodiment, the TDMA network includes a transmit/receive switch for directing the first and second RF signals along the receive and transmit paths, respectively. A digital memory which communicates with the protocol logic device is provided for storing data unique to a transponder. The protocol also includes a reader control message time slot for interrogating the transponder and an acknowledgment time slot for indicating the reception of a message.”).
- *See, e.g.*, Hoang at [0020]-[0021] (“FIG. 3 illustrates a transmission scheme for the communication system of FIG. 2. During communications among nodes 201-208, a specific transmission protocol is utilized by communication system 100 wherein each piconet communicates within a particular non-overlapping frame 301, 302 as described in U.S. patent application Ser. No. 10/414,838, which is incorporated by reference herein. With reference to FIG. 2, piconet 201 completes all necessary transmissions within frame 301, while piconet 202 completes all necessary transmissions within frame 302. During a frame, a particular controller of the piconet will broadcast piconet timing and control information within a beacon field, while each node (including the controller) will have a Contention Free Period slot, part of the Channel Time Allocation (CTA) facility of the IEEE 802.15.3 standard, for transmission. During its guaranteed time slot, a particular node broadcasts any command (COM) wishing to be executed to any particular node or may send/receive data intended for a single node or set of nodes. Note that because node 207 participates in each piconet, node 207 has a guaranteed time slot (GTS) for transmission/reception within each piconet’s frame. During the GTS, the node also broadcasts a beacon comprising identification of the piconet(s) a node is associated with (i.e., a piconet identifier (PNID)), along with a source address (SA, or device identifier (DEVID)), a destination address (device identifier (DA or DEVID)), and a receive time ($R \times T$) when the node can receive other node’s transmissions. This is illustrated in FIG. 3 with the expanded view of the GTS for node 205. It should be noted that although FIG. 3 shows the beacon signal comprising SA, DA, PNID, and $R \times T$, one of ordinary skill in the art will recognize that the beacon signal may comprise other elements such as, but not

limited to, the byte length of the frame being used, a beacon payload that can be used to broadcast generic data, . . . , etc.”).

- *See, e.g., Tiedemann at Abstract* (“A system for reducing receiver power consumption in communication system having a transmitter and one or more receivers schedules periodic messages in “slots.” Each receiver is assigned a slot during which it monitors the transmissions. The transmitter transmits messages to the receiver only during the assigned slots. The receiver is in an “active state” during its assigned slot. It may remain in the active state after its assigned slot if the message requires the receiver to perform additional actions. During the “inactive state,” which is the time period between successive occurrences of its assigned slot, the receiver may perform any action not requiring coordination with the transmitter. It may conserve power during this time by removing power from one or more components such as those used for monitoring the transmissions. At a time during the inactive state shortly before the assigned slot, the receiver applies power to these components and performs initializations. Such initializations may include requiring a pilot channel signal to which the receiver may synchronize itself if its timing signals have drifted out of synchronization with those of the transmitter during the preceding inactive state.”).
- *See, e.g., Mansfield at 6:21-44* (“Referring specifically to FIG. 4, base station 102 informs user device 104 whether it is permitted to transmit in the next uplink time slot 210, e.g., by transmitting the uplink transmission schedule (represented by scheduling bits 214) to user device 104 at the beginning of each time slot 208. As illustrated, the scheduling bits 214 may be transmitted as part of the user data (as shown in FIG. 4, time slots 1 and 5) or as part of the low data rate maintenance link (as shown in FIG. 4, time slots 2-4). For purposes of illustration, the scheduling bits 214 that indicate that the user device 104 is not permitted to transmit during the next uplink time slot 210 are dark, and the scheduling bits 214 that indicate that the user device 104 is permitted to transmit during the next uplink time slot 210 are light. Thus, as can be seen, user device 104 transmits user data in the uplink time slot 3 only after the base station 102 transmits scheduling bits 214 in the downlink time slot 2 indicating that user device 104 is permitted to transmit during the next uplink time slot 210. Base station 102 is thus able to readily control the Quality of Service (QoS) offered to each user device 104 according to the user data throughput requirements of user device 104. Scheduling for downlink transmissions is trivial since base station 102 simply transmits according to its predetermined schedule.”).

5. *Assigning Timeslots and TDMA Systems*

Assigning time slots for one device to wirelessly communicate with another device was well known at the time of the alleged invention(s) of the Asserted Patents. For example, time division multiple access (TDMA) systems which assigned time slots to users for wireless

communications were well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense's apparent interpretation of the claims.

- *See, e.g.*, 802.15.3 at 172 (“The PNC divides the CTAP into channel time allocations (CTAs). A DEV that is given a directed CTA is guaranteed that no other DEVs will compete for the channel during the indicated time duration of the CTA. A DEV with a CTA may or may not make use of all the allocated time duration within the CTA. The selection of a stream, command or asynchronous data for transmission during a CTA is determined locally by the DEV depending on the number of pending frames and their priorities. See A.1.2.1 for more information on priority management. There are two types of CTAs: dynamic CTA and pseudo-static CTA. The type of a CTA requested is indicated in the Channel Time Request command as specified in 7.5.6.1. The PNC may move dynamic CTAs within the superframe on a superframe by superframe basis. This allows the PNC the flexibility to rearrange CTA assignments to optimize the utilization of the assignments. The PNC moves a dynamic CTA by simply changing the CTA parameters in the beacon. Dynamic CTAs may be used for both asynchronous and isochronous streams.”).
- *See, e.g.*, 802.15.4 at 18 (“For low-latency applications or applications requiring specific data bandwidth, the PAN coordinator may dedicate portions of the active superframe to that application. These portions are called guaranteed time slots (GTSSs). The GTSSs form the contention-free period (CFP), which always appears at the end of the active superframe starting at a slot boundary immediately following the CAP, as shown in Figure 5. The PAN coordinator may allocate up to seven of these GTSSs, and a GTSS may occupy more than one slot period. However, a sufficient portion of the CAP shall remain for contention-based access of other networked devices or new devices wishing to join the network. All contention-based transactions shall be complete before the CFP begins. Also each device transmitting in a GTSS shall ensure that its transaction is complete before the time of the next GTSS or the end of the CFP. More information on the superframe structure can be found in 7.5.1.1.”).
- *See, e.g.*, Bluetooth at 45 (“The SCO link is a symmetric, point-to-point link between the master and a specific slave. The SCO link reserves slots and can therefore be considered as a circuit-switched connection between the master and the slave. The SCO link typically supports time-bounded information like voice. The master can support up to three SCO links to the same slave or to different slaves. A slave can support up to three SCO links from the same master, or two SCO links if the links originate from different masters. SCO packets are never retransmitted. The master will send SCO packets at regular intervals, the so-called SCO interval TSCO (counted in slots) to the slave in the reserved master-to-slave slots. The SCO slave is always allowed to respond with an SCO packet in the following slave-to-master slot unless a different slave was addressed in the previous master-to-slave slot. If the SCO slave fails to decode the slave address in the packet header, it is still allowed to return an SCO packet in the reserved SCO

slot.”), 46 (“In the slots not reserved for SCO links, the master can exchange packets with any slave on a per-slot basis. The ACL link provides a packet-switched connection between the master and all active slaves participating in the piconet. Both asynchronous and isochronous services are supported. Between a master and a slave only a single ACL link can exist. For most ACL packets, packet retransmission is applied to assure data integrity. A slave is permitted to return an ACL packet in the slave-to-master slot if and only if it has been addressed in the preceding master-to-slave slot. If the slave fails to decode the slave address in the packet header, it is not allowed to transmit.”).

- *See, e.g.,* HomeRF at 114 (“The MAC uses two different medium access methods to provide these services. It uses time division multiple access (TDMA) to provide the isochronous services, and it uses carrier-sense multiple access, collision avoidance (CSMA/CA) to provide the asynchronous services (priority and non-priority). It also defines a time-based access mechanism (the service slot) that is used to manage I-nodes.”), 28 (“To provide the connection-oriented services, the MAC uses a TDMA mechanism in which pairs of slots are allocated to a connection between a CP and an I-node. The isochronous connectionless broadcast service is provided using a transient connectionless TDMA slot.”).
- *See, e.g.,* Livet at Abstract (“A method and system for managing radio resources in a time-slotted wireless communication system is based on the quality of service (QoS) information of a user. A plurality of time slots of a radio resource are sorted into a plurality of different categories, such as high QoS time slots, high capacity time slots, and balanced time slots. Each category is associated with a different level of QoS. QoS information with respect to a user is obtained in response to a radio resource request received from the user. The user is associated with a particular category of time slots based on the QoS information of the user.”).
- *See, e.g.,* 802.11e at 2 (“3.126 contention-free period (CFP): The time period during operation of a point coordination function (PCF) when the right to transmit is assigned to stations (STAs) solely by a point coordinator (PC), allowing frame exchanges to occur between members of the basic service set (BSS) without contention for the wireless medium (WM).”).
- *See, e.g.,* 802.11-1999 at 71 (“The access priority provided by a PCF may be utilized to create a contention-free (CF) access method. The PC controls the frame transmissions of the STAs so as to eliminate contention for a limited period of time.”).
- *See, e.g., See, e.g.,* Ye at 1567 (“Like in all shared-medium networks, medium access control (MAC) is an important technique that enables the successful operation of the network. One fundamental task of the MAC protocol is to avoid collisions so that two interfering nodes do not transmit at the same time. There are many MAC protocols that have been developed for wireless voice and data communication networks. Typical examples include the time division multiple

access (TDMA), code division multiple access (CDMA), and contention-based protocols like IEEE 802.11 [1].”).

- *See, e.g.,* Ward at [0013] (“According to a first aspect of the invention, there is provided a location system comprising a plurality of devices, each of whose locations is detectable, and a base system for detecting and registering the locations of the devices, the base system being arranged to interrogate the locations of the devices one at a time in a sequence of time slots so that the location of each device is repeatedly interrogated and to interrogate the location of any one of at least some of the devices substantially immediately in response to a signal from the one device.”).
- *See, e.g.,* Turina at 6:37-55 (“FIG. 3 is a diagram that illustrates the downlink and uplink frames for packet transfers between a network and a VIP MS, in accordance with the preferred embodiment of the present invention. For the illustrative embodiment, a series of TDMA frames is shown with eight time slots per frame. For example, the GSM employs eight time slots per TDMA frame. However, it should be understood that the invention is not intended to be limited to a certain number of time slots per frame. Any practical number of TDMA time slots per frame could be used. As shown, the downlink physical channels dedicated to the VIP MS are realized as dedicated time slots in each frame, which are reserved in the first place for the VIP MS. However, as discussed below, during idle periods between VIP packets, these reserved VIP MS time slots can be temporarily utilized for other traffic. Consequently, the network throughput is significantly improved over conventional systems, because the dedicated VIP MS physical channels can be accessed for packet data traffic to/from other mobile stations during idle periods.”).
- *See, e.g.,* Rabenko at 4:42-61 (“In order to accomplish TDMA for upstream communication, it is necessary to assign time slots within which CMs having a message to send to the CMTS are allowed to transmit. The assignment of such time slots is accomplished by providing a request contention area in the upstream data path within which the CMs are permitted to contend in order to place a message which requests additional time in the upstream data path for the transmission of their message. The CMTS responds to these requests by assigning time slots to the CMs making such a request, so that as many of the CMs as possible may transmit their messages to the CMTS utilizing TDMA and so that the transmissions are performed without undesirable collisions. In other words, the CM requests an amount of bandwidth on the cable system to transmit data. In turn, the CM receives a “grant” of an amount of bandwidth to transmit data in response to the request. This time slot assignment by the CMTS is known as a “grant” because the CMTS is granting a particular CM permission to use a specific period of time in the upstream.”).
- *See, e.g.,* Odman at Abstract (“A method is provided for transmitting wireless signals in a network comprising a network coordinator and one or more remote devices. The available transmission time is divided into a plurality of

superframes, each of which is further divided up into a beacon duration, one or more management time slots, one or more guaranteed time slots, and one or more asynchronous time slots. Each of the management time slots, guaranteed time slots, and asynchronous time slots are assigned to one of the one or more remote devices. The network coordinator sends a beacon to the one or more remote devices during the beacon duration. The device or coordinator assigned to the current guaranteed time slot sends frames of isochronous data in the current guaranteed time slot. The device or coordinator assigned to the current asynchronous time slot sends frames of asynchronous data in the current asynchronous time slot.”).

- *See, e.g.,* Lan at [0165] (“FIGS. 5 and 6 are figures which show examples of operations of timeslot assignment according to the first embodiment of the present invention. In a first example shown in FIG. 5, the mobile station receives, from the base station, occupation states and interference amounts of timeslots of one frame beginning from the time of transmission request. For example, in the figure, a mobile station 1 (M1) sends a transmission request at the time of a timeslot 4 in a frame 1, and the mobile station receives, from the base station, occupation states and interference amounts for one frame which is from the timeslot 4 of the frame 1 to a timeslot 3 of a frame 2. Then, the mobile station selects a timeslot 5 and starts transmission from the timeslot 5 of the frame 2. As the first example shown in FIG. 5, the method in which a mobile station receives occupation states and interference amounts of timeslots of a length from the time of the transmission request is applicable to a mobile station having low transmission frequency or to a mobile station which does not have exacting delay requirement.”).
- *See, e.g.,* Brown at 5:54-67 (“Referring now to FIG. 2, it shows the structure of a frame 200 for communication according to the DECT specification. DECT is a time division, multiple access (TDMA) system using time division duplexing (TDD). Each frame such as frame 200 is divided into 24 full slots as is shown in FIG. 2. Generally, full slots 0 through 11 are used for communication from a base station to a mobile station and full slots 12 through 23 are used for communication from the mobile station to the base station. A typical full duplex link is located on slots one-half frame apart. Thus, if a transmit full slot, such as slot 202 in FIG. 2 is located at slot 0, the receive full slot would be at full slot 12, designated slot 204 in FIG. 2. The frame 200 totals 11,520 bits and is typically 10 msec. in duration.”).
- *See, e.g.,* Ben-Eli at 3:36-55 (“In one embodiment of the invention, feedback may be gathered from users based on the signal quality at their slot, at block 312. In a shared environment, communication may be typically done in time periods of constant duration which may be referred to as slots. In the slots, transmission may be scheduled to 0 or more users. A scheduler may decide at which slots transmission occurs to the user, and then which resources are allocated to a user in a particular slot, for example how much power, how many codes, what portion of the frequency, and so on, according to the resources that may be shared. The scheduler also may determine how to deliver the data to the user, for example

what modulation to use, what coding scheme to use, and so on, depending upon the physical layer capabilities. Signal quality may refer a measure of the quality of the link between the base station and the device, and may be, for example, the instantaneous Signal to Interference and Noise Ratio (SINR) at the device, or the achievable instantaneous rate at the device, although the scope of the present invention is not limited in this respect.”).

- *See, e.g.,* Huang at 3930 (“The IEEE standard, 802.15.4, defines the physical layer and medium access control (MAC) sublayer specifications for low-rate wireless personal area networks (LR-WPANs) [3]. It supports wireless communications between devices with minimal power consumption and typically operates in a personal operating space of 10 meter or less. The IEEE 802.15.4 defines two medium-access modes: beacon-enabled mode and nonbeacon-enabled mode. In the nonbeacon-enabled mode, arbitration of medium accesses is purely distributed among wireless devices based on CSMA(Carrier Sense Multiple Access)/CA(Collision Avoidance). In addition to CSMA/CA-based transmissions, the beacon-enabled mode provides a contention-free GTS (Guaranteed Time Slots) mechanism to support time-critical data deliveries. In this paper, we focus on the IEEE 802.15.4 beacon-enabled mode, and the details for the nonbeacon-enabled mode can be found in [3]. Figure 1 shows a superframe structure adopted by the IEEE 802.15.4 beacon-enabled mode. A superframe begins with a beacon issued by a PAN coordinator, and consists of an active portion and an inactive portion. The duration (also called beacon interval) of a superframe ranges from 15ms to 245s. The coordinator and devices can communicate with each other during the active period and enter the low-power mode during the inactive period. ... The active portion with 16 time slots is composed of three parts: a beacon, a contention access period (CAP), and a contention free period (CFP). The beacon is transmitted by the coordinator at the start of slot 0, and the CAP follows immediately after the beacon. In the CAP, a slotted CSMA-CA mechanism is used for devices to access the channel. In addition to non-time-critical data frames, MAC commands such as association requests and GTS requests shall be transmitted in the CAP.”).
- *See, e.g.,* Pallassini at 82-83 (“The natural effect of increasing the number of packets per second results in an huge amount of traffic in the network. Telos motes use a CSMA/CA protocol to access the channel, i.e. there is not synchronization a priori, this results into a great collision probability. To solve the problem of data delay and to avoid the collisions that lead to packet losses, we propose an overlay TDMA over CSMA. Using a distributed algorithm, as it is our overlay TDMA, we can schedule the nodes to have the minimal latency and to avoid collisions. To show the benefits of our protocol we simulate the behavior of a general network in which nodes are randomly scheduled by the fusion center. Our protocol permits to obtain, in a distributed way, the optimal solution of such a network resulting in a strong improvement over a casual schedule.”).
- *See, e.g.,* Gilb at 33-34 (“The CTAP is composed of one or more CTAs that are allocated by the PNC to a pair of DEV identifiers (DEVIDs). Only the DEV that

is listed as the source is allowed to transmit in a CTA, and so the access method for CTAs is time division, multiple access (TDMA). In the case where the CTA has the PNC identifier (PNCID) as either the source ID (SrcID) or destination ID (DestID), the CTA is called a management CTA (MCTA). In most cases, there is no difference between an MCTA and a CTA. The only exceptions to this are when the source address is either the unassociated ID (UnassocID) or the broadcast ID (BcstID). In this case, there are multiple DEVs that are allowed to send information in the MCTA. To handle potential collisions, a third type of access method, called slotted aloha, is used. Although this method is generally not as efficient as using the CAP for association, commands, and data, it was put in to allow for future PHYs that may not be able to perform clear channel assessment (CCA) efficiently.”).

- *See, e.g.,* Lansford at 1667 (“The SWAP-CA medium access control protocol is de-rived from the ETSI DECT standard [10]–[12] and from the popular WLAN standards such as IEEE 802.11 [14]. It is optimized specifically for the home environment. The MAC is designed to work over, and to take advantage of, the frequency hopping radio subsystem. It includes a time division multiple access (TDMA) service for delivery of real-time isochronous data, and a carrier sense multiple access with collision avoidance (CSMA/CA) service for delivery of asynchronous data. The MAC’s behavior depends on the devices that are in use in the network. Table 2 contains the functionality supported by the MAC for different device types.”).
- *See, e.g.,* Nakagawa at [0047] (“The control section 14 controls the transmitter 11 and the receiver 12 based on various information stored in the storage section 15. Switching control between transmitting and receiving, transmit power control, switching control and synchronization control between an ad-hoc network and a mobile communications network and the like are performed by this control section 14. For example, when communication is performed with the base station 30 in the mobile communications network or another radio communications apparatus within the ad-hoc network, switching between transmitting and receiving is performed based on time slot assignment set in advance, and communication is performed in a TDD mode.”), [0021] (“Here, TDD-TDMA is a TDMA (Time Division Multiple Access) system that uses TDD mode as its duplex mode. TDMA is a multiple access system in which the same frequency band is shared by multiple transmitters for a short time in turn. As an example of adoption of the TDD-TDMA, there is PHS (personal handy phone system), for example. TDD-OFDM is OFDM (Orthogonal Frequency Division Multiplexing) in which the TDD mode is used as a duplex mode, and OFDM is a transmission system in which multiple carrier waves are arranged so that spectrums are orthogonal with each other. In this transmission system, one or multiple carrier waves are assigned to each transmitter. As the multiple access system based on OFDM, there are included OFDMA (Orthogonal Frequency Division Multiple Access), OFCDM (Orthogonal Frequency and Code Division Multiplexing) and the like.”).

- *See, e.g.,* Parantainen at [0050]-[0053] (“The fourth embodiment of the invention is presented for a constellation in which the cell employs two PCCCH time slots, but in which at least some mobile terminals in the cell capable of receiving MBMS are only able to receive on two time slots. In this case, the two PCCCH time slots are advantageously allocated one time slot apart from each other, and the PMBCH is allocated to the time slot between the two PCCCH time slots. An example for the allocation of channels according to the fourth embodiment of the invention is depicted in FIG. 6. FIG. 6 shows again a sequence of downlink time slots, which are numbered for each frame from 1 to 8. A first PCCCH time slot 3, which corresponds always to the PBCCH time slot, is spaced one time slot apart from a second PCCCH time slot 5. The PMBCH is allocated to the time slot that is located between the two PCCCH time slots 3 and 5, i.e. on time slot 4. The paging messages for a specific mobile terminal are provided by either of the two PCCCHs. With such an allocation, all mobile terminals in the GERAN cell which are capable of listening to at least two downlink time slot are able to decode paging messages and the MBMS data. Mobile terminals following the first PCCCH time slot 3, which contains also the PBCCH blocks, can receive with the presented allocation the PBCCH, the PCCCH providing the paging messages and the PMBCH without interruptions. Mobile terminals following the second PCCCH time slot 5 can receive the paging messages provided by the second PCCCH normally, but they have to quit reception on the PMBCH time slot 4 from time to time for a short period, when decoding system information messages from the PBCCH provided on time slot 3. Mobile terminals capable of receiving on three time slots are obviously able to receive MBMS data without interruptions also with the allocation of the fourth embodiment. With such mobile terminals, the fourth embodiment constitutes a special case of the third embodiment.”).
- *See, e.g.,* Karaoguz at [0038] (“FIG. 3 is a timing diagram of a radio receiver operating in accordance with the present invention. Referring now to FIG. 3, an IEEE 802.15.3 Standard Defined communication for high data rate wireless personal area networks includes the transmission of periodic beacons that signal the beginning of a communication signal that is, in turn, followed by a contention access period (CAP) and at least one allocated time slot for data communications. Under 802.15.3, the period between beacons is typically in the range of ten to a few hundred milliseconds. Typically, in a time division multiple access (TDMA) environment, a plurality of allocated time slots follow the CAP wherein each time slot is allocated for communications for a particular radio device. Thus, according to the protocol, a plurality of guaranteed time slots (GTS) follow the CAP. A particular radio knows which allocated time slot is allocated for its use and, therefore, how much time exists until that designated time slot begins.”).
- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice

terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.

- *See, e.g.*, Schloss at Abstract (“A TDMA network for reader-transponder communications including a receiver having an antenna for receiving and transforming radiated energy to a first RF signal and a detector for demodulating and converting the first RF signal to a digital signal. A protocol logic device is provided for decoding the digital signal and for executing a protocol. The protocol comprises a plurality of randomly selected time slots to gain admission to the TDMA network and a plurality of assigned time slots to transmit messages during the reader-transponder communications. In a transponder implementation, an oscillator is provided for converting protocol formatted digital signals from the logic device to a second RF signal. Thereafter, the antenna transforms the second RF signal to radiated energy and transmits the radiated energy. In a preferred embodiment, the TDMA network includes a transmit/receive switch for directing the first and second RF signals along the receive and transmit paths, respectively. A digital memory which communicates with the protocol logic device is provided for storing data unique to a transponder. The protocol also includes a reader control message time slot for interrogating the transponder and an acknowledgment time slot for indicating the reception of a message.”), 3:59-66 (“The invention is embodied in a TDMA network 100 of the type used in reader-transponder communications having an RF modulation/demodulation section 102 for modulating, demodulating and converting signals between an analog and digital format and a digital link controller 104 for decoding messages and providing a protocol structure to the reader-transponder communications as shown in FIG. 1.”).
- *See, e.g.*, Hoang at [0020]-[0021] (“FIG. 3 illustrates a transmission scheme for the communication system of FIG. 2. During communications among nodes 201-208, a specific transmission protocol is utilized by communication system 100 wherein each piconet communicates within a particular non-overlapping frame 301, 302 as described in U.S. patent application Ser. No. 10/414,838, which is incorporated by reference herein. With reference to FIG. 2, piconet 201 completes all necessary transmissions within frame 301, while piconet 202 completes all necessary transmissions within frame 302. During a frame, a particular controller of the piconet will broadcast piconet timing and control information within a

beacon field, while each node (including the controller) will have a Contention Free Period slot, part of the Channel Time Allocation (CTA) facility of the IEEE 802.15.3 standard, for transmission. During its guaranteed time slot, a particular node broadcasts any command (COM) wishing to be executed to any particular node or may send/receive data intended for a single node or set of nodes. Note that because node 207 participates in each piconet, node 207 has a guaranteed time slot (GTS) for transmission/reception within each piconet's frame. During the GTS, the node also broadcasts a beacon comprising identification of the piconet(s) a node is associated with (i.e., a piconet identifier (PNID)), along with a source address (SA, or device identifier (DEVID)), a destination address (device identifier (DA or DEVID)), and a receive time ($R \times T$) when the node can receive other node's transmissions. This is illustrated in FIG. 3 with the expanded view of the GTS for node 205. It should be noted that although FIG. 3 shows the beacon signal comprising SA, DA, PNID, and $R \times T$, one of ordinary skill in the art will recognize that the beacon signal may comprise other elements such as, but not limited to, the byte length of the frame being used, a beacon payload that can be used to broadcast generic data, . . . , etc.”).

- *See, e.g., Tiedemann at Abstract* (“A system for reducing receiver power consumption in communication system having a transmitter and one or more receivers schedules periodic messages in “slots.” Each receiver is assigned a slot during which it monitors the transmissions. The transmitter transmits messages to the receiver only during the assigned slots. The receiver is in an “active state” during its assigned slot. It may remain in the active state after its assigned slot if the message requires the receiver to perform additional actions. During the “inactive state,” which is the time period between successive occurrences of its assigned slot, the receiver may perform any action not requiring coordination with the transmitter. It may conserve power during this time by removing power from one or more components such as those used for monitoring the transmissions. At a time during the inactive state shortly before the assigned slot, the receiver applies power to these components and performs initializations. Such initializations may include requiring a pilot channel signal to which the receiver may synchronize itself if its timing signals have drifted out of synchronization with those of the transmitter during the preceding inactive state.”).
- *See, e.g., Mansfield at 6:21-44* (“Referring specifically to FIG. 4, base station 102 informs user device 104 whether it is permitted to transmit in the next uplink time slot 210, e.g., by transmitting the uplink transmission schedule (represented by scheduling bits 214) to user device 104 at the beginning of each time slot 208. As illustrated, the scheduling bits 214 may be transmitted as part of the user data (as shown in FIG. 4, time slots 1 and 5) or as part of the low data rate maintenance link (as shown in FIG. 4, time slots 2-4). For purposes of illustration, the scheduling bits 214 that indicate that the user device 104 is not permitted to transmit during the next uplink time slot 210 are dark, and the scheduling bits 214 that indicate that the user device 104 is permitted to transmit during the next uplink time slot 210 are light. Thus, as can be seen, user device 104 transmits user data in the uplink time slot 3 only after the base station 102 transmits scheduling

bits 214 in the downlink time slot 2 indicating that user device 104 is permitted to transmit during the next uplink time slot 210. Base station 102 is thus able to readily control the Quality of Service (QoS) offered to each user device 104 according to the user data throughput requirements of user device 104. Scheduling for downlink transmissions is trivial since base station 102 simply transmits according to its predetermined schedule.”).

6. Communicating Information During Time Slots

Communicating information between wireless devices during assigned time slots was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g., 802.15.3 at 172* (“The PNC divides the CTAP into channel time allocations (CTAs). A DEV that is give a directed CTA is guaranteed that no other DEVs will compete for the channel during the indicated time duration of the CTA. A DEV with a CTA may or may not make use of all the allocated time duration within the CTA. The selection of a stream, command or asynchronous data for transmission during a CTA is determined locally by the DEV depending on the number of pending frames and their priorities. See A.1.2.1 for more information on priority management. There are two types of CTAs: dynamic CTA and pseudo-static CTA. The type of a CTA requested is indicated in the Channel Time Request command as specified in 7.5.6.1. The PNC may move dynamic CTAs within the superframe on a superframe by superframe basis. This allows the PNC the flexibility to rearrange CTA assignments to optimize the utilization of the assignments. The PNC moves a dynamic CTA by simply changing the CTA parameters in the beacon. Dynamic CTAs may be used for both asynchronous and isochronous streams.”).
- *See, e.g., 802.15.4 at 18* (“For low-latency applications or applications requiring specific data bandwidth, the PAN coordinator may dedicate portions of the active superframe to that application. These portions are called guaranteed time slots (GTSSs). The GTSSs form the contention-free period (CFP), which always appears at the end of the active superframe starting at a slot boundary immediately following the CAP, as shown in Figure 5. The PAN coordinator may allocate up to seven of these GTSSs, and a GTS may occupy more than one slot period. However, a sufficient portion of the CAP shall remain for contention-based access of other networked devices or new devices wishing to join the network. All contention-based transactions shall be complete before the CFP begins. Also each device transmitting in a GTS shall ensure that its transaction is complete before the time of the next GTS or the end of the CFP. More information on the superframe structure can be found in 7.5.1.1.”).
- *See, e.g., Bluetooth at 45* (“The SCO link is a symmetric, point-to-point link between the master and a specific slave. The SCO link reserves slots and can

therefore be considered as a circuit-switched connection between the master and the slave. The SCO link typically supports time-bounded information like voice. The master can support up to three SCO links to the same slave or to different slaves. A slave can support up to three SCO links from the same master, or two SCO links if the links originate from different masters. SCO packets are never retransmitted. The master will send SCO packets at regular intervals, the so-called SCO interval TSCO (counted in slots) to the slave in the reserved master-to-slave slots. The SCO slave is always allowed to respond with an SCO packet in the following slave-to-master slot unless a different slave was addressed in the previous master-to-slave slot. If the SCO slave fails to decode the slave address in the packet header, it is still allowed to return an SCO packet in the reserved SCO slot.”), 46 (“In the slots not reserved for SCO links, the master can exchange packets with any slave on a per-slot basis. The ACL link provides a packet-switched connection between the master and all active slaves participating in the piconet. Both asynchronous and isochronous services are supported. Between a master and a slave only a single ACL link can exist. For most ACL packets, packet retransmission is applied to assure data integrity. A slave is permitted to return an ACL packet in the slave-to-master slot if and only if it has been addressed in the preceding master-to-slave slot. If the slave fails to decode the slave address in the packet header, it is not allowed to transmit.”).

- *See, e.g.,* HomeRF at 440 (“When a Connection Point is present, the network operates as a managed network. The Connection Point can also (depending on its class) manage the allocation of TDMA time slots thereby providing contention free access to the medium for isochronous data.”), 263 (“The access mechanism used during contention-free periods is Time Division Multiple Access (TDMA). The contention-free periods are available only in a Class-1 managed network. The Class-1 CP manages access to the medium during contention-free periods by sending a regular CP1 beacon that contains TDMA signaling. ... This section defines procedures that enable an I-node and a CP to exchange TDMA MPDUs during contention-free periods. ... Main TDMA MPDUs are transmitted in the main slots. Retry TDMA MPDUs are transmitted in the retry slots.”).
- *See, e.g.,* Livet at 2:55-3:2 (“In a time-slotted communication system, a communication is transmitted over time slots. One or more time slots are designated to a particular user for either uplink or downlink communication. The system 100 of the present invention assigns one of a plurality of designations to time slots based upon the QoS of a user. In a preferred embodiment, the system 100 uses three designations: high QoS time slots, high capacity time slots, and balanced time slots. It should be understood that any number of designations may be used, and the title of the designations is simply for illustration of the preferred embodiment of the present invention. Accordingly, although three designations will be described herein after, more or less designations may be used. The priority scheme of the present invention may be used for either an uplink or a downlink channel.”).

- *See, e.g.*, 802.11e at 2 (“3.126 contention-free period (CFP): The time period during operation of a point coordination function (PCF) when the right to transmit is assigned to stations (STAs) solely by a point coordinator (PC), allowing frame exchanges to occur between members of the basic service set (BSS) without contention for the wireless medium (WM).”).
- *See, e.g.*, 802.11-1999 at 71 (“The access priority provided by a PCF may be utilized to create a contention-free (CF) access method. The PC controls the frame transmissions of the STAs so as to eliminate contention for a limited period of time.”).
- *See, e.g., See, e.g., Ye* at 1567 (“Like in all shared-medium networks, medium access control (MAC) is an important technique that enables the successful operation of the network. One fundamental task of the MAC protocol is to avoid collisions so that two interfering nodes do not transmit at the same time. There are many MAC protocols that have been developed for wireless voice and data communication networks. Typical examples include the time division multiple access (TDMA), code division multiple access (CDMA), and contention-based protocols like IEEE 802.11 [1].”).
- *See, e.g., Ward* at [0013] (“According to a first aspect of the invention, there is provided a location system comprising a plurality of devices, each of whose locations is detectable, and a base system for detecting and registering the locations of the devices, the base system being arranged to interrogate the locations of the devices one at a time in a sequence of time slots so that the location of each device is repeatedly interrogated and to interrogate the location of any one of at least some of the devices substantially immediately in response to a signal from the one device.”).
- *See, e.g., Turina* at 6:37-55 (“FIG. 3 is a diagram that illustrates the downlink and uplink frames for packet transfers between a network and a VIP MS, in accordance with the preferred embodiment of the present invention. For the illustrative embodiment, a series of TDMA frames is shown with eight time slots per frame. For example, the GSM employs eight time slots per TDMA frame. However, it should be understood that the invention is not intended to be limited to a certain number of time slots per frame. Any practical number of TDMA time slots per frame could be used. As shown, the downlink physical channels dedicated to the VIP MS are realized as dedicated time slots in each frame, which are reserved in the first place for the VIP MS. However, as discussed below, during idle periods between VIP packets, these reserved VIP MS time slots can be temporarily utilized for other traffic. Consequently, the network throughput is significantly improved over conventional systems, because the dedicated VIP MS physical channels can be accessed for packet data traffic to/from other mobile stations during idle periods.”).
- *See, e.g., Rabenko* at 4:42-61 (“In order to accomplish TDMA for upstream communication, it is necessary to assign time slots within which CMs having a

message to send to the CMTS are allowed to transmit. The assignment of such time slots is accomplished by providing a request contention area in the upstream data path within which the CMs are permitted to contend in order to place a message which requests additional time in the upstream data path for the transmission of their message. The CMTS responds to these requests by assigning time slots to the CMs making such a request, so that as many of the CMs as possible may transmit their messages to the CMTS utilizing TDMA and so that the transmissions are performed without undesirable collisions. In other words, the CM requests an amount of bandwidth on the cable system to transmit data. In turn, the CM receives a “grant” of an amount of bandwidth to transmit data in response to the request. This time slot assignment by the CMTS is known as a “grant” because the CMTS is granting a particular CM permission to use a specific period of time in the upstream.”).

- *See, e.g.,* Odman at Abstract (“A method is provided for transmitting wireless signals in a network comprising a network coordinator and one or more remote devices. The available transmission time is divided into a plurality of superframes, each of which is further divided up into a beacon duration, one or more management time slots, one or more guaranteed time slots, and one or more asynchronous time slots. Each of the management time slots, guaranteed time slots, and asynchronous time slots are assigned to one of the one or more remote devices. The network coordinator sends a beacon to the one or more remote devices during the beacon duration. The device or coordinator assigned to the current guaranteed time slot sends frames of isochronous data in the current guaranteed time slot. The device or coordinator assigned to the current asynchronous time slot sends frames of asynchronous data in the current asynchronous time slot.”).
- *See, e.g.,* Lan at [0165] (“FIGS. 5 and 6 are figures which show examples of operations of timeslot assignment according to the first embodiment of the present invention. In a first example shown in FIG. 5, the mobile station receives, from the base station, occupation states and interference amounts of timeslots of one frame beginning from the time of transmission request. For example, in the figure, a mobile station 1 (M1) sends a transmission request at the time of a timeslot 4 in a frame 1, and the mobile station receives, from the base station, occupation states and interference amounts for one frame which is from the timeslot 4 of the frame 1 to a timeslot 3 of a frame 2. Then, the mobile station selects a timeslot 5 and starts transmission from the timeslot 5 of the frame 2. As the first example shown in FIG. 5, the method in which a mobile station receives occupation states and interference amounts of timeslots of a length from the time of the transmission request is applicable to a mobile station having low transmission frequency or to a mobile station which does not have exacting delay requirement.”).
- *See, e.g.,* Brown at 5:54-67 (“Referring now to FIG. 2, it shows the structure of a frame 200 for communication according to the DECT specification. DECT is a time division, multiple access (TDMA) system using time division duplexing (TDD). Each frame such as frame 200 is divided into 24 full slots as is shown in

FIG. 2. Generally, full slots 0 through 11 are used for communication from a base station to a mobile station and full slots 12 through 23 are used for communication from the mobile station to the base station. A typical full duplex link is located on slots one-half frame apart. Thus, if a transmit full slot, such as slot 202 in FIG. 2 is located at slot 0, the receive full slot would be at full slot 12, designated slot 204 in FIG. 2. The frame 200 totals 11,520 bits and is typically 10 msec. in duration.”).

- *See, e.g., Ben-Eli at Abstract* (“Network resources such as in a wireless system may be allocated to user devices on the network based upon at least one or more minimum user requirements being satisfied. A user may be determined as satisfied when minimum requirements of rate and delay are reached or maintained. The network may optimize throughput on the network by allowing a maximum number of users on the network to be satisfied. Users may be ranked according to signal quality, and network resources may be allocated to users according to rank to satisfy users until the resources of the network are allocated.”).
- *See, e.g., Huang at 3930* (“The IEEE standard, 802.15.4, defines the physical layer and medium access control (MAC) sublayer specifications for low-rate wireless personal area networks (LR-WPANs) [3]. It supports wireless communications between devices with minimal power consumption and typically operates in a personal operating space of 10 meter or less. The IEEE 802.15.4 defines two medium-access modes: beacon-enabled mode and nonbeacon-enabled mode. In the nonbeacon-enabled mode, arbitration of medium accesses is purely distributed among wireless devices based on CSMA(Carrier Sense Multiple Access)/CA(Collision Avoidance). In addition to CSMA/CA-based transmissions, the beacon-enabled mode provides a contention-free GTS (Guaranteed Time Slots) mechanism to support time-critical data deliveries. In this paper, we focus on the IEEE 802.15.4 beacon-enabled mode, and the details for the nonbeacon-enabled mode can be found in [3]. Figure 1 shows a superframe structure adopted by the IEEE 802.15.4 beacon-enabled mode. A superframe begins with a beacon issued by a PAN coordinator, and consists of an active portion and an inactive portion. The duration (also called beacon interval) of a superframe ranges from 15ms to 245s. The coordinator and devices can communicate with each other during the active period and enter the low-power mode during the inactive period. ... The active portion with 16 time slots is composed of three parts: a beacon, a contention access period (CAP), and a contention free period (CFP). The beacon is transmitted by the coordinator at the start of slot 0, and the CAP follows immediately after the beacon. In the CAP, a slotted CSMA-CA mechanism is used for devices to access the channel. In addition to non-time-critical data frames, MAC commands such as association requests and GTS requests shall be transmitted in the CAP.”).
- *See, e.g., Pallassini at 82-83* (“The natural effect of increasing the number of packets per second results in an huge amount of traffic in the network. Telos motes use a CSMA/CA protocol to access the channel, i.e. there is not

synchronization a priori, this results into a great collision probability. To solve the problem of data delay and to avoid the collisions that lead to packet losses, we propose an overlay TDMA over CSMA. Using a distributed algorithm, as it is our overlay TDMA, we can schedule the nodes to have the minimal latency and to avoid collisions. To show the benefits of our protocol we simulate the behavior of a general network in which nodes are randomly scheduled by the fusion center. Our protocol permits to obtain, in a distributed way, the optimal solution of such a network resulting in a strong improvement over a casual schedule.”).

- *See, e.g.,* Gilb at 33-34 (“The CTAP is composed of one or more CTAs that are allocated by the PNC to a pair of DEV identifiers (DEVIDs). Only the DEV that is listed as the source is allowed to transmit in a CTA, and so the access method for CTAs is time division, multiple access (TDMA). In the case where the CTA has the PNC identifier (PNCID) as either the source ID (SrcID) or destination ID (DestID), the CTA is called a management CTA (MCTA). In most cases, there is no difference between an MCTA and a CTA. The only exceptions to this are when the source address is either the unassociated ID (UnassocID) or the broadcast ID (BestID). In this case, there are multiple DEVs that are allowed to send information in the MCTA. To handle potential collisions, a third type of access method, called slotted aloha, is used. Although this method is generally not as efficient as using the CAP for association, commands, and data, it was put in to allow for future PHYs that may not be able to perform clear channel assessment (CCA) efficiently.”).
- *See, e.g.,* Lansford at 1667 (“The SWAP-CA medium access control protocol is de-rived from the ETSI DECT standard [10]–[12] and from the popular WLAN standards such as IEEE 802.11 [14]. It is optimized specifically for the home environment. The MAC is designed to work over, and to take advantage of, the frequency hopping radio subsystem. It includes a time division multiple access (TDMA) service for delivery of real-time isochronous data, and a carrier sense multiple access with collision avoidance (CSMA/CA) service for delivery of asynchronous data. The MAC’s behavior depends on the devices that are in use in the network. Table 2 contains the functionality supported by the MAC for different device types.”).
- *See, e.g., See, e.g.,* Nakagawa at [0047] (“The control section 14 controls the transmitter 11 and the receiver 12 based on various information stored in the storage section 15. Switching control between transmitting and receiving, transmit power control, switching control and synchronization control between an ad-hoc network and a mobile communications network and the like are performed by this control section 14. For example, when communication is performed with the base station 30 in the mobile communications network or another radio communications apparatus within the ad-hoc network, switching between transmitting and receiving is performed based on time slot assignment set in advance, and communication is performed in a TDD mode.”).

- *See, e.g.,* Parantainen at [0050]-[0053] (“The fourth embodiment of the invention is presented for a constellation in which the cell employs two PCCCH time slots, but in which at least some mobile terminals in the cell capable of receiving MBMS are only able to receive on two time slots. In this case, the two PCCCH time slots are advantageously allocated one time slot apart from each other, and the PMBCH is allocated to the time slot between the two PCCCH time slots. An example for the allocation of channels according to the fourth embodiment of the invention is depicted in FIG. 6. FIG. 6 shows again a sequence of downlink time slots, which are numbered for each frame from 1 to 8. A first PCCCH time slot 3, which corresponds always to the PBCCH time slot, is spaced one time slot apart from a second PCCCH time slot 5. The PMBCH is allocated to the time slot that is located between the two PCCCH time slots 3 and 5, i.e. on time slot 4. The paging messages for a specific mobile terminal are provided by either of the two PCCCHs. With such an allocation, all mobile terminals in the GERAN cell which are capable of listening to at least two downlink time slot are able to decode paging messages and the MBMS data. Mobile terminals following the first PCCCH time slot 3, which contains also the PBCCH blocks, can receive with the presented allocation the PBCCH, the PCCCH providing the paging messages and the PMBCH without interruptions. Mobile terminals following the second PCCCH time slot 5 can receive the paging messages provided by the second PCCCH normally, but they have to quit reception on the PMBCH time slot 4 from time to time for a short period, when decoding system information messages from the PBCCH provided on time slot 3. Mobile terminals capable of receiving on three time slots are obviously able to receive MBMS data without interruptions also with the allocation of the fourth embodiment. With such mobile terminals, the fourth embodiment constitutes a special case of the third embodiment.”).
- *See, e.g.,* Karaoguz at [0038] (“FIG. 3 is a timing diagram of a radio receiver operating in accordance with the present invention. Referring now to FIG. 3, an IEEE 802.15.3 Standard Defined communication for high data rate wireless personal area networks includes the transmission of periodic beacons that signal the beginning of a communication signal that is, in turn, followed by a contention access period (CAP) and at least one allocated time slot for data communications. Under 802.15.3, the period between beacons is typically in the range of ten to a few hundred milliseconds. Typically, in a time division multiple access (TDMA) environment, a plurality of allocated time slots follow the CAP wherein each time slot is allocated for communications for a particular radio device. Thus, according to the protocol, a plurality of guaranteed time slots (GTS) follow the CAP. A particular radio knows which allocated time slot is allocated for its use and, therefore, how much time exists until that designated time slot begins.”).
- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice

terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.

- *See, e.g.*, Schloss at Abstract (“A TDMA network for reader-transponder communications including a receiver having an antenna for receiving and transforming radiated energy to a first RF signal and a detector for demodulating and converting the first RF signal to a digital signal. A protocol logic device is provided for decoding the digital signal and for executing a protocol. The protocol comprises a plurality of randomly selected time slots to gain admission to the TDMA network and a plurality of assigned time slots to transmit messages during the reader-transponder communications. In a transponder implementation, an oscillator is provided for converting protocol formatted digital signals from the logic device to a second RF signal. Thereafter, the antenna transforms the second RF signal to radiated energy and transmits the radiated energy. In a preferred embodiment, the TDMA network includes a transmit/receive switch for directing the first and second RF signals along the receive and transmit paths, respectively. A digital memory which communicates with the protocol logic device is provided for storing data unique to a transponder. The protocol also includes a reader control message time slot for interrogating the transponder and an acknowledgment time slot for indicating the reception of a message.”).
- *See, e.g.*, Hoang at [0020]-[0021] (“FIG. 3 illustrates a transmission scheme for the communication system of FIG. 2. During communications among nodes 201-208, a specific transmission protocol is utilized by communication system 100 wherein each piconet communicates within a particular non-overlapping frame 301, 302 as described in U.S. patent application Ser. No. 10/414,838, which is incorporated by reference herein. With reference to FIG. 2, piconet 201 completes all necessary transmissions within frame 301, while piconet 202 completes all necessary transmissions within frame 302. During a frame, a particular controller of the piconet will broadcast piconet timing and control information within a beacon field, while each node (including the controller) will have a Contention Free Period slot, part of the Channel Time Allocation (CTA) facility of the IEEE 802.15.3 standard, for transmission. During its guaranteed time slot, a particular node broadcasts any command (COM) wishing to be executed to any particular node or may send/receive data intended for a single node or set of nodes. Note that because node 207 participates in each piconet, node 207 has a guaranteed

time slot (GTS) for transmission/reception within each piconet's frame. During the GTS, the node also broadcasts a beacon comprising identification of the piconet(s) a node is associated with (i.e., a piconet identifier (PNID)), along with a source address (SA, or device identifier (DEVID)), a destination address (device identifier (DA or DEVID)), and a receive time ($R \times T$) when the node can receive other node's transmissions. This is illustrated in FIG. 3 with the expanded view of the GTS for node 205. It should be noted that although FIG. 3 shows the beacon signal comprising SA, DA, PNID, and $R \times T$, one of ordinary skill in the art will recognize that the beacon signal may comprise other elements such as, but not limited to, the byte length of the frame being used, a beacon payload that can be used to broadcast generic data, . . . , etc.”).

- *See, e.g., Tiedemann at Abstract* (“A system for reducing receiver power consumption in communication system having a transmitter and one or more receivers schedules periodic messages in “slots.” Each receiver is assigned a slot during which it monitors the transmissions. The transmitter transmits messages to the receiver only during the assigned slots. The receiver is in an “active state” during its assigned slot. It may remain in the active state after its assigned slot if the message requires the receiver to perform additional actions. During the “inactive state,” which is the time period between successive occurrences of its assigned slot, the receiver may perform any action not requiring coordination with the transmitter. It may conserve power during this time by removing power from one or more components such as those used for monitoring the transmissions. At a time during the inactive state shortly before the assigned slot, the receiver applies power to these components and performs initializations. Such initializations may include requiring a pilot channel signal to which the receiver may synchronize itself if its timing signals have drifted out of synchronization with those of the transmitter during the preceding inactive state.”).
- *See, e.g., Mansfield at 6:21-44* (“Referring specifically to FIG. 4, base station 102 informs user device 104 whether it is permitted to transmit in the next uplink time slot 210, e.g., by transmitting the uplink transmission schedule (represented by scheduling bits 214) to user device 104 at the beginning of each time slot 208. As illustrated, the scheduling bits 214 may be transmitted as part of the user data (as shown in FIG. 4, time slots 1 and 5) or as part of the low data rate maintenance link (as shown in FIG. 4, time slots 2-4). For purposes of illustration, the scheduling bits 214 that indicate that the user device 104 is not permitted to transmit during the next uplink time slot 210 are dark, and the scheduling bits 214 that indicate that the user device 104 is permitted to transmit during the next uplink time slot 210 are light. Thus, as can be seen, user device 104 transmits user data in the uplink time slot 3 only after the base station 102 transmits scheduling bits 214 in the downlink time slot 2 indicating that user device 104 is permitted to transmit during the next uplink time slot 210. Base station 102 is thus able to readily control the Quality of Service (QoS) offered to each user device 104 according to the user data throughput requirements of user device 104. Scheduling for downlink transmissions is trivial since base station 102 simply transmits according to its predetermined schedule.”).

7. *Identifying Individual Devices Using Bitmasks*

Identifying individual devices, for example for routing purposes, by communicating or otherwise providing bitmask(s) was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense's apparent interpretation of the claims.

- *See, e.g.,* Brawn at [0028] (“FIG. 1A is an example of a bitmap network mask 100 in accordance with an embodiment of the present invention. In this example, the network parameter is an Internet Protocol address. The mask 100 comprises a starting address 102 of 16.3.15.58, a bitmap length 104 of 5 and a mask sequence 106 of entries with an entry size of one bit. The starting parameter, in this case, starting address 102 is an indexing parameter used in conjunction with another indexing parameter, the bitmap length 104 which in this example of one bit entries maps directly to the number of parameters covered in the range of the mask sequence 106, to locate a bit in the mask sequence 106 corresponding to a target address, hereafter referred to as the target bit. For example, a data packet from IP address 16.3.15.62 is received. In order to determine if an ACL allows data from this address, it is determined whether the bitmap mask 100 applies. In this example, the starting address 102 16.3.15.58 is subtracted from the target address 16.3.15.62 resulting in a difference of four (4). The bitmap length 104 of five (5) indicates that there are five (5) network addresses, 16.3.15.58, 16.3.15.59, 16.3.15.60, 16.3.15.61, and 16.3.15.62, in the range of this bitmap mask 100. The first bit 110 of the mask sequence 106 corresponds to the starting address 102 of 16.3.15.58, and each subsequent bit in the sequence corresponds to each subsequent address in the range. The difference of four indicates that the target address is in the range of the bitmap mask 100, and this difference is used to index the target bit 108 in the mask sequence 106. The first bit is treated as bit number 0, so bit number 4, the fifth bit in the sequence is the target bit 108. In this example, a “1” value indicates that the bitmap applies, and a “0” indicates that it does not apply. The target bit 108 is a “1” so data from this address is allowed access. This bitmap network mask 100 also applies to 16.3.15.58 and 16.3.15.61 as indicated by bit 0 and bit 3 of the mask sequence also having values of one.”).
- *See, e.g.,* Ye at 1570 (“To illustrate this algorithm, consider a network where all nodes can hear each other. The timer of one node will fire first and its broadcast will synchronize all of its peers on its schedule. If instead two nodes independently assign schedules (either because they cannot hear each other, or because they happen to transmit at nearly the same time), those nodes on the border between the two schedules will adopt both. In this way, a node only needs to send once for a broadcast packet. The disadvantage is that these border nodes have less time to sleep and consume more energy than others.”).
- *See, e.g.,* Marko at 6:65-7:15 (“Accordingly, the receiver mask delay circuit 404 is enabled by the transceiver receive control signal RX CNTL and sets a delay according to the receiver mask delay value programmed by the base controller

(not shown). If MUX 3 operation is selected as a low input to an OR gate 429, a low signal for the predetermined number of bits from the receiver mask delay circuit 404 will disable the AND gate 431 from providing the correct frame synchronization character to the sync detector 350 until the receiver mask delay circuit 404 has expired. The first AND gate 431 is then enabled by a high output signal from the receiver mask delay circuit 404 after the receiver mask expiration period to allow the limited data from the data detector 330 to be clocked into the frame synchronization detector 350. On subsequent frames where the received data is assumed valid, the control circuitry 400 will allow the receive detection circuit 300 to be enabled during the desired period of the particular submux.”).

- *See, e.g., Pallassini at 70-71* (“The underlying idea of the protocol is to schedule the transmissions of the nodes in order to have a data flow that converges from the furthest node toward the base station. In such a solution, when nodes one hop away from the base station get a transmission right, can send their information with the information coming from their children, thus reducing the number of transmissions needed to have all the data collected at the base station. Each step of the protocol implementation is described below: 1. The fusion center generates an empty reservation packet which consists of as many time slots as the number of nodes minus one. This assumption requires that the fusion center knows exactly the number of nodes N in the network. 2. Once the reservation packet is generated, the fusion center makes as many copies of it as the number of its branches. Then for each of its branches, it sends one copy of the packet with as many free slots as the number of its children in that branch and the other slots blocked. 3. At the lower level, the node receiving the reservation packet, assigns itself the last free time slot inside the free field assigned him by its father. Then it acts like the fusion center, i.e. it makes as many copies of the received packet as the number of its branches and again reserves/blocks the remaining slots (inside the free field let available for him by its father) for its branches taking into account once again the number of children per each branch. 4. This procedure keeps going until the reservation packet reaches the leaf nodes. 5. Each leaf node finds available only one slot, reserved for it by its father in the reservation packet. This allows the leaf nodes to transmit before their parents. Therefore, the data flow begins to converge toward the base station.”).

8. *Prioritizing Time Slots*

Prioritizing time slot assignments, for example based on network/data characteristics or one or more of the device and user, was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims. Indeed, during prosecution of the ’129 patent, Proxense distinguished prior art references from the claimed inventions on the basis that the prior art disclosed assignment based on network

characteristics/data, confirming that these systems were known in the art. *See, e.g.*, PROX_INTEL-00000354 at PROX_INTEL-00000386-89, PROX_INTEL-00000435-38, PROX_INTEL-00000526, PROX_INTEL-00000528-29.

- *See, e.g.*, 802.15.4 at 159 (“A GTS shall be allocated before use, with the PAN coordinator deciding whether to allocate a GTS based on the requirements of the GTS request and the current available capacity in the superframe. GTSs shall be allocated on a first-come-first-served basis, and all GTSs shall be placed contiguously at the end of the superframe and after the CAP. Each GTS shall be deallocated when the GTS is no longer required, and a GTS can be deallocated at any time at the discretion of the PAN coordinator or by the device that originally requested the GTS. A device that has been allocated a GTS may also operate in the CAP.”).
- *See, e.g.*, Bluetooth at 45 (“The SCO link is a symmetric, point-to-point link between the master and a specific slave. The SCO link reserves slots and can therefore be considered as a circuit-switched connection between the master and the slave. The SCO link typically supports time-bounded information like voice. The master can support up to three SCO links to the same slave or to different slaves. A slave can support up to three SCO links from the same master, or two SCO links if the links originate from different masters. SCO packets are never retransmitted. The master will send SCO packets at regular intervals, the so-called SCO interval TSCO (counted in slots) to the slave in the reserved master-to-slave slots. The SCO slave is always allowed to respond with an SCO packet in the following slave-to-master slot unless a different slave was addressed in the previous master-to-slave slot. If the SCO slave fails to decode the slave address in the packet header, it is still allowed to return an SCO packet in the reserved SCO slot.”), 46 (“In the slots not reserved for SCO links, the master can exchange packets with any slave on a per-slot basis. The ACL link provides a packet-switched connection between the master and all active slaves participating in the piconet. Both asynchronous and isochronous services are supported. Between a master and a slave only a single ACL link can exist. For most ACL packets, packet retransmission is applied to assure data integrity. A slave is permitted to return an ACL packet in the slave-to-master slot if and only if it has been addressed in the preceding master-to-slave slot. If the slave fails to decode the slave address in the packet header, it is not allowed to transmit.”).
- *See, e.g.*, HomeRF at 17 (“[Isochronous Data Service] has the highest priority of the data services. A single packet is given dedicated bandwidth every subframe and dedicated bandwidth on the succeeding frame if a retransmission is required.”), 15 (“[Asynchronous Data Service] has the lowest priority of the supported data services. Priority of the individual asynchronous data service packets is random based on the CSMA/CA backoff process.”).

- *See, e.g.,* Livet at 2:55-3:2 (“In a time-slotted communication system, a communication is transmitted over time slots. One or more time slots are designated to a particular user for either uplink or downlink communication. The system 100 of the present invention assigns one of a plurality of designations to time slots based upon the QoS of a user. In a preferred embodiment, the system 100 uses three designations: high QoS time slots, high capacity time slots, and balanced time slots. It should be understood that any number of designations may be used, and the title of the designations is simply for illustration of the preferred embodiment of the present invention. Accordingly, although three designations will be described herein after, more or less designations may be used. The priority scheme of the present invention may be used for either an uplink or a downlink channel.”); 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. The RRM function can use the admission control, congestion control, handover, user link maintenance and real time (RT) or non-real time (NRT) packet Switching algorithm as a basis for allocating time slots for a particular user. In one embodiment, a system receives a request for radio resources from a user. In response to the request, the system allocates a particular time slot to the user according to the user’s QoS information obtained from a core network. QoS criterion includes a status of user Subscription, nature of user application, information regarding geographic region where the user requests radio resource, or the like. The system controls initial allocation of radio resources to a particular user based on the category designation associated with the user. After initial allocation is established, the system constantly monitors the traffic conditions. If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 3:46-58 (“In a preferred embodiment of the present invention, users are classified into three classes: a high QoS service subscriber, a high capacity service Subscriber, and a balanced service subscriber. It should be understood that this classification is merely for illustration of the preferred embodiment of the present invention, and any number or title may be used. With some exceptions, high QoS time slots are assigned to high QoS service Subscribers, balanced time slots are assigned to balanced service Subscribers, and high capacity time slots are assigned to high capacity service subscribers. The system 100 controls the initial allocation of radio resources to a particular user based on the status of the subscription of the user.”).
- *See, e.g.,* Kim at 695 (“2.1 Service Differentiation by Contention Window Size All devices within the network are divided into multiple different priority classes by differentiating the contention window size in phase. A CW value is set to CW[q] according to the priority of the device. Namely, the early stage of network forming phase, every sensor device is assigned with the different priority according to the importance of the function by differentiating the CW value. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If q=0, then CW=CW[0] and it means the priority 0

class (high class), while for $q=1$ and 2 , $CW=CW[1]$ and $CW=CW[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows.: $CW[0] < CW[1] < CW[2]$ Such a setting of the differentiated CW value within the 802.15.4 plays a similar role in AIFS differentiation depending on traffics within the 802.11e EDCF. 2.2 Service Differentiation by Backoff Exponent In the early stage of the network forming phase, every sensor device is assigned with the different priority according to the functional importance by differentiating the backoff exponent. A BE value is set to $BE[q]$ according to the functional importance of the device. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If $q=0$, then $BE=BE[0]$ and it means the priority 0 class (high class), while for $q=1$ and 2 , $BE=BE[1]$ and $BE=BE[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows: $BE[0] < BE[1] < BE[2]$.”).

- See, e.g., 802.11-1999 at 71 (“The PCF uses a virtual carrier-sense mechanism aided by an access priority mechanism. The PCF shall distribute information within Beacon management frames to gain control of the medium by setting the network allocation vector (NAV) in STAs. In addition, all frame transmissions under the PCF may use an interframe space (IFS) that is smaller than the IFS for frames transmitted via the DCF. The use of a smaller IFS implies that point-coordinated traffic shall have priority access to the medium over STAs in overlapping BSSs operating under the DCF access method. The access priority provided by a PCF may be utilized to create a contention-free (CF) access method. The PC controls the frame transmissions of the STAs so as to eliminate contention for a limited period of time.”).
- See, e.g., 802.11e at 73 (“9.1.3.2 HCF controlled channel access (HCCA) The HCCA mechanism uses a QoS-aware centralized coordinator, called a *hybrid coordinator* (HC), and operates under rules that are different from the PC of the PCF. The HC is collocated with the QAP of the QBSS and uses the HC’s higher priority of access to the WM to initiate frame exchange sequences and to allocate TXOPs to itself and other QSTAs in order to provide limited-duration controlled access phase (CAP) for contention-free transfer of QoS data. The HC traffic delivery and TXOP allocation may be scheduled during the CP and any locally generated CFP (generated optionally by the HC) to meet the QoS requirements of a particular TC or TS. TXOP allocations and contention-free transfers of QoS traffic can be based on the HC’s QBSS-wide knowledge of the amounts of pending traffic belonging to different TS and/or TCs and are subject to QBSS-specific QoS policies.”).
- See, e.g., Ward at [0058] (“It is possible to offer a premium service, which may not be available for everyone but which may be made available to nervous small-scale traders who wish to take advantage of a stock-crash feature and for which they pay a small additional fee. Thus, if the value of a stock in an investor’s portfolio falls to less than, for example, half of what they paid for it, the scheduler

allocates the next available time slot to that investor so that they may be informed of a market catastrophe with minimal latency, thus allowing the investor to sell the investment immediately.”), [0008] (“It would be possible to exceed the capacity of such a system if too many transducers were assigned too high values of LQoS. In order to avoid such a situation, which might give rise to one or more of the transducers never being polled, the LQoS values are scaled so as to ensure that the polling capacity of the system is never exceeded.”), [0056] (“In applications where it is required to respond to a stimulus, which for example may be external to the communication system or network, scheduling of transmission may be interrupted in the manner described hereinbefore so as to insert a packet into the order of transmission at the earliest opportunity. For example, when data payloads of complete packets have been scheduled for transmission in succeeding time slots, receipt of an external stimulus can cause a packet to be formed and transmitted substantially immediately, for example in the next time slot, so as to provide a low latency response to such a stimulus. In general, a mode of operation corresponding to that illustrated in FIGS. 5 and 6 is necessary to ensure that no packets are lost because of the interruption in the normal or old schedule.”).

- *See, e.g.,* Turina at 6:37-55 (“FIG. 3 is a diagram that illustrates the downlink and uplink frames for packet transfers between a network and a VIP MS, in accordance with the preferred embodiment of the present invention. For the illustrative embodiment, a series of TDMA frames is shown with eight time slots per frame. For example, the GSM employs eight time slots per TDMA frame. However, it should be understood that the invention is not intended to be limited to a certain number of time slots per frame. Any practical number of TDMA time slots per frame could be used. As shown, the downlink physical channels dedicated to the VIP MS are realized as dedicated time slots in each frame, which are reserved in the first place for the VIP MS. However, as discussed below, during idle periods between VIP packets, these reserved VIP MS time slots can be temporarily utilized for other traffic. Consequently, the network throughput is significantly improved over conventional systems, because the dedicated VIP MS physical channels can be accessed for packet data traffic to/from other mobile stations during idle periods.”).
- *See, e.g.,* Rabenko at 6:64-7:5 (“The time slot allocations 92 defined by CM transmit opportunities 114 may optionally be defined, at least in part, on the basis of priorities established by the CMTS 1042 for different CMs 1046. For example, priorities may be established for individual CMs 1046 on the basis of an election made by the subscribers, which is typically dependent upon the type of service desired. Thus, a subscriber may elect to have either a premium (high priority) service or a regular (low priority) service.”), 7:6-15 (“Alternatively, priorities may be established by the CMTS 1042 for the CMs based upon size and number of CM transmit opportunities 114 historically requested by the subscribers. Thus, a CM that typically requires a large number of time intervals 110 may be defined as a high priority user, and thus given priority in the allocation of time slots within a CM transmit opportunity 114, based upon the assumption that such large usage is

indicative of a continuing need for such priority, e.g., is indicative that the subscriber is utilizing cable television, pay-per-view or the like.”).

- *See, e.g.,* Odman at [0099]-[0100] (“Although the disclosed embodiment uses a plurality of GTS 640, a plurality of ATS 770, one uplink MTS 630 placed before the GTS 640, and one downlink MTS 650 placed after the ATS 770, the number, distribution, and placement of GTS 640, ATS 770, and MTS 630, 650 may be varied in alternate embodiments. In this embodiment the management time slots (MTS) are for management frames and high priority asynchronous data frames under 256 bytes, the guaranteed time slots (GTS) are for medium priority isochronous data, and the asynchronous time slots (ATS) are for asynchronous low priority data and high priority asynchronous data over 255 bytes.”).
- *See, e.g.,* Lan at [0223] (“In the third embodiment, packet transmission is prioritized and timeslots are assigned by using the QoS request according to traffic state at the time of packet transmission acceptance.”), [0186] (“In a second embodiment, the basic operation of the present invention corresponding to the second object will be described. In a third embodiment, a method in which a timeslot is assigned by a QoS (quality of service) request according to a traffic state at the time of packet transmission acceptance. In this embodiment, giving a higher priority to after-mentioned class 2 users, quality for the class 2 users is degraded in higher priority when congestion occurs.”).
- *See, e.g.,* Brown at 14:21-40 (“As can be seen from the foregoing, the present invention provides a communication system and method for efficiently communicating both asynchronous data and isochronous data. An isochronous beacon is transmitted at the start of each frame by a base station to provide control information and timing for all stations in the communication system. In response to the beacon, isochronous data is communicated with mobile stations on designated isochronous time slots. Following the isochronous time slots, the remainder of the frame is used for communication of asynchronous data. This protocol permits flexibility, as the communication system is able to accommodate variable amounts of both isochronous data and asynchronous data. Additional isochronous time slots may be allocated if necessary to accommodate additional isochronous data channels. Similarly, the bandwidth allocated to asynchronous data may be maximized in the absence of isochronous data and tailored to the number of isochronous data channels required. Priority is given to communication of isochronous data, which is real-time data.”).
- *See, e.g.,* Ben-Eli at Abstract (“Network resources such as in a wireless system may be allocated to user devices on the network based upon at least one or more minimum user requirements being satisfied. A user may be determined as satisfied when minimum requirements of rate and delay are reached or maintained. The network may optimize throughput on the network by allowing a maximum number of users on the network to be satisfied. Users may be ranked according to signal quality, and network resources may be allocated to users

according to rank to satisfy users until the resources of the network are allocated.”).

- *See, e.g.,* Huang at 3929-3930 (“In this paper, we propose an adaptive GTS allocation (AGA) scheme for IEEE 802.15.4 with the considerations of low-latency and fairness. There are two phases for the proposed scheme: In the classification phase, devices are assigned priorities in a dynamic fashion based on recent GTS usage feedbacks. Devices that need more attention from the coordinator are given higher priorities. In the GTS scheduling phase, GTSs are given to devices in a non-decreasing order of their priorities. A starvation-avoidance mechanism is presented to regain service attention for lower-priority devices that need more GTSs for data transmissions. The scheme is designed based on the existing IEEE 802.15.4 medium access control (MAC) protocol without any modification. A simulation model validated by the developed mathematical analysis is presented to investigate average packet waiting times and fairness for our adaptive scheme. The capability of the proposed scheme is evaluated by a series of experiments. It is shown that the proposed scheme significantly outperforms the existing implementations with FCFS.”), 3932 (“2) Priority Assignment: By using the above state diagram, the PAN coordinator can monitor the recent transmission behaviors of devices, and classify the devices into proper traffic types. However, with scarce GTS resources (i.e., 7 time-slots) of IEEE 802.15.4-based networks, the four-state classification for devices is somewhat rough and can not be sufficient for precisely classifying transmission behaviors of devices. Thus the state diagram in Figure 3 is further revised so that each device is dynamically assigned a priority number for GTS allocation. Upon the occurrence of GTS hit of a device, the priority number of the device is decreased by the PAN coordinator, and the priority of GTS allocation for the device upgrades. On the other hand, when GTS miss occurs to a device, the PAN coordinator increases the priority number of the device, and hence the opportunity for obtaining a GTS for the device reduces. Maintenance of priority numbers of devices depends on the transmission feedback as well as the traffic-level states of devices, and the details for maintaining priority numbers of devices are presented below.”).
- *See, e.g.,* Gilb at 57 (“Although every CTA has a stream index, the source DEV may send data with any stream index during the CTA. If the DEV has higher priority traffic it needs to send to the destination, it can use any or all of the CTAs that it has allocated to the destination to send the data. This includes sending asynchronous data or commands to the destination DEV. In general, once the DEV has been given the CTA, it is allowed to use the time for any purpose.”).
- *See, e.g.,* Lansford at 1668 (“The contention-free periods are divided into a number of pairs of fixed length slots, two per voice connection. The first slot in each pair is used to transmit voice data from the CP to a node (downlink), and the second is used to transmit voice data from a node to the CP (uplink). CFP2 at the end of the superframe is used for the initial transmission of the voice data, while CFP1 at the start of the superframe is used for the optional retransmission of any

voice packet that was not received or was incorrectly received in the previous dwell. Each voice packet transmitted by an I-node includes in the packet header a piggyback acknowledgment (ACK) of the last voice data message received by the node, i.e., in the up-link packet the voice node ACKs the downlink packet sent by the CP. This allows the CP to determine prior to a hop which voice data transmissions were lost, and determine whether or not retransmissions are required. Retransmissions are advertised in the beacon at the start of the next superframe; each voice data packet is retransmitted only once.”).

- *See, e.g., Nakagawa at [0048]* (“When communication is started with another radio communications apparatus within the ad-hoc network, processing for measuring the power of interference signals for each time slot set for the uplink and the downlink of the mobile communications network and selecting time slots to be used for communications within the ad-hoc network based on the measured value. Furthermore, when communication is performed with other radio communications apparatus within the ad-hoc network, timing for communications with that other radio communications apparatus within the ad-hoc network is set to correspond to the communication timing in the mobile communications network, based on synchronization information received from the base station 30. Furthermore, when communication is performed with another radio communications apparatus within the ad-hoc network, an interference level is detected from a receive signal inputted into the receiver 12, and transmit power is adjusted according to the interference level.”), [0049] (“When communication is performed with the use of the mobile communications network, switching control of a communications path is performed in accordance with an instruction from the base station 30. As the communications path, there are included a first communications path for directly communicating with the base station 30 and second communications paths for communicating with base station equipment (the base station 30 or radio network controller equipment (RNC) 40) via other radio communications apparatuses within the ad-hoc network. The other radio communications apparatuses have a function of relaying signals exchanged between the first radio communications apparatus 10 (UE1) and the base station equipment. These radio communications apparatuses include, for example, a radio communications apparatus (UE2: a first ad-hoc terminal) having a function of performing radio communications with the base station 30 and a radio communications apparatus (UE3: a second ad-hoc terminal) capable of connecting to the base station equipment (the radio network controller equipment 40 or the base station 30) via a communications network such as a LAN though not having the function of performing radio communication with the base station 30, as shown in FIG. 3. Signals to be relayed by these other radio communications apparatuses (UE2 and UE3) include a signal transmitted from the first radio communications apparatus 10 (UE1) with the use of the uplink of the mobile communications network and a signal transmitted from the base station 30 with the use of the downlink.”), [0074] (“When receiving the set-up information necessary for communications with the node Y, the node X stores the set-up information in the storage section 15, and then performs transmitting and receiving of data signals directly with the node Y in accordance with the set-up

information. In this case, the node X performs power control in order not to interfere neighboring radio communications apparatuses which do not join the ad-hoc network. That is, it measures the interference level of all time slots based on received signals inputted into the receiver 12 and performs transmit power control so that the maximum value (the tolerance value) of transmit power, which is the sum of the measured values and an offset value set in advance, is not exceeded. The node X also performs processing for receiving a signal from the base station 30, obtaining information for synchronization included in a predetermined time slot of the received signal, and setting timing for communications with the node Y so that it corresponds to the communication timing in the mobile communications network, based on the synchronization information, and processing for determining estimated channel values of a desired signal transmitted from the node Y and other interference signals based on midambles included in the received signals, removing the interference signals by joint detection with the use of the estimated channel values and the spreading code assigned to each signal, and the like.”).

- *See, e.g.,* Major at 19:42-20:19 (“At step 82, the mobile device waits for messages and signals 84 to be generated or received. Assuming that the redirector software 12 operating at the user’s desktop system 10 is configured to redirect upon receiving a message from the user’s mobile device 24, at step 86, the user can decide to generate a command message that will start redirection. If the user does so, then at step 88 the redirection message is composed and sent to the desktop system 10 via the wireless network 22, through the wireless gateway 20, via the Internet 18 to the LAN 14, and is finally routed to the desktop machine 10. In this situation where the mobile device 24 is sending a message directly to the desktop system 10, no outer wrapper is added to the message (such as message C in FIGS. 1 and 2). In addition to the redirection signal, the mobile device 24 could transmit any number of other commands to control the operation of the host system, and in particular the redirector program 12. For example, the mobile 24 could transmit a command to put the host system into the preferred list mode, and then could transmit additional commands to add or subtract certain senders from the preferred list. In this manner, the mobile device 24 can dynamically limit the amount of information being redirected to it by minimizing the number of senders on the preferred list. Other example commands include: (1) a message to change the configuration of the host system to enable the mobile device 24 to receive and process certain attachments; (2) a message to instruct the host system to redirect an entire data item to the mobile device in the situation where only a portion of a particular data item has been redirected; (3) a message to instruct the host system to modify the priority level associated with classes or subclasses of data items.”).
- *See, e.g.,* Parantainen at [0008] (“The physical channels must be located in the frequency and time domain in a way that reception and transmission by the mobile terminals in the cell is enabled. In case the mobile terminals in the cell are to follow several channels at the same time, multislot class constraints of the mobile terminals have moreover to be taken into account. A mobile terminal can receive and transmit on a predetermined number of time slots, which number

depends on the capabilities of the mobile terminal. The number of time slots that are supported for transmission and reception determine the multislot class of the mobile terminal. Typically, a mobile terminal is able to support e.g. 2, 3 or 4 time slots in the downlink and 1 or 2 time slots in the uplink. In the simplest case, the mobile terminal is a 1+1 terminal, which can receive and transmit on only one time slot per direction. The uplink transmission periods and the downlink reception periods allocated to a terminal must be set in such a way that they leave sufficient time in between, in order to enable the mobile terminal to change from reception to transmission and vice versa, to change the frequency, and to carry out neighbor cell measurements. An exemplary allocation taking into account these requirements is illustrated in FIG. 3.”), [0015] (“This object is reached according to the invention with a method comprising transmitting paging messages in at least one common control channel defined in a frame structures employed in the radio cell and transmitting the MBMS data in a dedicated channel defined equally in this frame structure. It is further proposed that this dedicated channel is allocated such that the mobile terminals are able to receive paging messages and the MBMS data simultaneously. This implies in particular that the multislot class constraints of the mobile terminals which are to receive the MBMS data are taken into account.”).

- *See, e.g.,* Parantainen at [0050]-[0053] (“The fourth embodiment of the invention is presented for a constellation in which the cell employs two PCCCH time slots, but in which at least some mobile terminals in the cell capable of receiving MBMS are only able to receive on two time slots. In this case, the two PCCCH time slots are advantageously allocated one time slot apart from each other, and the PMBCH is allocated to the time slot between the two PCCCH time slots. An example for the allocation of channels according to the fourth embodiment of the invention is depicted in FIG. 6. FIG. 6 shows again a sequence of downlink time slots, which are numbered for each frame from 1 to 8. A first PCCCH time slot 3, which corresponds always to the PBCCH time slot, is spaced one time slot apart from a second PCCCH time slot 5. The PMBCH is allocated to the time slot that is located between the two PCCCH time slots 3 and 5, i.e. on time slot 4. The paging messages for a specific mobile terminal are provided by either of the two PCCCHs. With such an allocation, all mobile terminals in the GERAN cell which are capable of listening to at least two downlink time slot are able to decode paging messages and the MBMS data. Mobile terminals following the first PCCCH time slot 3, which contains also the PBCCH blocks, can receive with the presented allocation the PBCCH, the PCCCH providing the paging messages and the PMBCH without interruptions. Mobile terminals following the second PCCCH time slot 5 can receive the paging messages provided by the second PCCCH normally, but they have to quit reception on the PMBCH time slot 4 from time to time for a short period, when decoding system information messages from the PBCCH provided on time slot 3. Mobile terminals capable of receiving on three time slots are obviously able to receive MBMS data without interruptions also with the allocation of the fourth embodiment. With such mobile terminals, the fourth embodiment constitutes a special case of the third embodiment.”).

- *See, e.g., Karaoguz at [0012]* (“As another aspect of the present invention, elements having similar power cycle time values or characteristics may be grouped together wherein they are powered down and back up jointly. Further, an element, as defined herein, is not necessarily limited to an entire module or block. For example, a local oscillator may be separated into a plurality of components, each having separate power cycle times. More specifically, the elements of a local oscillator include a crystal, a crystal amplifier, a phase-locked-loop (PLL), and a clock distribution tree. Each of these four elements have differing power cycle times. The PLL has the greatest power cycle time because it has the greatest recovery (power-up) time. Thus, the present invention provides for partially powering down circuit modules according to power cycle characteristics of each of the components and component blocks therein. Similarly, a medium access control (MAC) device may be broken into at least two component blocks having different power cycle characteristics and, therefore, may be controlled separately to minimize power consumption.”).
- *See, e.g., Schloss at 3:59-66* (“The invention is embodied in a TDMA network 100 of the type used in reader-transponder communications having an RF modulation/demodulation section 102 for modulating, demodulating and converting signals between an analog and digital format and a digital link controller 104 for decoding messages and providing a protocol structure to the reader-transponder communications as shown in FIG. 1.”), 6:66-7:45 (“The protocol structure associated with the protocol logic device 110 shown in FIG. 2 will now be discussed. The network protocol employs a time division multiple access (TDMA) scheme in which various users are assigned specific time intervals in which to communicate. By taking turns, many users can share a single frequency channel. The present invention eliminates the need to isolate users, either physically or by using separate frequency assignments, to keep their respective communications from interfering with one another. The protocol structure of the present invention is illustrated in FIGS. 3-6. Utilization of the TDMA network schemes of the past has proved unsatisfactory. The pure slotted aloha scheme based upon random selection becomes undesirable when the traffic density increases. Likewise, the fixed slot assignment scheme is very inefficient when slots are reserved for a large number of potentially infrequent users. A novel approach lies in the unique combination of slotted aloha and fixed slot protocols. The slotted aloha protocol provides random slots which are used as a means for vehicle transponders 114 to enter the TDMA communication network 100. The slotted aloha random slots are not used for communication of data. Once an identification message from the vehicle transponder 114 is received and identified, the transponder 114 is assigned specific and unique time slots. Thereafter, data communication occurs between the reader 112 and the vehicle transponder 114 in the assigned time slots. Entry of a vehicle transponder 114 to the TDMA network 100 is not permitted during the assigned time slots. This protocol rule eliminates interference between response signals of different vehicle transponders 114 and ensures a very high data communication success rate between the reader 112 and the transponders 114. Further, an increased number of

transponders 114 can be accommodated by the TDMA network 100 since message repeat time is minimized. This combination of time slots provides the best results for the following reasons. The random time slot selection is convenient for entry into the TDMA network 100 but is a poor choice for uniquely communicating with a large number of vehicle transponders 114. The assigned time slots are efficient for communicating among a known list of vehicle transponders 114 but entry into the TDMA network 100 by vehicle transponders 114 is difficult.”).

- *See, e.g.,* Mansfield at 6:21-44 (“Referring specifically to FIG. 4, base station 102 informs user device 104 whether it is permitted to transmit in the next uplink time slot 210, e.g., by transmitting the uplink transmission schedule (represented by scheduling bits 214) to user device 104 at the beginning of each time slot 208. As illustrated, the scheduling bits 214 may be transmitted as part of the user data (as shown in FIG. 4, time slots 1 and 5) or as part of the low data rate maintenance link (as shown in FIG. 4, time slots 2-4). For purposes of illustration, the scheduling bits 214 that indicate that the user device 104 is not permitted to transmit during the next uplink time slot 210 are dark, and the scheduling bits 214 that indicate that the user device 104 is permitted to transmit during the next uplink time slot 210 are light. Thus, as can be seen, user device 104 transmits user data in the uplink time slot 3 only after the base station 102 transmits scheduling bits 214 in the downlink time slot 2 indicating that user device 104 is permitted to transmit during the next uplink time slot 210. Base station 102 is thus able to readily control the Quality of Service (QoS) offered to each user device 104 according to the user data throughput requirements of user device 104. Scheduling for downlink transmissions is trivial since base station 102 simply transmits according to its predetermined schedule.”).

9. *Unassigning/Reassigning Time Slots*

Unassigning a time slot previously assigned to one user as well as reassigning timeslots were well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g.,* 802.15.4 at 159 (“A GTS shall be allocated before use, with the PAN coordinator deciding whether to allocate a GTS based on the requirements of the GTS request and the current available capacity in the superframe. GTSs shall be allocated on a first-come-first-served basis, and all GTSs shall be placed contiguously at the end of the superframe and after the CAP. Each GTS shall be deallocated when the GTS is no longer required, and a GTS can be deallocated at any time at the discretion of the PAN coordinator or by the device that originally requested the GTS. A device that has been allocated a GTS may also operate in the CAP.”), 17 (“7.5.7.5 GTS reallocation The deallocation of a GTS may result in the superframe becoming fragmented. For example, Figure 65 shows three stages of a superframe with allocated GTSs. In stage 1, three GTSs are allocated

starting at slots 14, 10, and 8, respectively. If GTS 2 is now deallocated (stage 2), there will be a gap in the superframe during which nothing can happen. To solve this, GTS 3 will have to be shifted to fill the gap, thus increasing the size of the CAP (stage 3). ... The PAN coordinator shall ensure that any gaps occurring in the CFP, appearing due to the deallocation of a GTS, are removed to maximize the length of the CAP. When a GTS is deallocated by the PAN coordinator, it shall add a GTS descriptor into its beacon frame indicating that the GTS has been deallocated. If the deallocation is initiated by a device, the PAN coordinator shall not add a GTS descriptor into its beacon frame to indicate the deallocation. For each device with an allocated GTS having a starting slot lower than the GTS being deallocated, the PAN coordinator shall update the GTS with the new starting slot and add a GTS descriptor to its beacon corresponding to this adjusted GTS. The new starting slot is computed so that no space is left between this GTS and either the end of the CFP, if the GTS appears at the end of the CFP, or the start of the next GTS in the CFP. In situations where multiple reallocations occur at the same time, the PAN coordinator may choose to perform the reallocation in stages. The PAN coordinator shall keep each GTS descriptor in its beacon for aGTSDescPersistenceTime superframes.”), FIG. 65.

- *See, e.g., Bluetooth at 124* (“A connection may break down due to various reasons such as a device moving out of range or a power failure condition. Since this may happen without any prior warning, it is important to monitor the link on both the master and the slave side to avoid possible collisions when the AM_ADDR is reassigned to another slave. To be able to supervise link loss, both the master and the slave use link supervision timers, T supervision. Upon reception of a packet that passes the HEC check and has the correct AM_ADDR, the timer is reset. If at any time in connection state, the timer reaches the supervisionTO value, the connection is reset. The same timeout value is used for both SCO and ACL connections.”), 46 (“In the slots not reserved for SCO links, the master can exchange packets with any slave on a per-slot basis.”).
- *See, e.g., HomeRF at 370* (“When an existing connection is destroyed, the CP might need to adjust the main slot allocation in order to minimize the duration of the CFP and avoid holes in the TDMA frame. Only one main slot allocation can be changed at a time. CP does not delay this re-ordering, because until it has, CFP2 has a “hole” in it that may allow CSMA devices in other networks to jump in. ... To limit the number of nodes that have to move slots, the node allocated the earliest (highest-numbered) slot position in CFP2 is moved to the vacant position. If a connection to the highest-numbered main slot position is closed, no reallocation of main slots allocated to TDMA connections needs to be performed. ... The ICBS-channel is always allocated the highest-numbered main slot. Its position is adjusted when TDMA connections are created and destroyed. ... The Connection Point notifies the node of its new slots using the Main Slots field of the TDMA Beacon. On receipt of the Beacon the node starts using the new slot and will transmit up-link data in the new slot.”), FIG. 182.

- *See, e.g.,* Livet at 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. The RRM function can use the admission control, congestion control, handover, user link maintenance and real time (RT) or non-real time (NRT) packet Switching algorithm as a basis for allocating time slots for a particular user. In one embodiment, a system receives a request for radio resources from a user. In response to the request, the system allocates a particular time slot to the user according to the user’s QoS information obtained from a core network. QoS criterion includes a status of user Subscription, nature of user application, information regarding geographic region where the user requests radio resource, or the like. The system controls initial allocation of radio resources to a particular user based on the category designation associated with the user. After initial allocation is established, the system constantly monitors the traffic conditions. If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 3:46-58 (“In a preferred embodiment of the present invention, users are classified into three classes: a high QoS service subscriber, a high capacity service Subscriber, and a balanced service subscriber. It should be understood that this classification is merely for illustration of the preferred embodiment of the present invention, and any number or title may be used. With some exceptions, high QoS time slots are assigned to high QoS service Subscribers, balanced time slots are assigned to balanced service Subscribers, and high capacity time slots are assigned to high capacity service subscribers. The system 100 controls the initial allocation of radio resources to a particular user based on the status of the subscription of the user.”).
- *See, e.g.,* 802.11-1999 at 88 (“The PC may terminate any CFP at or before the aCFPMaxDuration, based on available traffic and size of the polling list. Because the transmission of any beacon may be delayed due to a medium busy condition at the nominal beacon transmission time, a CFP may be foreshortened by the amount of the delay. In the case of a busy medium due to DCF traffic, the beacon shall be delayed for the time required to complete the current DCF frame exchange. In cases where the beacon transmission is delayed, the CFPDurRemaining value in the beacon at the beginning of the CFP shall specify a time that causes the CFP to end no later than TBTT plus the value of aCFPMaxDuration. This is illustrated in Figure 61.”).
- *See, e.g.,* 802.11e at 91 (“Non-AP QSTAs may send TXOP requests during polled TXOPs or EDCA TXOPs using the QoS Control field in the QoS data or QoS Null frame directed to the HC, with the TXOP Duration Requested or Queue Size subfield value and TID subfield value indicated to the HC. QAPs indicate whether they process TXOP request or queue size in the QoS Info field in the Beacon, Probe Response, and (Re)Association Response frames. QAPs shall process requests in at least one format. The QAP may reallocate TXOPs if the request belongs to TS or update the EDCA parameter set if the above request belongs to TC. Non-AP QSTAs shall use only the request format that the QAP indicates it

can process.”), 188-189 (“If a new stream is admitted with a maximum SI smaller than the current SI, the scheduler needs to change the current SI to a smaller number than the maximum SI of the newly admitted stream. Therefore, the TXOP duration for the current admitted streams needs also to be recalculated with the new SI. If a stream is dropped, the scheduler might use the time available to resume contention. The scheduler might also choose to move the TXOPs for the QSTAs following the QSTA dropped to use the unused time. An example is shown in Figure K.3, when the stream for QSTA j is removed. However, this option might require the announcement of a new schedule to all QSTAs.”).

- *See, e.g., Ward at [0048]* (“When the step 53 detects that a priority request has been received, a step 56 selects the address of the signalling transponder which made the priority request, for example by retrieving the relevant address from the memory 45 and supplying it to the scheduler 48. A step 57 effectively causes the base system to wait until the present time slot has been completed and then causes, in a step 58, the polling signal for the transponder which made the priority request to be inserted into the schedule so as to create a “new schedule” as shown in FIG. 6. For the four transponder or “Bat” system whose scheduling is illustrated in FIG. 1, it is assumed that Bat 3 has made the priority request. Thus, in the next available time slot, the location polling signal for Bat 3 is transmitted. The old schedule is therefore effectively interrupted in order to form location detection of Bat 3 as quickly as possible.”).
- *See, e.g., Turina at 8:5-18* (“Notably, when a VIP MS (e.g., located in one cell) moves into a different cell, the MS can be granted the same exclusive resources. This grant can be made either in response to the MS renegotiating those resources in the new cell, or the same effect can be obtained from signalling within the network. For the latter case, during the handover from the one cell to the other (e.g., when the MS “presents” itself to the new cell), the cell update process can be performed by the MS, and if enough resources are available in the new cell, the network can automatically “transfer” or reallocate the VIP resources from the old cell. This automatic reallocation of resources can be accomplished, for example, using a special signalling procedure, such as the type used for a conventional handover.”).
- *See, e.g., Odman at [0153]* (“Regardless of the destination, after the frames are sent, the CTA needs to be deallocated for a given device. There are several possible schemes provided for deallocation.”), [0161] (“Using a fourth alternative, every allocation could last forever. In this case the requesting device is responsible for freeing the CTA when it no longer has any traffic. Under one preferred embodiment, every time the transmit controller 930 has a CTA for a certain destination device, and the asynchronous transmit queue 920 reports that it has no frames for that destination device, the transmit controller 930 of the source device must send a CTA-free message using the destination device’s address as the identifier.”), [0162] (“This works well at the cost of increased traffic, since CTA freeing has to be done per destination device. The biggest cost is that transmit controller 930 must send a new frame for every CTA that is not needed.

It cannot combine several free messages into one, since it must pull frames out of the queue individually for every CTA (one or more times) and free them as they are not needed. The transmit controller 930 cannot queue up requests since it's strictly a real-time handler of the TDMA protocol that needs to process events as they occur. In other words, it cannot use non-deterministic processing.”).

- *See, e.g.,* Lan at [0187] (“In a fourth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of available timeslots decreases or increases during packet transmission. In addition, in the case that timeslots need to be deleted when the number of available timeslots is decreased, the quality for class 2 users is degraded in higher priority.”), [0188] (“In a fifth embodiment, a method in which timeslots are assigned according to a QoS request in consideration of a traffic state at the time of packet transmission acceptance. The difference between the third embodiment and the fifth embodiment is as follows. In the third embodiment, quality for the class 2 users is degraded in higher priority when congestion occurs at the time of acceptance. On the other hand, in the fifth embodiment, excess timeslots which are assigned in excess of a minimum timeslot number or a desired timeslot number are deleted in higher priority.”), [0189] (“In a sixth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of available timeslots decreases or increases during packet transmission. The difference between the fourth embodiment and the sixth embodiment is as follows. In the fourth embodiment, quality of class 2 users is degraded in higher priority when congestion occurs in transmission. On the other hand, in the sixth embodiment, excess timeslots which are assigned beyond a minimum timeslot number or a desired timeslot number are deleted in higher priority when congestion occurs in transmission.”).
- *See, e.g.,* Huang at 3931-3932 (“In original IEEE 802.15.4 specification [3], the devices intending to utilize GTSs for data transmission may wait for the expiration of GTSs (i.e., the allocated GTSs that have not been used for a specific period) of high-priority transmissions. This passively deallocation scheme for GTS resources would result in starvation of light-traffic devices. Conversely, by using our AGA scheme, starvation of light-traffic devices can be avoided since these devices can be gradually promoted to the heavy-traffic state with the existing GTS-request facility to notify the PAN coordinator for traffic-level promotion.”).
- *See, e.g.,* Gilb at 91 (“The PNC may also wish to terminate an asynchronous allocation. The PNC’s resources may have become overloaded, and so it is unable to handle the asynchronous allocation. If the destination DEV is disassociated from the piconet, either by its own request, by ATP timeout, or because the PNC requests it, the PNC may want to explicitly terminate the allocation and inform the source DEV. When the PNC wants to terminate an asynchronous allocation, it simply stops allocating the channel time and sends a channel time response command to the source DEV. The reason codes that the PNC might send when it

terminates an asynchronous allocation include the following:

- Target DEV unassociated
 - Target DEV not a member
 - Stream terminated by PNC.”).
- *See, e.g.,* Mansfield at 7:35-63 (“Alternatively, each base station 102 may also determine the user data throughput requirement of each user device 104 by identifying the application used by user device 104. For example, a short bit stream or preamble code (not shown) that is unique to or identifies a particular application may be transmitted. In response, base stations 102 may allocate an associated average data transmission rate to user device 104. Alternatively, an application may result in the transmitted user data itself having certain features that may identify the application. Base station 102 optionally correlates or recognizes the characteristics, and thereby identifies the corresponding application. In another example, user device 104 may be associated with a particular application, so that when user device 104 attempts to communicate, base station 102 may recognize the fixed application for a particular user device 104 and, in response, allocate an associated average data transmission rate to user device 104. Alternatively, user device 104 may change applications and base station 102 could recognize when user device 104 changed applications, and thereby appropriately allocate an associated average data transmission rate. In all the examples, a significant point is that base station 102 may recognize the type of application a user device 104 desires to use from a data stream, subscriber identification feature, preamble or one of various other features, and in response, associate a particular data throughput. Base station 102 may also allocate average data transmission rates by considering the applications used by other user device 104 and reprioritize data throughputs accordingly.”).

10. Active/Sleep Modes Based on Time Slot Assignment

Causing a wireless device or a portion of a wireless device, such as the radio, to change between sleep mode and active modes, including based on an assigned time slot was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims. Indeed, during prosecution of the ’152 patent, Proxense distinguished prior art references from the claimed invention on the basis that the prior art disclosed powering down and then powering up a device based on a predetermined period of inactivity, confirming that these techniques were known in the art. *See, e.g.,* PROX_INTEL-00000831 at PROX_INTEL-00000983-84.

- *See, e.g.*, 802.15.3 at 15 (“PSPS mode, as described in 8.13.1, allows DEVs to sleep at intervals defined by the PNC. The DEV sends a request to the PNC when it wants to enter the PSPS mode. The PNC informs the piconet by setting the DEV’s bit in its PS Status IE in the beacon. The PNC then selects beacons that will be the system wake beacons and indicates the next one in the PS Status IE for the PSPS set. All DEVs in PSPS mode are required to listen to the system wake beacons.”), (“DSPS mode, as described in 8.13.2, is designed to enable groups of DEVs to sleep for multiple superframes but still be able to wake up during the same superframe. DEVs synchronize their sleep patterns by joining a DSPS set which specifies the interval between wake periods for the DEVs and the next time the DEVs will be awake. Besides allowing the DEVs to wake up and exchange traffic at the same time, the use of DSPS sets makes it easy for other DEVs in the piconet to determine exactly when a DSPS DEV will be available to receive traffic.”), 208 (“There are four power management (PM) modes defined in this standard, ACTIVE, APS, PSPS, and DSPS modes. The latter three modes are collectively referred to as power save (PS) modes. A DEV that is in ACTIVE, APS, PSPS, or DSPS mode is said to be an ACTIVE DEV, an APS DEV, a PSPS DEV, or a DSPS DEV, respectively. In any given PM mode, a DEV may be in one of two power states, either AWAKE or SLEEP states. A WAKE state is defined as the state of the DEV where it is either transmitting or receiving. SLEEP state is defined as the state in which the DEV is neither transmitting nor receiving. A DEV, regardless of its PM mode, is allowed to enter the SLEEP state during a CTA for which it is neither the source nor the destination. A DEV is also allowed to enter the A WAKE state during any time when it is in a power save mode.”).
- *See, e.g.*, 802.15.4 at 140 (“The coordinator on a PAN can optionally bound its channel time using a superframe structure. A superframe is bounded by the transmission of a beacon frame and can have an active portion and an inactive portion. The coordinator shall interact with its PAN only during the active portion of the superframe and, therefore, may enter a low power (sleep) mode during the inactive portion.”).
- *See, e.g.*, Bluetooth at 110 (“In the active mode, the Bluetooth unit actively participates on the channel. The master schedules the transmission based on traffic demands to and from the different slaves. In addition, it supports regular transmissions to keep slaves synchronized to the channel. Active slaves listen in the master-to-slave slots for packets. If an active slave is not addressed, it may sleep until the next new master transmission. From the type indication in the packet, the number of slots the master has reserved for its transmission can be derived; during this time, the non-addressed slaves do not have to listen on the master-to-slave slots. A periodic master transmission is required to keep the slaves synchronized to the channel. Since the slaves only need the channel access code to synchronize with, any packet type can be used for this purpose.”), 112 (“When a slave does not need to participate on the piconet channel, but still wants to remain synchronized to the channel, it can enter the park mode which is a low-power mode with very little activity in the slave. In the park mode, the slave gives

up its active member address AM_ADDR. Instead, it receives two new addresses to be used in the park mode The parked slave wakes up at regular intervals to listen to the channel in order to re-synchronize and to check for broadcast messages. To support the synchronization and channel access of the parked slaves, the master supports a beacon channel described in the next section. The beacon structure is communicated to the slave when it is being parked. When the beacon structure changes, the parked slaves are updated through broadcast messages.”), 111 (“In the sniff mode, the duty cycle of the slave’s listen activity can be reduced. If a slave participates on an ACL link, it has to listen in every ACL slot to the master traffic. With the sniff mode, the time slots where the master can start transmission to a specific slave is reduced; that is, the master can only start transmission in specified time slots. These so-called sniff slots are spaced regularly with an interval of Tsniff.”).

- *See, e.g.,* HomeRF at 384 (“An I-node can support the I-node sleep state machine. An I-node that does not support the I-node sleep state machine shall remain able to receive and transmit as defined in section 5.8 TDMA Access Mechanism. ... An I-node that supports the sleep state machine can reduce power during the ISS Asleep state. ... The I-node Sleep States are defined in Table 256.”), Table 256.
- *See, e.g.,* Liu ’827 at Abstract (“A mobile station in an 802.11 wireless network dynamically adjusts a number of 802.11 beacon intervals to sleep based on a power savings level and a required wake-up time to receive packets from an access point. The power savings level is based on data traffic activity in a current period. The mobile station wakes up to receive a beacon, and if a beacon is not received, the mobile station sleeps for one additional beacon period.”).
- *See, e.g.,* 802.11-1999 at 129 (“A STA may be in one of two different power states: ... Awake: STA is fully powered. ... Doze: STA is not able to transmit or receive and consumes very low power.”).
- *See, e.g.,* Ye at 1568 (“Latency can be important or unimportant depending on what application is running and the node state. During a period that there is no sensing event, there is normally very little data flowing in the network. Most of the time nodes are in idle state. Sub-second latency is not important, and we can trade it off for energy savings. S-MAC therefore lets nodes periodically sleep if otherwise they are in the idle listening mode. In the sleep mode, a node will turn off its radio. The design reduces the energy consumption due to idle listening. However, the latency is increased, since a sender must wait for the receiver to wake up before it can send out data.”).
- *See, e.g.,* Tanach at 2:38-44 (“As soon as the AdvanceIdleTimer 102 reaches a selected Tidle threshold, it may be used to trigger an idle state having a sleep duration equal to a programmable Tsleep value counted by the Sleep Timer 106, in which some portions of a mobile device (e.g., analog-to-digital converters, analog front end, etc.) are switched from an ON state to a SNOOZE state, while the digital PHY layer devices are disabled.”).

- *See, e.g.,* Abreu at 19:25-35 (“As can be seen from the foregoing, the present invention provides a method and apparatus for identifying a suitable base station from among a plurality of base stations transmitting beacons or control channels which are received by a radiotelephone handset. The handset locates base stations 30 whose control channel signals are unsynchronized with and 2. A method as defined in claim 1 wherein the associated 25 location parameter comprises a bit count and a slot count lag another control channel signals. The handset enters a sleep mode to conserve battery power when no control channel signals are present. The invention allows the handset to synchronize to a base station having acceptable signal 35 strength. access rights identity and system capability.”).
- *See, e.g.,* Gilb at 40 (“One of the key advantages of IEEE Std 802.15.3 is its support of power management modes. The goal in any power management strategy is for the DEV to turn off as many of its operations as possible for the longest period of time. When the DEV is turned off or “sleeping,” it will not be listening to beacons or other traffic. A DEV is “woken up” when it begins listening to beacons or time allocations on a regular basis. However, it is not enough for the DEV to “disappear” for some period of time. To maintain communications with a sleeping DEV, the other DEVs in the piconet will need to know when it will be awake again. These DEVs also need a method to wake up the sleeping DEV if traffic needs to be sent to it. In addition, if more than one DEV is sleeping, then the DEVs that are running the same application need to wake up at the same time to communicate. To do this, the standard provides three power-save modes, asynchronous power save (APS), device synchronized power save (DSPS), and piconet synchronized power save (PSPS). A DEV that is not in a power-save mode and is therefore listening to every beacon is in ACTIVE mode. In any of the four power management modes, ACTIVE or the three power-save modes, the DEV may be in SLEEP state or AWAKE state, depending on the traffic in the piconet. If the DEV sees that it is not the source or destination of a particular CTA, it is not required to have its receiver active for that duration. This allows DEVs, even those in ACTIVE mode, to save power. The various groupings of power-related modes in the standard are listed in Table 3-1.”).
- *See, e.g.,* Lansford at 1671 (“For A-nodes, the behavior of the power management service depends on the type of packet being transmitted. Fig. 7 illustrates the process of sending broadcast messages to power-saving asynchronous nodes. The process is described with the help of an example in which two asynchronous nodes (Node A and Node B) send broadcast packets, and Node C, a power saving node, is a receiver of these packets: a) Node C powers up and receives a “dwells-to-wake-up” counter of three, which is broadcast in the CPB. The maximum value of the “dwells-to-broadcast” counter is a system design parameter that allows the designer to trade off latency, CP buffer size, and broadcast reliability against battery life. The CP maintains a countdown to the next dwell when power saving (PS) nodes would wake up. b) Node A transmits a broadcast message, which is received and stored by the CP. c) Node B transmits a broadcast message, which is received and stored by the CP. d) Node C wakes up when its dwells-to-wake-up counter reaches zero. It checks the CPB and sees an indication from the CP that

packets are available for it and consequently stays powered up. e) The CP transmits the buffered broadcast messages during the dwell. f) Node C receives the broadcast messages and then goes back to sleep mode.”).

- *See, e.g.,* Karaoguz at [0011] (“A radio receiver includes functionality for selectively powering down radio receiver elements in a manner that maximizes battery life. A control module of a radio receiver evaluates, on a radio receiver element-by-element basis, whether the element may be powered down, when it should be brought back up, and what type of power down mode should be utilized therefor. Accordingly, by considering the amount of time that is required to power down and power back up (power cycle time) the element in relation to the amount of available time to do so, the control module can selectively power down radio receiver elements to conserve power and battery life of the radio receiver. Additionally, in one embodiment of the invention, the control module not only considers whether there is enough time to power down an element and back up, but also whether the power consumed in doing so is less than the power saved during the period in which the element is powered down. Thus, the control element serves to intelligently manage power consumption on an element-by-element basis.”), [0039] (“Accordingly, the present invention includes powering down specific radio receiver elements according to a plurality of factors, including power down time, power up time required, the duration of a power down period (and thus the relative power savings) in relation to additional power required to bring the radio receiver/transmitter element back into an operational state. The value of “t” represents the time between beacons, the time from CAP to the allocated time slot of the GTS, the time from the allocated time slot to the subsequent beacon, and the time from a beacon to the allocated time slot of the GTS. Thus, as may be seen, the timing of the allocated time slot with respect to each of the other portions of the signal is known. Accordingly, a controller operating according to the present invention may readily calculate an amount of time “t” until an allocated time slot arrives as a part of determining whether to place a specified radio receiver element in to a power down state or mode of operation.”), [0041]-[0042] (“FIG. 5 is a timing diagram illustrating power reduction operation in accordance with an embodiment of the present invention and, more specifically, a method for power reduction. A power control module determines an inactivity time 130. In the example, the inactivity time is time between received RF transmissions 132. The power control module determines if any receiver element can be powered off and powered up during the inactivity time 130 in order to save power. The power control module uses a known element wake up time 134 to calculate a restoration time 136. The restoration time indicates when the element must be powered on in order achieve an operational mode steady state 138 prior to the expiration of the inactivity time 130. If sufficient time exists between a known settle time 140 and the restoration time 136 to justify powering the element down and the back up, a power savings maybe be realized. Accordingly, the power control module instructs the element to power down at power down time 142. The element remains in a reduced power mode (either off or operating at a lower power level) until the restoration time 136. At restoration time 136, the element is powered back on. FIG. 6 is a

functional block diagram illustrating one embodiment of a receiver path of a handheld host according to the present invention. As may be seen, a power control module 150 is coupled to provide power management control for each radio receiver element shown therein. More specifically, the power control module 150 is coupled to provide power up and power down signals to each element of the radio receiver elements shown therein FIG. 6. Each element shown in FIG. 6 has a specified power down and power up period. Some elements have a power up period that is approximately equal to 4 or 5 microseconds, while other elements (e.g., an oscillator) require 4 or 5 milliseconds to power up. Thus, the power control module 150 determines whether to power down and power up a particular element according to the amount of time that it takes to power it down, power it up, and the amount of power consumed therefor in relation to the amount saved for the period in which the radio receiver element will be in a power down state of operation.”), [0055] (“FIG. 8 is a flow chart illustrating a method for saving power in a radio receiver according to one embodiment of the present invention. First, logic within the radio receiver determines a receiver inactivity time wherein the receiver inactivity time is a time period between received radio frequency (RF) transmissions (step 250). The inactivity time is based upon a number of considerations, including known and defined communication periods, a number of communication beacons, or a known amount of time until an allocated time slot in a time divided communication system.”), FIGs. 5-6, 8.

- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.
- *See, e.g.,* Smith at 9:25-65 (“Based on the received beacon signal or GPR, a different access point may be selected, as seen at block 430. The mobile station is connected to the selected access point. Alternatively, access point selection may occur after creating or updating the site timing table, or at other appropriate points during the EPS. For example, the AP selection may occur upon completion of the

EPS to allow for each AP to have an equal chance of being selected. With information received from the beacon signal or the GPR, entries within the site timing table may be updated, as seen at block 435. Entries in the site timing table, such as an access-point timestamp, a local station timestamp, a beacon interval or a GPR interval, are updated according to information received from the beacon signal or the GPR. The local station timestamp comprises local station timing information, which may include the time when the first byte of the beacon signal or the GPR frame was received. In some cases, entries within the site timing table will be added when the mobile station comes within the range of another access point. In other cases, site timing table entries will be removed when the mobile station goes out of range of an access point. The EPS schedule is generated with the updated information in the site timing table, including a channel number, a local scan start time, and a maximum channel scan time for each site timing table entry in the site timing table, as seen at block 440. The local scan start time can be calculated, for example, from the access-point timestamp, the local station timestamp, and the beacon or GPR interval. The maximum channel scan time may be set differently for each channel, and may be dynamically adjusted while the EPS is performed in order to accommodate, for example, a constantly busy channel or an excessive amount of jitter in the actual beacon signal or GPR transmission time received over a given channel.”), 9:65-10:18 (“A power mode may be determined based on the scan start time, as seen at block 450. When sufficient time exists prior to the next anticipated beacon signal or GPR transmission, the mobile station may be placed into a low-power mode to minimize power consumption. For example, a calculation is made for a time period remaining until a target beacon transmission time or a target gratuitous probe response transmission time is scheduled. The mobile station may enter a low-power mode based on the calculation and other time considerations such as receiver warm-up time, processor wake-up time, or baseband circuitry warm-up time. When time allows, the low-power mode is entered, as seen at block 455. For example, a low-power timer is set based on the scan start time and wake-up time required to receive beacon signals and GPRs. When the low-power timer expires, the mobile station exits the low-power mode. Whether or not the mobile station enters the low-power mode, enhanced passive scanning is continued as seen back at block 420 in accordance with the EPS schedule generated from the site timing table.”), 10:19-34 (“FIG. 5 shows a block diagram of an enhanced passive scanning system for a wireless local area network, in accordance with one embodiment of the present invention at 500. Enhanced passive scanning system 500 includes a mobile station 510. Mobile station 510 includes a controller 550, a transmitter/receiver 552, a pair of diversified antennas 554 a and 554 b, a memory 556, and a set of timers 558. Running computer program code stored in memory 556, controller 550 directs transmitter/receiver 552 to receive beacon signals and GPRs. A site timing table entry in a site timing table stored in memory 556 may be updated based on the received beacon signals or GPRs. A scan start time may be set and stored in a set of timers 558. Based on the scan start time, mobile station 510 may determine a power mode and enter into a low-power mode when

sufficient time is available before receiving the next beacon signal or GPR.”), FIG. 4; *see also* Smith at 8:33-36, 9:7-64.

- *See, e.g.*, Tiedemann at Abstract (“A system for reducing receiver power consumption in communication system having a transmitter and one or more receivers schedules periodic messages in “slots.” Each receiver is assigned a slot during which it monitors the transmissions. The transmitter transmits messages to the receiver only during the assigned slots. The receiver is in an “active state” during its assigned slot. It may remain in the active state after its assigned slot if the message requires the receiver to perform additional actions. During the “inactive state,” which is the time period between successive occurrences of its assigned slot, the receiver may perform any action not requiring coordination with the transmitter. It may conserve power during this time by removing power from one or more components such as those used for monitoring the transmissions. At a time during the inactive state shortly before the assigned slot, the receiver applies power to these components and performs initializations. Such initializations may include requiring a pilot channel signal to which the receiver may synchronize itself if its timing signals have drifted out of synchronization with those of the transmitter during the preceding inactive state.”), 2:26-40 (“In a digital cellular telephone system, for example, the receiver may acquire and track a pilot signal that the transmitter provides on a separate pilot channel. In the inactive state, the receiver may conserve power by removing power from the pilot signal tracking circuitry during the inactive state. In the inactive state, the receiver may maintain its slot timing using an internal clock source. A short time before the next occurrence of its assigned slot, the receiver may apply power to this circuitry and require the pilot signal. The receiver may then realign its timing with that of the transmitter by synchronizing it to the pilot signal. In addition to applying power and requiring a pilot signal, the receiver may perform any other actions or initializations to prepare it to receive a message at the beginning of its assigned slot.”), 7:31-65 (“Transmitter slot signal generator 130 generates an active slot signal 129, which may interrupt processor 126 when processor 126 must provide messages 128, i.e., a short time before the active slot. Transmitter slot signal generator 130 may have a counter for maintaining a slot count. Alternatively, the count may be maintained by processor 126. Transmitter slot signal generator 130 synchronizes messages 128 to the system clock 138, which is generated by transmitter clock source 140. Pilot signal generator 136 generates pilot signal 134, which is also synchronized to system clock 138. Summer 142 adds pilot signal 134 to synchronized message signal 132 and provides the sum signal 144 to a paging channel transmitter 141. Paging channel transmitter 141 broadcasts the transmitted messages 143. In the mobile station receiver 122, paging channel receiver 146 receives transmitted messages 143. In the inactive mode, the power controller 147 may remove power from one or more components, such as receiver 146. Received message signal 150 is provided to receiver slot signal generator 152. In the inactive mode, receiver slot signal generator 152 maintains the slot count in synchronization with local clock signal 156, which is generated by receiver clock source 158. In the active mode, receiver slot signal generator 152 extracts the messages and pilot signal from received message signal 150 and

provides synchronized messages 160 in synchronization with the pilot signal. Synchronized messages 160 are provided to processor 162. Processor 162 provides output signals 164 in response to the messages. Signals 164 alert the mobile station to the type of action it must perform. For example, the mobile station may activate a “traffic” channel for conducting subsequent voice communication in response to signals 164 that alert it to the presence of an incoming call.”), FIG. 3.

11. Broadcasting Beacons

Broadcasting beacons, for example by a router, base station, coordinator node, reader, and other similar device was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g.*, 802.15.3 at 9 (“A piconet is formed when an 802.15.3 DEV that is capable of acting as the PNC begins transmitting beacons. Thus, even if there are no associated DEVs, the PNC sending the beacon is considered to be a piconet. One of the primary functions of the PNC is to transmit a beacon with appropriate information about the piconet.”), 12-13 (“For regular CTAs, the PNC is able to change their position within the superframe every superframe. If a DEV misses a beacon, it is unable to use the allocation for a regular CTA. To avoid lost throughput due to missed beacons, DEV s are allowed to request a special type of CTA called a pseudo-static CTA, as described in 8.4.3.1. If the DEV is allocated a pseudo-static CTA, it is allowed to use the CTA for up to mMaxLostBeacons missed beacons. The PNC is allowed to move the locations of these CTAs, but needs to maintain the time for the old allocation for mMaxLostBeacons superframes to avoid collisions, as described in 8.4.3.1.”)
- *See, e.g.*, 802.15.4 at 17 (“The LR-WPAN standard allows the optional use of a superframe structure. The format of the superframe is defined by the coordinator. The superframe is bounded by network beacons, is sent by the coordinator (see Figure 4), and is divided into 16 equally sized slots. The beacon frame is transmitted in the first slot of each superframe. If a coordinator does not wish to use a superframe structure, it may turn off the beacon transmissions. The beacons are used to synchronize the attached devices, to identify the PAN, and to describe the structure of the superframes. Any device wishing to communicate during the contention access period (CAP) between two beacons shall compete with other devices using a slotted CSMA-CA mechanism. All transactions shall be completed by the time of the next network beacon.”), 18 (“When a device wishes to transfer data to a coordinator in a beacon-enabled network, it first listens for the network beacon. When the beacon is found, the device synchronizes to the superframe structure. At the appropriate point, the device transmits its data frame, using slotted CSMA-CA, to the coordinator. The coordinator acknowledges the successful reception of the data by transmitting an optional acknowledgment

frame. The transaction is now complete. This sequence is summarized in Figure 6.”).

- *See, e.g., Bluetooth at 112* (“When a slave does not need to participate on the piconet channel, but still wants to remain synchronized to the channel, it can enter the park mode which is a low-power mode with very little activity in the slave. In the park mode, the slave gives up its active member address AM_ADDR. Instead, it receives two new addresses to be used in the park mode The parked slave wakes up at regular intervals to listen to the channel in order to re-synchronize and to check for broadcast messages. To support the synchronization and channel access of the parked slaves, the master supports a beacon channel described in the next section. The beacon structure is communicated to the slave when it is being parked. When the beacon structure changes, the parked slaves are updated through broadcast messages.”); *116* (“Parked slaves sleep most of the time. However, periodically they wake up to re-synchronize to the channel. Any packet exchanged on the channel can be used for synchronization. Since master transmission is mandatory on the beacon slots, parked slaves will exploit the beacon channel to re-synchronize. A parked slave will wake-up at the beacon instant to read the packet sent on the first beacon slot. If this fails, it will retry on the next beacon slot in the beacon train; in total, there are NB opportunities per beacon instant to re-synchronize. During the search, the slave may increase its search window, see also Section 9.4 on page 88. The separation between the beacon slots in the beacon train ΔB is chosen such that consecutive search windows will not overlap.”)
- *See, e.g., HomeRF at 134* (“MM_LOST Primitive ... Indicates that the I-node has lost connectivity with the network. This indication occurs following a timeout on the receipt of CP beacons as defined in section 5.16.5 Transitions from the Managed Synchronization State.”), *137* (“CP Beacon Provides for the periodic transmission of the CP beacon MPDU. The CP beacon can consist of both a TDMA oriented beacon and a CSMA oriented beacon. The TDMA beacon carries management signaling for the isochronous services. The CSMA oriented beacon carries management signaling for the asynchronous service and the priority asynchronous service.”), *175* (“An A-node, S-node or CP will receive CP1 Beacons as CP2 Beacons - the operation of the PD-SAP services results in the TDMA Beacon part of a CP1 Beacon being discarded. ... An I-node will receive only the TDMA Beacon part of a CP1 Beacon”).
- *See, e.g., Liu '827 at 2:36-59* (“In some embodiments, an access point may periodically send beacons to mobile stations. For example, access point 102 may periodically transmit beacon frames to be received by any mobile station within range. Access points may also buffer uni-cast data packets for a sleeping station and indicate that in the Traffic Indication Map (TIM) element of beacon. A mobile station in a reduced power state may be required to wake up periodically and listen to the beacons. If the mobile station receives an indication of buffered packets, it may, for example, wake up and poll the packets from the access point. Further, in 802.11 embodiments, broadcast and/or multicast packets that an access

point has buffered will be sent out when the Delivery Traffic Indication Message (DTIM) Count in the TIM element becomes zero. The DTIM count is expressed as a number of beacon intervals, and the DTIM count decrements by one in each beacon. A mobile station is also required to wake up for broadcast or multicast packets when the DTIM count becomes zero. The term “broadcast time” as used herein refers to a time at which a mobile station should be awake to receive broadcast or multi-cast packets. In some embodiments, mobile stations include a timer to cause interrupts at Target Beacon Transmission Times (TBTT) based on beacon interval.”).

- *See, e.g.,* Liu '877 at 4:47-51 (“For example, if a beacon from access point 122 is detected, mobile unit 110 may determine whether the beacon includes a desired service set identifier (SSID) which may be used, for example, to differentiate one wireless local area network from another wireless local area network.”).
- *See, e.g.,* 802.11-1999 at 52-53 (“7.3.1.6 Listen Interval field The Listen Interval field is used to indicate to the AP how often an STA wakes to listen to Beacon management frames. The value of this parameter is the STA’s Listen Interval parameter of the MLME-Associate.request primitive and is expressed in units of Beacon Interval. The length of the Listen Interval field is 2 octets. The Listen Interval field is illustrated in Figure 29.”).
- *See, e.g.,* Ye at 1570-1571 (“B.2 Choosing and Maintaining Schedules Before each node starts its periodic listen and sleep, it needs to choose a schedule and exchange it with its neighbors. Each node maintains a schedule table that stores the schedules of all its known neighbors. It follow the steps below to choose its schedule and establish its schedule table.
 1. The node first listens for a certain amount of time. If it does not hear a schedule from another node, it randomly chooses a time to go to sleep and immediately broadcasts its schedule in a SYNC message, indicating that it will go to sleep after t seconds. We call such a node a synchronizer, since it chooses its schedule independently and other nodes will synchronize with it.
 2. If the node receives a schedule from a neighbor before choosing its own schedule, it follows that schedule by setting its schedule to be the same. We call such a node a follower. It then waits for a random delay t_d and rebroadcasts this schedule, indicating that it will sleep in $t-t_d$ seconds. The random delay is for collision avoidance, so that multiple followers triggered from the same synchronizer do not systematically collide when rebroadcasting the schedule.
 3. If a node receives a different schedule after it selects and broadcasts its own schedule, it adopts both schedules (i.e., it schedules itself to wake up at the times of both its neighbor and itself). It broadcasts its own schedule before going to sleep.”).
- *See, e.g.,* Abreu at 19:25-35 (“As can be seen from the foregoing, the present invention provides a method and apparatus for identifying a suitable base station from among a plurality of base stations transmitting beacons or control channels which are received by a radiotelephone handset The handset locates base stations

30 whose control channel signals are unsynchronized with and 2. A method as defined in claim 1 wherein the associated 25 location parameter comprises a bit count and a slot count lag another control channel signals. The handset enters a sleep mode to conserve battery power when no control channel signals are present. The invention allows the handset to synchronize to a base station having acceptable signal 35 strength. access rights identity and system capability.”).

- *See, e.g., Duong at 35* (“Whenever a handover trigger occurs, the MN starts the AP discovery process (box 1 in Figure 2) by cycling through the possible radio channels in search for a new, more suitable AP. The IEEE 802.11 standard [3] specifies two types of scanning, namely passive and active. In the passive scanning mode, the MN switches to a new channel, waits to receive beacons for a period of time $T_{channel}$, and then switches to the next channel. Normally, $T_{channel}$ is set slightly greater than twice the beacon interval (T_{beacon}) so that the MN can receive two beacons on a channel. After cycling through all available channels (possibly several times), the MN can select a new AP based on information gathered from the beacons (discussed below).”).
- *See, e.g., Kitchin at 4:63-5:29* (“Mobile unit 110 may detect the beacon transmitted by access point 122 in the alternate channel, channel B, at 220 since access point 122 transmitted the alternate channel and the offset time in channel A beacons. In one embodiment of the invention, mobile unit 110 may continually background monitor the alternate channel at the predetermined time as indicated by the offset time during a specified time window to determine whether access point 122 has switched to the alternate channel. In the event mobile unit 110 detects that access point has in fact switched to the alternate channel by detecting a beacon transmitted from access point 122 in the alternate, predetermined channel such as shown at 218, mobile unit 110 may likewise switch to the alternate channel, channel B, as shown at 222 to continue to communicate with access point 122 and complete a transition to channel B, although the scope of the invention is not limited in this respect. In an alternative embodiment, access point may preemptively transmit multiple alternate channels and optionally multiple associated offset times for the multiple alternate channels to accommodate a situation in which there may be a catastrophic interferer on one alternate channel simultaneous with a catastrophic interferer on the original channel. Mobile unit 110 may check each alternate channel until a beacon transmitted by access point 122 is detected on an alternate channel, and may optionally do so in an order preannounced by access point 122, although the scope of the invention is not limited in this respect. In one such embodiment, the time offset from a first channel to a subsequent channel may be constant valued between the channels, and in a further embodiment, the TBTT offset times for the alternate channels may be ordered according to a predetermined order of alternate channels where the predetermined order may be based on, for example, the signal quality on the alternate channels, although the scope of the invention is not limited in this respect.”).

- *See, e.g.,* Gilb at 41-42 (“The next-best power savings method is the DSPS mode. In this mode, the DEVs wake up periodically to listen to beacons. A beacon during which the DEV is in AWAKE state is referred to as a wake beacon. The time period between wake beacons is called the Wake Beacon Interval. The beacon number when the DEV will be awake is called the Next Wake Beacon. A group of DEVs that share the same Wake Beacon Interval and Next Wake Beacon is called a DSPS set. Multiple DEVs can join the same DSPS set, which allows them to be awake at the same time. Because an 802.15.3 communications link is peer-to-peer, it is important that both the source and destination are awake at the same time so that they can exchange frames. DSPS mode allows DEVs with similar application requirements to be asleep for long periods of time while maintaining synchronization of their wake beacons. Furthermore, the DEVs can allocate sub-rate channel time, i.e., channel time every N beacons, aligned with their wake beacons. The only requirement is that the sub-rate interval is greater than the Wake Beacon Interval so that the sleeping DEVs are not required to wake up more often than their normal wake cycle. Figure 3-6 shows the wake beacons and sub-rate allocation for a DSPS DEV that has a Wake Beacon Interval of 4 (i.e., it is awake every 4th beacon) and has sub-rate allocation every 8th beacon (i.e., its CTA rate factor is 8).”).
- *See, e.g.,* Lansford at 1668 (“The start of a superframe is marked by a connection point beacon (CPB) signal. The CPB is used for multiple purposes, including: 1) maintaining network synchronization; 2) controlling the format of the superframe; 3) managing the network during the contention-free period by indicating when each node should transmit and receive data. The CPB can include a list of active voice connections (and, therefore, slot assignments), retransmission slot assignments for the current superframe, connection status information, and paging information; and 4) providing power management services for isochronous and asynchronous nodes to maximize the battery life of portable devices (see Section IV-C). Slot assignment and synchronization information does not change on a per frame basis, so if a node misses a beacon it uses the information contained in the most recent valid beacon. All connection and paging status requests and information are repeated until the receiver acknowledges them.”).
- *See, e.g.,* Karaoguz at [0011] (“A radio receiver includes functionality for selectively powering down radio receiver elements in a manner that maximizes battery life. A control module of a radio receiver evaluates, on a radio receiver element-by-element basis, whether the element may be powered down, when it should be brought back up, and what type of power down mode should be utilized therefor. Accordingly, by considering the amount of time that is required to power down and power back up (power cycle time) the element in relation to the amount of available time to do so, the control module can selectively power down radio receiver elements to conserve power and battery life of the radio receiver. Additionally, in one embodiment of the invention, the control module not only considers whether there is enough time to power down an element and back up, but also whether the power consumed in doing so is less than the power saved during the period in which the element is powered down. Thus, the control

element serves to intelligently manage power consumption on an element-by-element basis.”), [0039]-[0040] (“Accordingly, the present invention includes powering down specific radio receiver elements according to a plurality of factors, including power down time, power up time required, the duration of a power down period (and thus the relative power savings) in relation to additional power required to bring the radio receiver/transmitter element back into an operational state. The value of “t” represents the time between beacons, the time from CAP to the allocated time slot of the GTS, the time from the allocated time slot to the subsequent beacon, and the time from a beacon to the allocated time slot of the GTS. Thus, as may be seen, the timing of the allocated time slot with respect to each of the other portions of the signal is known. Accordingly, a controller operating according to the present invention may readily calculate an amount of time “t” until an allocated time slot arrives as a part of determining whether to place a specified radio receiver element in to a power down state or mode of operation. FIG. 4 is a timing diagram of a radio receiver operating in accordance with the present invention. As before, the beacons are separated by a specified period (“t”). Typical values for the specified period can range from approximately ten milliseconds to approximately hundreds of milliseconds for some communication networks and protocols and by even greater values for other networks and protocols. FIG. 4 specifically illustrates that a power control module may determine to place a radio receiver element, or a plurality of radio receiver elements, in a power down mode of operation for a specified number of beacons (a specified amount of time). For example, according to one embodiment of the present invention, the power control module determines to place the at least one radio receiver element into a reduced power mode of operation for a period equal to ten beacons (hundreds to thousands of milliseconds).”), FIG. 4.

- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.

- *See, e.g., Smith at 9:25-65* (“Based on the received beacon signal or GPR, a different access point may be selected, as seen at block 430. The mobile station is connected to the selected access point. Alternatively, access point selection may occur after creating or updating the site timing table, or at other appropriate points during the EPS. For example, the AP selection may occur upon completion of the EPS to allow for each AP to have an equal chance of being selected. With information received from the beacon signal or the GPR, entries within the site timing table may be updated, as seen at block 435. Entries in the site timing table, such as an access-point timestamp, a local station timestamp, a beacon interval or a GPR interval, are updated according to information received from the beacon signal or the GPR. The local station timestamp comprises local station timing information, which may include the time when the first byte of the beacon signal or the GPR frame was received. In some cases, entries within the site timing table will be added when the mobile station comes within the range of another access point. In other cases, site timing table entries will be removed when the mobile station goes out of range of an access point. The EPS schedule is generated with the updated information in the site timing table, including a channel number, a local scan start time, and a maximum channel scan time for each site timing table entry in the site timing table, as seen at block 440. The local scan start time can be calculated, for example, from the access-point timestamp, the local station timestamp, and the beacon or GPR interval. The maximum channel scan time may be set differently for each channel, and may be dynamically adjusted while the EPS is performed in order to accommodate, for example, a constantly busy channel or an excessive amount of jitter in the actual beacon signal or GPR transmission time received over a given channel.”).
- *See, e.g., Hoang at [0020]-[0021]* (“FIG. 3 illustrates a transmission scheme for the communication system of FIG. 2. During communications among nodes 201-208, a specific transmission protocol is utilized by communication system 100 wherein each piconet communicates within a particular non-overlapping frame 301, 302 as described in U.S. patent application Ser. No. 10/414,838, which is incorporated by reference herein. With reference to FIG. 2, piconet 201 completes all necessary transmissions within frame 301, while piconet 202 completes all necessary transmissions within frame 302. During a frame, a particular controller of the piconet will broadcast piconet timing and control information within a beacon field, while each node (including the controller) will have a Contention Free Period slot, part of the Channel Time Allocation (CTA) facility of the IEEE 802.15.3 standard, for transmission. During its guaranteed time slot, a particular node broadcasts any command (COM) wishing to be executed to any particular node or may send/receive data intended for a single node or set of nodes. Note that because node 207 participates in each piconet, node 207 has a guaranteed time slot (GTS) for transmission/reception within each piconet’s frame. During the GTS, the node also broadcasts a beacon comprising identification of the piconet(s) a node is associated with (i.e., a piconet identifier (PNID)), along with a source address (SA, or device identifier (DEVID)), a destination address (device identifier (DA or DEVID)), and a receive time ($R \times T$) when the node can receive

other node's transmissions. This is illustrated in FIG. 3 with the expanded view of the GTS for node 205. It should be noted that although FIG. 3 shows the beacon signal comprising SA, DA, PNID, and R×T, one of ordinary skill in the art will recognize that the beacon signal may comprise other elements such as, but not limited to, the byte length of the frame being used, a beacon payload that can be used to broadcast generic data, . . . , etc.”).

- *See, e.g.*, Tiedemann at 7:31-65 (“Transmitter slot signal generator 130 generates an active slot signal 129, which may interrupt processor 126 when processor 126 must provide messages 128, i.e., a short time before the active slot. Transmitter slot signal generator 130 may have a counter for maintaining a slot count. Alternatively, the count may be maintained by processor 126. Transmitter slot signal generator 130 synchronizes messages 128 to the system clock 138, which is generated by transmitter clock source 140. Pilot signal generator 136 generates pilot signal 134, which is also synchronized to system clock 138. Summer 142 adds pilot signal 134 to synchronized message signal 132 and provides the sum signal 144 to a paging channel transmitter 141. Paging channel transmitter 141 broadcasts the transmitted messages 143. In the mobile station receiver 122, paging channel receiver 146 receives transmitted messages 143. In the inactive mode, the power controller 147 may remove power from one or more components, such as receiver 146. Received message signal 150 is provided to receiver slot signal generator 152. In the inactive mode, receiver slot signal generator 152 maintains the slot count in synchronization with local clock signal 156, which is generated by receiver clock source 158. In the active mode, receiver slot signal generator 152 extracts the messages and pilot signal from received message signal 150 and provides synchronized messages 160 in synchronization with the pilot signal. Synchronized messages 160 are provided to processor 162. Processor 162 provides output signals 164 in response to the messages. Signals 164 alert the mobile station to the type of action it must perform. For example, the mobile station may activate a “traffic” channel for conducting subsequent voice communication in response to signals 164 that alert it to the presence of an incoming call.”), FIG. 3.

12. *Monitoring for Beacons*

Monitoring for beacons broadcast by routers, base stations, coordinator nodes, readers, and other similar devices was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense's apparent interpretation of the claims.

- *See, e.g.*, 802.15.3 at 9 (“A piconet is formed when an 802.15.3 DEV that is capable of acting as the PNC begins transmitting beacons. Thus, even if there are no associated DEVs, the PNC sending the beacon is considered to be a piconet. One of the primary functions of the PNC is to transmit a beacon with appropriate information about the piconet.”), 12-13 (“For regular CTAs, the PNC is able to change their position within the superframe every superframe. If a DEV misses a

beacon, it is unable to use the allocation for a regular CTA. To avoid lost throughput due to missed beacons, DEV s are allowed to request a special type of CTA called a pseudo-static CTA, as described in 8.4.3.1. If the DEV is allocated a pseudo-static CTA, it is allowed to use the CTA for up to mMaxLostBeacons missed beacons. The PNC is allowed to move the locations of these CTAs, but needs to maintain the time for the old allocation for mMaxLostBeacons superframes to avoid collisions, as described in 8.4.3.1.”).

- *See, e.g., 802.15.4 at 17* (“The LR-WPAN standard allows the optional use of a superframe structure. The format of the superframe is defined by the coordinator. The superframe is bounded by network beacons, is sent by the coordinator (see Figure 4), and is divided into 16 equally sized slots. The beacon frame is transmitted in the first slot of each superframe. If a coordinator does not wish to use a superframe structure, it may turn off the beacon transmissions. The beacons are used to synchronize the attached devices, to identify the PAN, and to describe the structure of the superframes. Any device wishing to communicate during the contention access period (CAP) between two beacons shall compete with other devices using a slotted CSMA-CA mechanism. All transactions shall be completed by the time of the next network beacon.”), 18 (“When a device wishes to transfer data to a coordinator in a beacon-enabled network, it first listens for the network beacon. When the beacon is found, the device synchronizes to the superframe structure. At the appropriate point, the device transmits its data frame, using slotted CSMA-CA, to the coordinator. The coordinator acknowledges the successful reception of the data by transmitting an optional acknowledgment frame. The transaction is now complete. This sequence is summarized in Figure 6.”).
- *See, e.g., Bluetooth at 112* (“When a slave does not need to participate on the piconet channel, but still wants to remain synchronized to the channel, it can enter the park mode which is a low-power mode with very little activity in the slave. In the park mode, the slave gives up its active member address AM_ADDR. Instead, it receives two new addresses to be used in the park mode The parked slave wakes up at regular intervals to listen to the channel in order to re-synchronize and to check for broadcast messages. To support the synchronization and channel access of the parked slaves, the master supports a beacon channel described in the next section. The beacon structure is communicated to the slave when it is being parked. When the beacon structure changes, the parked slaves are updated through broadcast messages.”); 116 (“Parked slaves sleep most of the time. However, periodically they wake up to re-synchronize to the channel. Any packet exchanged on the channel can be used for synchronization. Since master transmission is mandatory on the beacon slots, parked slaves will exploit the beacon channel to re-synchronize. A parked slave will wake-up at the beacon instant to read the packet sent on the first beacon slot. If this fails, it will retry on the next beacon slot in the beacon train; in total, there are NB opportunities per beacon instant to re-synchronize. During the search, the slave may increase its search window, see also Section 9.4 on page 88. The separation between the

beacon slots in the beacon train ΔB is chosen such that consecutive search windows will not overlap.”)

- *See, e.g.,* HomeRF at 134 (“MM_LOST Primitive ... Indicates that the I-node has lost connectivity with the network. This indication occurs following a timeout on the receipt of CP beacons as defined in section 5.16.5 Transitions from the Managed Synchronization State.”), 137 (“CP Beacon Provides for the periodic transmission of the CP beacon MPDU. The CP beacon can consist of both a TDMA oriented beacon and a CSMA oriented beacon. The TDMA beacon carries management signaling for the isochronous services. The CSMA oriented beacon carries management signaling for the asynchronous service and the priority asynchronous service.”), 175 (“An A-node, S-node or CP will receive CP1 Beacons as CP2 Beacons - the operation of the PD-SAP services results in the TDMA Beacon part of a CP1 Beacon being discarded. ... An I-node will receive only the TDMA Beacon part of a CP1 Beacon”).
- *See, e.g.,* Liu '827 at Abstract (“A mobile station in an 802.11 wireless network dynamically adjusts a number of 802.11 beacon intervals to sleep based on a power savings level and a required wake-up time to receive packets from an access point. The power savings level is based on data traffic activity in a current period. The mobile station wakes up to receive a beacon, and if a beacon is not received, the mobile station sleeps for one additional beacon period.”).
- *See, e.g.,* Liu '827 at 2:36-59 (“In some embodiments, an access point may periodically send beacons to mobile stations. For example, access point 102 may periodically transmit beacon frames to be received by any mobile station within range. Access points may also buffer uni-cast data packets for a sleeping station and indicate that in the Traffic Indication Map (TIM) element of beacon. A mobile station in a reduced power state may be required to wake up periodically and listen to the beacons. If the mobile station receives an indication of buffered packets, it may, for example, wake up and poll the packets from the access point. Further, in 802.11 embodiments, broadcast and/or multicast packets that an access point has buffered will be sent out when the Delivery Traffic Indication Message (DTIM) Count in the TIM element becomes zero. The DTIM count is expressed as a number of beacon intervals, and the DTIM count decrements by one in each beacon. A mobile station is also required to wake up for broadcast or multicast packets when the DTIM count becomes zero. The term “broadcast time” as used herein refers to a time at which a mobile station should be awake to receive broadcast or multi-cast packets. In some embodiments, mobile stations include a timer to cause interrupts at Target Beacon Transmission Times (TBTT) based on beacon interval.”).
- *See, e.g.,* 802.11-1999 at 52-53 (“7.3.1.6 Listen Interval field The Listen Interval field is used to indicate to the AP how often an STA wakes to listen to Beacon management frames. The value of this parameter is the STA’s Listen Interval parameter of the MLME-Associate.request primitive and is expressed in units of

Beacon Interval. The length of the Listen Interval field is 2 octets. The Listen Interval field is illustrated in Figure 29.”).

- *See, e.g., Ye at 1570-1571* (“B.2 Choosing and Maintaining Schedules
Before each node starts its periodic listen and sleep, it needs to choose a schedule and exchange it with its neighbors. Each node maintains a schedule table that stores the schedules of all its known neighbors. It follow the steps below to choose its schedule and establish its schedule table.
1. The node first listens for a certain amount of time. If it does not hear a schedule from another node, it randomly chooses a time to go to sleep and immediately broadcasts its schedule in a SYNC message, indicating that it will go to sleep after t seconds. We call such a node a synchronizer, since it chooses its schedule independently and other nodes will synchronize with it.
2. If the node receives a schedule from a neighbor before choosing its own schedule, it follows that schedule by setting its schedule to be the same. We call such a node a follower. It then waits for a random delay t_d and rebroadcasts this schedule, indicating that it will sleep in $t - t_d$ seconds. The random delay is for collision avoidance, so that multiple followers triggered from the same synchronizer do not systematically collide when rebroadcasting the schedule.
3. If a node receives a different schedule after it selects and broadcasts its own schedule, it adopts both schedules (i.e., it schedules itself to wake up at the times of both is neighbor and itself). It broadcasts it own schedule before going to sleep.”).
- *See, e.g., Abreu at 19:25-35* (“As can be seen from the foregoing, the present invention provides a method and apparatus for identifying a suitable base station from among a plurality of base stations transmitting beacons or control channels which are received by a radiotelephone handset The handset locates base stations 30 whose control channel signals are unsynchronized with and 2. A method as defined in claim 1 wherein the associated 25 location parameter comprises a bit count and a slot count lag another control channel signals. The handset enters a sleep mode to conserve battery power when no control channel signals are present. The invention allows the handset to synchronize to a base station having acceptable signal 35 strength. access rights identity and system capability.”)
- *See, e.g., Duong at 35* (“Whenever a handover trigger occurs, the MN starts the AP discovery process (box 1 in Figure 2) by cycling through the possible radio channels in search for a new, more suitable AP. The IEEE 802.11 standard [3] specifies two types of scanning, namely passive and active. In the passive scanning mode, the MN switches to a new channel, waits to receive beacons for a period of time $T_{channel}$, and then switches to the next channel. Normally, $T_{channel}$ is set slightly greater than twice the beacon interval (T_{beacon}) so that the MN can receive two beacons on a channel. After cycling through all available channels (possibly several times), the MN can select a new AP based on information gathered from the beacons (discussed below).”).

- *See, e.g.,* Kitchin at 4:63-5:29 (“Mobile unit 110 may detect the beacon transmitted by access point 122 in the alternate channel, channel B, at 220 since access point 122 transmitted the alternate channel and the offset time in channel A beacons. In one embodiment of the invention, mobile unit 110 may continually background monitor the alternate channel at the predetermined time as indicated by the offset time during a specified time window to determine whether access point 122 has switched to the alternate channel. In the event mobile unit 110 detects that access point has in fact switched to the alternate channel by detecting a beacon transmitted from access point 122 in the alternate, predetermined channel such as shown at 218, mobile unit 110 may likewise switch to the alternate channel, channel B, as shown at 222 to continue to communicate with access point 122 and complete a transition to channel B, although the scope of the invention is not limited in this respect. In an alternative embodiment, access point may preemptively transmit multiple alternate channels and optionally multiple associated offset times for the multiple alternate channels to accommodate a situation in which there may be a catastrophic interferer on one alternate channel simultaneous with a catastrophic interferer on the original channel. Mobile unit 110 may check each alternate channel until a beacon transmitted by access point 122 is detected on an alternate channel, and may optionally do so in an order preannounced by access point 122, although the scope of the invention is not limited in this respect. In one such embodiment, the time offset from a first channel to a subsequent channel may be constant valued between the channels, and in a further embodiment, the TBTT offset times for the alternate channels may be ordered according to a predetermined order of alternate channels where the predetermined order may be based on, for example, the signal quality on the alternate channels, although the scope of the invention is not limited in this respect.”).
- *See, e.g.,* Gilb at 41-42 (“The next-best power savings method is the DSPS mode. In this mode, the DEVs wake up periodically to listen to beacons. A beacon during which the DEV is in AWAKE state is referred to as a wake beacon. The time period between wake beacons is called the Wake Beacon Interval. The beacon number when the DEV will be awake is called the Next Wake Beacon. A group of DEVs that share the same Wake Beacon Interval and Next Wake Beacon is called a DSPS set. Multiple DEVs can join the same DSPS set, which allows them to be awake at the same time. Because an 802.15.3 communications link is peer-to-peer, it is important that both the source and destination are awake at the same time so that they can exchange frames. DSPS mode allows DEVs with similar application requirements to be asleep for long periods of time while maintaining synchronization of their wake beacons. Furthermore, the DEVs can allocate sub-rate channel time, i.e., channel time every N beacons, aligned with their wake beacons. The only requirement is that the sub-rate interval is greater than the Wake Beacon Interval so that the sleeping DEVs are not required to wake up more often than their normal wake cycle. Figure 3-6 shows the wake beacons and sub-rate allocation for a DSPS DEV that has a Wake Beacon Interval of 4

(i.e., it is awake every 4th beacon) and has sub-rate allocation every 8th beacon (i.e., its CTA rate factor is 8).”).

- *See, e.g.,* Lansford at 1668 (“The start of a superframe is marked by a connection point beacon (CPB) signal. The CPB is used for multiple purposes, including: 1) maintaining network synchronization; 2) controlling the format of the superframe; 3) managing the network during the contention-free period by indicating when each node should transmit and receive data. The CPB can include a list of active voice connections (and, therefore, slot assignments), retransmission slot assignments for the current superframe, connection status information, and paging information; and 4) providing power management services for isochronous and asynchronous nodes to maximize the battery life of portable devices (see Section IV-C). Slot assignment and synchronization information does not change on a per frame basis, so if a node misses a beacon it uses the information contained in the most recent valid beacon. All connection and paging status requests and information are repeated until the receiver acknowledges them.”).
- *See, e.g.,* Karaoguz at [0011] (“A radio receiver includes functionality for selectively powering down radio receiver elements in a manner that maximizes battery life. A control module of a radio receiver evaluates, on a radio receiver element-by-element basis, whether the element may be powered down, when it should be brought back up, and what type of power down mode should be utilized therefor. Accordingly, by considering the amount of time that is required to power down and power back up (power cycle time) the element in relation to the amount of available time to do so, the control module can selectively power down radio receiver elements to conserve power and battery life of the radio receiver. Additionally, in one embodiment of the invention, the control module not only considers whether there is enough time to power down an element and back up, but also whether the power consumed in doing so is less than the power saved during the period in which the element is powered down. Thus, the control element serves to intelligently manage power consumption on an element-by-element basis.”), [0039]-[0040] (“Accordingly, the present invention includes powering down specific radio receiver elements according to a plurality of factors, including power down time, power up time required, the duration of a power down period (and thus the relative power savings) in relation to additional power required to bring the radio receiver/transmitter element back into an operational state. The value of “t” represents the time between beacons, the time from CAP to the allocated time slot of the GTS, the time from the allocated time slot to the subsequent beacon, and the time from a beacon to the allocated time slot of the GTS. Thus, as may be seen, the timing of the allocated time slot with respect to each of the other portions of the signal is known. Accordingly, a controller operating according to the present invention may readily calculate an amount of time “t” until an allocated time slot arrives as a part of determining whether to place a specified radio receiver element in to a power down state or mode of operation. FIG. 4 is a timing diagram of a radio receiver operating in accordance with the present invention. As before, the beacons are separated by a specified period (“t”). Typical values for the specified period can range from

approximately ten milliseconds to approximately hundreds of milliseconds for some communication networks and protocols and by even greater values for other networks and protocols. FIG. 4 specifically illustrates that a power control module may determine to place a radio receiver element, or a plurality of radio receiver elements, in a power down mode of operation for a specified number of beacons (a specified amount of time). For example, according to one embodiment of the present invention, the power control module determines to place the at least one radio receiver element into a reduced power mode of operation for a period equal to ten beacons (hundreds to thousands of milliseconds).”), FIG. 4.

- *See, e.g.,* Yi at [0009]-[0010] (“It is an object of the present invention to save power during Wireless Local Area Network (WLAN) based voice communication, in which a wireless voice terminal effecting voice communication based on a WLAN without violating the IEEE 802.11 standard is efficiently switched between an active mode and a doze mode during the voice communication, thereby decreasing power consumption of the wireless voice terminal to improve communication time. In order to solve this object, according to one aspect of the present invention, an apparatus is provided comprising: at least one AP (Access Point) arranged to set and transmit a bit of a beacon message corresponding to a station for exchanging traffic, to register the station on a PS-polling list upon an acknowledgment of the beacon message being received, to assign a predetermined time slot to the station, and to transmit the traffic during the time slot, when at least one piece of traffic is to be exchanged for wireless voice communication; and at least one station adapted to be awakened into an active mode to parse the received beacon message, to calculate the assigned time slot when a bit of the station is set, and to awaken into the active mode during the time slot to exchange the at least one piece of traffic, when the beacon message has been received from the AP upon being in a doze mode.”), [0121]-[0143], FIG. 7.
- *See, e.g.,* Smith at 9:25-65 (“Based on the received beacon signal or GPR, a different access point may be selected, as seen at block 430. The mobile station is connected to the selected access point. Alternatively, access point selection may occur after creating or updating the site timing table, or at other appropriate points during the EPS. For example, the AP selection may occur upon completion of the EPS to allow for each AP to have an equal chance of being selected. With information received from the beacon signal or the GPR, entries within the site timing table may be updated, as seen at block 435. Entries in the site timing table, such as an access-point timestamp, a local station timestamp, a beacon interval or a GPR interval, are updated according to information received from the beacon signal or the GPR. The local station timestamp comprises local station timing information, which may include the time when the first byte of the beacon signal or the GPR frame was received. In some cases, entries within the site timing table will be added when the mobile station comes within the range of another access point. In other cases, site timing table entries will be removed when the mobile station goes out of range of an access point. The EPS schedule is generated with the updated information in the site timing table, including a channel number, a

local scan start time, and a maximum channel scan time for each site timing table entry in the site timing table, as seen at block 440. The local scan start time can be calculated, for example, from the access-point timestamp, the local station timestamp, and the beacon or GPR interval. The maximum channel scan time may be set differently for each channel, and may be dynamically adjusted while the EPS is performed in order to accommodate, for example, a constantly busy channel or an excessive amount of jitter in the actual beacon signal or GPR transmission time received over a given channel.”).

- *See, e.g.,* Hoang at [0023]-[0024] (“Since all nodes within a given piconet will transmit and receive on a particular channel within a frame, and since relay nodes must monitor the beacons of all the piconets it is spanning with only one radio, those beacons must occur at different times-preferably spaced far enough to allow sufficient channel switching time. Thus, relay nodes will listen to a first beacon from a first piconet on a first channel at a first period of time (start of first frame), and then switch to a second channel, listening for a second beacon from a second piconet, at a second time period (start of second frame). Thus, it follows that the meshing piconets must use the same superframe period and maintain beacon synchronization and spacing. On start up, each PNC scans the radio channels for pre-existing piconets and selects an unused channel for its piconet. If there is no unused channel, it then follows the child/neighbor piconet startup procedure as defined in IEEE 802.15.3. If there is no pre-existing piconet or no piconet which meshing is desired, the PNC sets up its own piconet in independent mode with a self-selected superframe size. Operation then continues as defined in 802.15.3 for a PNC. If there are one or more existing piconets & meshing is desired, the PNC selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. The PNC applies a fixed delay from the reference beacon to its own beacon in its own channel. One method of generating non-overlapping delays is to use the radio channel number to space the beacons within a superframe. For example, if the radio supports 8 channels, then the beacons are placed at $\frac{1}{8}$ superframe spacing, in order of channel 1, 2, to 8. The PNC monitors the reference beacon (requiring a switch to the reference’s radio channel and back) every superframe and follows the reference’s superframe size in case it changes. FIG. 4 shows a possible channel timing diagram for network 100 to permit maximum throughput over a multi-hop link between nodes 208 and 206, using node 207 as a relay node. Assuming the radio system supports 8 channels and piconets 201 and 202 use channel 1 and 3 respectively. The beacons will be placed at $\frac{1}{8}$ superframe intervals based on the channel number. Thus, the beacon for channel 3 will be placed at $\frac{1}{4}$ ($2 \times \frac{1}{8}$) superframe delay from channel 1’s beacon. The scheduling shown requires an average of 1 radio channel switch at every beacon spacing interval ($\frac{1}{8}$ superframe). Other channel time allocations are possible if the amount of channel switching should be minimized. Each channel is occupied only about half of the time for the multi-hop link. The remaining time, depicted as blank areas in the channel-specific (CH x) time line, is available for other traffic.”), [0028] (“FIG. 6 is a flow chart showing operation of node 500 when acting as a PNC. The logic flow begins at step 601 where logic circuitry 501 determines that node 500 is to become a PNC. This procedure is

defined in IEEE 802.15.3. At step 603 logic circuitry 501 determines if any other piconets are within range. This is accomplished by circuitry 501 instructing transceiver 505 to scan available channels to determine if any other piconet controllers' beacons are heard. If, at step 603 it is determined that no other piconets are heard, the logic flow continues to step 605 where standard IEEE 802.15.3 formation techniques are utilized to form a piconet. If, however, at step 603 it is determined that other piconets are heard, the logic flow continues to step 607 where logic circuitry 501 determines if any unused channels exist. If at step 607 it is determined that channels are not available, the logic flow returns to step 605 where the child/neighbor piconet startup procedure is executed as defined in IEEE 802.15.3. If, however, it is determined that channels are available, the logic flow continues to step 609 where logic circuitry 501 selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. A frequency of operation is chosen by logic circuitry 501 (step 611) and a fixed delay from the reference beacon is chosen (step 613) for beacon transmissions. As discussed above, the fixed delay is based on the frequency of operation with beacons being placed at $1/n$ superframe intervals (with n being the number of channels utilized by the system). Finally PNC operations begin at step 615.”), FIGs. 3, 6.

- *See, e.g.,* Tiedemann at 7:31-65 (“Transmitter slot signal generator 130 generates an active slot signal 129, which may interrupt processor 126 when processor 126 must provide messages 128, i.e., a short time before the active slot. Transmitter slot signal generator 130 may have a counter for maintaining a slot count. Alternatively, the count may be maintained by processor 126. Transmitter slot signal generator 130 synchronizes messages 128 to the system clock 138, which is generated by transmitter clock source 140. Pilot signal generator 136 generates pilot signal 134, which is also synchronized to system clock 138. Summer 142 adds pilot signal 134 to synchronized message signal 132 and provides the sum signal 144 to a paging channel transmitter 141. Paging channel transmitter 141 broadcasts the transmitted messages 143. In the mobile station receiver 122, paging channel receiver 146 receives transmitted messages 143. In the inactive mode, the power controller 147 may remove power from one or more components, such as receiver 146. Received message signal 150 is provided to receiver slot signal generator 152. In the inactive mode, receiver slot signal generator 152 maintains the slot count in synchronization with local clock signal 156, which is generated by receiver clock source 158. In the active mode, receiver slot signal generator 152 extracts the messages and pilot signal from received message signal 150 and provides synchronized messages 160 in synchronization with the pilot signal. Synchronized messages 160 are provided to processor 162. Processor 162 provides output signals 164 in response to the messages. Signals 164 alert the mobile station to the type of action it must perform. For example, the mobile station may activate a “traffic” channel for conducting subsequent voice communication in response to signals 164 that alert it to the presence of an incoming call.”), FIG. 3.

13. Channel Scanning

Scanning for activity on different channels than the channel being used for current communications, for example to identify other network nodes to communicate with, was well known at the time of the alleged invention(s) of the Asserted Patents.

- *See, e.g.*, 802.15.3 at 150 (“All DEVs shall use passive scanning to detect an active piconet. That is, DEVs shall be in receive mode for a period of time in a channel, as specified in the MLME-SCAN.request, to look for beacon frames from a PNC. If open scan is specified in the MLME-SCAN.request, the DEV searches for any beacon frame. If open scan is not specified, the DEV shall ignore all received frames not matching the PNID and BSID parameters contained in the request.”).
- *See, e.g.*, 802.15.4 at 14 (“The mechanisms used for starting and maintaining a PAN are described in 7.5.2. Channel scanning is used by a device to assess the current state of a channel (or channels), locate all beacons within its POS, or locate a particular beacon with which it has lost synchronization. Before starting a new PAN, the results of a channel scan can be used to select an appropriate logical channel and a PAN identifier that is not being used by any other PAN in the area. Because it is still possible for the POS of two PANs with the same PAN identifier to overlap, a procedure exists to detect and resolve this situation. Following a channel scan and suitable PAN identifier selection, an FFD can begin operating as the PAN coordinator. Also described in the subclause is a method to allow a beaconing FFD to discover other such devices during normal operations, i.e., when not scanning.”).
- *See, e.g.*, Bluetooth at 96 (“In the paging and inquiry procedures, the device access code (DAC) and the inquiry access code (IAC) are used, respectively. A unit in the page scan or inquiry scan substate correlates against these respective access codes with a matching correlator”).
- *See, e.g.*, HomeRF at 326-327 (“The procedures defined in this section are used by the MAC entity to find a HomeRF network. This section defines common scanning procedures used by the specific scanning procedures: scanning for a known network, and learning a NWID. ... To start the scan, the node shall set its Hop Pattern to ScanHopPattern and Hop Index to ScanHopIndex[]. These select the PHY channel. The scanning process involves listening on different PHY channels, for up to MaxNumScanChannels channels, and listening on each channel for ScanDurationPerChannel.[] ... The scan can be terminated if the specific scanning procedure so determines. If the scan has not been terminated, at the end of ScanDurationPerChannel on one channel, the MAC shall hop to the next channel defined by incrementing its HopIndex.”).
- *See, e.g.*, Liu '877 at 4:26:37 (“Mobile unit 110 at block 214 may then tune to an available channel in the preferred region, and may look for any IEEE 802.11 wireless network activity such as any traffic, including data packets or

management packets, for one or more available channels in the preferred region, and optionally until all available channels are scanned. For each channel, a determination may be made at block 216 whether any IEEE 802.11 activity or packets are detected, and if not, a determination may be made at block 220 whether a maximum waiting time has been reached. If a maximum waiting time has been reached, method 200 may continue at block 234 which is discussed, below.”), 5:11-16 (“A determination may be made at step 234 whether all channels have been scanned in a current, non-eliminated region. In the event not all channels have been scanned, mobile unit 110 may tune to another channel within a non-eliminated region at block 238, and method 200 may continue at block 216 on the next tuned channel. In the event all channels have been scanned, another scan cycle may be started at block 236 within the limited, or valid, regions, using a predetermined time interval, and method 200 may continue accordingly at block 216.”).

- See, e.g., 802.11-1999 at 126 (“11.1.3.1 Passive scanning If a ScanType is passive, the STA shall listen to each channel scanned for no longer than a maximum duration defined by the ChannelTime parameter. 11.1.3.2 Active scanning Active scanning involves the generation of Probe frames and the subsequent processing of received Probe Response frames. The details of the active scanning procedures are as specified in the following subclauses.”).
- See, e.g., Duong at 35-36 (“Whenever a handover trigger occurs, the MN starts the AP discovery process (box 1 in Figure 2) by cycling through the possible radio channels in search for a new, more suitable AP. The IEEE 802.11 standard [3] specifies two types of scanning, namely passive and active. In the passive scanning mode, the MN switches to a new channel, waits to receive beacons for a period of time $T_{channel}$, and then switches to the next channel. Normally, $T_{channel}$ is set slightly greater than twice the beacon interval (T_{beacon}) so that the MN can receive two beacons on a channel. After cycling through all available channels (possibly several times), the MN can select a new AP based on information gathered from the beacons (discussed below).”).
- See, e.g., Kitchin at 4:10-32 (“Referring now to FIG. 2, a timing diagram of dynamic frequency selection in a wireless LAN system in accordance with one embodiment of the invention will be discussed. As shown in FIG. 2, channel A beacon transmissions are shown at 210 and channel B beacon transmissions are shown at 212. While operating on channel A, access point 122 may determine an alternate channel to which it might switch if channel A becomes unsuitable, for example channel B. Access point 122 may transmit the alternate channel, channel B, to mobile unit 110 and an offset time, t_{oB} , in beacon transmissions 210 on channel A. Thus, in one embodiment of the invention, access point 122 may preemptively announce to mobile unit 110 a predetermined alternative channel to which access point 122 will switch prior to an actual catastrophic event, although the scope of the invention is not limited in this respect. Mobile unit 110 associated with access point 122 may perform background scanning of other channel for potential alternate access points. In addition, however, mobile unit 110 may check

the indicated alternate channel, channel B, at a time encompassing the indicated beacon offset, t_{oB} , such that if access point 122 switches to the alternate channel, channel B, due to a catastrophic interferer, mobile unit 110 may readily detect the switch.

- *See, e.g.,* Abreu at 10:50-60 (“If, while trying to reach a resolution for all entries in the candidate profile table 136, the handset 120 eliminates all entries from the candidate profile table 136, the handset 120 will increment to the next frequency and begin scanning for control channels. If the handset 120 has scanned all frequencies and eliminated all entries from the candidate profile table 136, the handset 120 will enter sleep mode. Once the sleep mode duration expires, the handset 120 will again try to find a suitable base station. The handset 120 will continue scanning until a suitable base station is found or the handset 120 is powered down.”).
- *See, e.g.,* Gilb at 43 (“The last power-save mode is piconet synchronized power save (PSPS) mode. The primary goal of PSPS mode is not power savings, but rather ensuring that DEVs are awake for system changes and announcements. The DEVs in PSPS mode wake up at a time specified in the PS Status IE for the PSPS set (i.e., set 1). However, unlike DSPS modes, the DEVs in PSPS mode are not allowed to specify the interval between wake beacons. Instead the PNC chooses this interval based on requests from the DEVs in PSPS mode. The beacon when DEVs in PSPS mode are required to be in AWAKE state is called the system wake beacon. Because there is only one PSPS set for the entire piconet, the sleep interval, and hence the power savings, is a compromise between the requests of the DEV and the PNC’s desire to change piconet parameters quickly. The PNC is allowed to change the interval between every system awake beacon. The PNC is prohibited from making major piconet changes until at least one system wake beacon has passed. This is intended to improve the chances that a DEV will hear the system changes before they happen. Of course, if any DEV misses the system change announcements, it will be able to recover from the changes by scanning for its piconet.”).
- *See, e.g.,* Lansford at 1666 (“When a SWAP-CA node is turned on, it immediately enters into a network discovery phase in which it tries to determine if another node or CP is present within its range and if a network already exists that it can join. The node accomplishes its discovery phase by operating in a passive scanning mode. In the passive scan mode, the node listens on every channel, ³ within its operational frequency band, for a specific amount of time, greater than a single superframe (see Section IV). “Listening” on a channel is accomplished by the physical layer, which forces the node to hop on a known scan pattern that is a good spread of the hopping patterns on all the channels of the network. During a scan, the node receives all network packets regardless of the NWID or destination address. These packets are analyzed by the node’s MAC management module, and a decision is made on whether or not to join the network. The scan can be terminated as soon as the first network is found or when the management module so determines. When a network is found, the node synchronizes to the network by

setting its hopping pattern to the discovered network's hopping pattern and by recording the network's NWID. The synchronization information is available on every data packet on the network and is used by the "joining" node to set its own parameters.").

- *See, e.g., Karaoguz at [0053]* ("In another embodiment of the present invention, and for other communication protocols (for example, Bluetooth), a radio receiver goes into a sleep mode of operation and occasionally "sniffs" for data (wakes up to communicate with the access point to download any queued data or messages). In one embodiment of the invention, a clear channel assessment is periodically made to determine whether a receiver or receiver element should be powered up. For a specific illustration, a low noise amplifier is powered up to determine, with a crude degree of approximation, whether a channel selected by a front end channel select filter detects that the specified channel includes data or transmissions thereon. If the possibility of such transmissions seems to exist, radio receiver elements are powered up to further facilitate determining whether the radio receiver should be brought up to a fully operational state. In one alternate embodiment, a received signal strength indicator (RSSI) is used to determine whether any powered down elements should be powered back on.").
- *See, e.g., Smith at 10:19-34* ("FIG. 5 shows a block diagram of an enhanced passive scanning system for a wireless local area network, in accordance with one embodiment of the present invention at 500. Enhanced passive scanning system 500 includes a mobile station 510. Mobile station 510 includes a controller 550, a transmitter/receiver 552, a pair of diversified antennas 554 a and 554 b, a memory 556, and a set of timers 558. Running computer program code stored in memory 556, controller 550 directs transmitter/receiver 552 to receive beacon signals and GPRs. A site timing table entry in a site timing table stored in memory 556 may be updated based on the received beacon signals or GPRs. A scan start time may be set and stored in a set of timers 558. Based on the scan start time, mobile station 510 may determine a power mode and enter into a low-power mode when sufficient time is available before receiving the next beacon signal or GPR."), FIG. 5; *see also Smith at 10:57-12:51, FIG. 6.*
- *See, e.g., Hoang at [0023]-[0024]* ("Since all nodes within a given piconet will transmit and receive on a particular channel within a frame, and since relay nodes must monitor the beacons of all the piconets it is spanning with only one radio, those beacons must occur at different times-preferably spaced far enough to allow sufficient channel switching time. Thus, relay nodes will listen to a first beacon from a first piconet on a first channel at a first period of time (start of first frame), and then switch to a second channel, listening for a second beacon from a second piconet, at a second time period (start of second frame). Thus, it follows that the meshing piconets must use the same superframe period and maintain beacon synchronization and spacing. On start up, each PNC scans the radio channels for pre-existing piconets and selects an unused channel for its piconet. If there is no unused channel, it then follows the child/neighbor piconet startup procedure as defined in IEEE 802.15.3. If there is no pre-existing piconet or no piconet which

meshing is desired, the PNC sets up its own piconet in independent mode with a self-selected superframe size. Operation then continues as defined in 802.15.3 for a PNC. If there are one or more existing piconets & meshing is desired, the PNC selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. The PNC applies a fixed delay from the reference beacon to its own beacon in its own channel. One method of generating non-overlapping delays is to use the radio channel number to space the beacons within a superframe. For example, if the radio supports 8 channels, then the beacons are placed at $\frac{1}{8}$ superframe spacing, in order of channel 1, 2, to 8. The PNC monitors the reference beacon (requiring a switch to the reference's radio channel and back) every superframe and follows the reference's superframe size in case it changes. FIG. 4 shows a possible channel timing diagram for network 100 to permit maximum throughput over a multi-hop link between nodes 208 and 206, using node 207 as a relay node. Assuming the radio system supports 8 channels and piconets 201 and 202 use channel 1 and 3 respectively. The beacons will be placed at $\frac{1}{8}$ superframe intervals based on the channel number. Thus, the beacon for channel 3 will be placed at $\frac{1}{4}$ ($2 \times \frac{1}{8}$) superframe delay from channel 1's beacon. The scheduling shown requires an average of 1 radio channel switch at every beacon spacing interval ($\frac{1}{8}$ superframe). Other channel time allocations are possible if the amount of channel switching should be minimized. Each channel is occupied only about half of the time for the multi-hop link. The remaining time, depicted as blank areas in the channel-specific (CH x) time line, is available for other traffic."), [0028] ("FIG. 6 is a flow chart showing operation of node 500 when acting as a PNC. The logic flow begins at step 601 where logic circuitry 501 determines that node 500 is to become a PNC. This procedure is defined in IEEE 802.15.3. At step 603 logic circuitry 501 determines if any other piconets are within range. This is accomplished by circuitry 501 instructing transceiver 505 to scan available channels to determine if any other piconet controllers' beacons are heard. If, at step 603 it is determined that no other piconets are heard, the logic flow continues to step 605 where standard IEEE 802.15.3 formation techniques are utilized to form a piconet. If, however, at step 603 it is determined that other piconets are heard, the logic flow continues to step 607 where logic circuitry 501 determines if any unused channels exist. If at step 607 it is determined that channels are not available, the logic flow returns to step 605 where the child/neighbor piconet startup procedure is executed as defined in IEEE 802.15.3. If, however, it is determined that channels are available, the logic flow continues to step 609 where logic circuitry 501 selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. A frequency of operation is chosen by logic circuitry 501 (step 611) and a fixed delay from the reference beacon is chosen (step 613) for beacon transmissions. As discussed above, the fixed delay is based on the frequency of operation with beacons being placed at $1/n$ superframe intervals (with n being the number of channels utilized by the system). Finally PNC operations begin at step 615."), FIGs. 3, 6.

14. Changing Channel Number If No Beacon Is Detected

Changing a channel number in response to, for example, failing to receive a beacon in a predetermined timeframe, including by increasing the channel number, was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense's apparent interpretation of the claims.

- *See, e.g.*, 802.15.3 at 168 (“If the beacons from the PNC are not received by the DEV for longer than the ATP, the DEV shall consider itself disassociated from the piconet and may try to associate again. The DEV notifies the DME that the ATP expired using the MLME-ATP-EXPIRED.ind primitive.”); 150-151 (“All DEVs shall use passive scanning to detect an active piconet. That is, DEVs shall be in receive mode for a period of time in a channel, as specified in the MLME-SCAN.request, to look for beacon frames from a PNC. If open scan is specified in the MLME-SCAN.request, the DEV searches for any beacon frame. If open scan is not specified, the DEV shall ignore all received frames not matching the PNID and BSID parameters contained in the request. In addition, the searching DEV shall collect statistics on each channel scanned and save them in the ChannelRatingList as described in 6.3.2. DEVs search for piconets by traversing through all the indexed channels indicated in the MLMESCAN. request. A DEV may search the channels in any order as long as all valid channels are contained in the search pattern. The result of a scan shall include information on any parent, child, as described in 8.2.5, or 802.15.3 neighbor, as described in 8.2.6, piconets that were detected. This provides a complete inventory of each channel.”).
- *See, e.g.*, 802.15.4 at 152 (“If the next higher layer receives repeated communications failures following its requests to transmit data, it may conclude that it has been orphaned. A single communications failure occurs when a device transaction fails to reach the coordinator, i.e., an acknowledgment is not received after aMaxFrameRetries attempts at sending the data. If the next higher layer concludes that it has been orphaned, it may instruct the MLME to either perform the orphaned device realignment procedure, or to reset the MAC sublayer and then perform the association procedure. If the decision has been made by the next higher layer to perform the orphaned device realignment procedure, it shall issue an MLME-SCAN.request with the ScanType parameter set to orphan scan and the ScanChannel parameter containing the list of channels to be scanned. Upon receiving this primitive, the MAC sublayer shall begin an orphan scan, as described in 7.5.2.1.4. If the orphan scan is successful (i.e., its PAN has been located), the device shall update its MAC PIB with the PAN information contained in the coordinator realignment command (see 7.3.2.5). If the orphan scan was unsuccessful, the next higher layer shall decide what further action needs be taken, e.g., to retry the orphan scan or attempt to reassociate.”), 104 (“If a device has not heard the beacon for aMaxLostBeacons consecutive superframes following an MLMESYNC. request primitive, either initially or during tracking, the MLME will issue this primitive with a loss reason of BEACON_LOST. If the

beacon was being tracked, the MLME will not attempt to track the beacon any further.”), 15 (“An orphan scan allows a device to attempt to relocate its coordinator following a loss of synchronization. During an orphan scan, the MAC sublayer shall discard all frames received over the PHY data service that are not coordinator realignment MAC command frames. An orphan scan over a specified set of logical channels is requested using the MLME-SCAN.request primitive with the ScanType parameter set to indicate an orphan scan. For each logical channel, the device shall first switch to the channel, by setting phyCurrentChannel accordingly, and then send an orphan notification command (see 7.3.2.3). The device shall then enable its receiver for at most aResponseWaitTime symbols. If the device successfully receives a coordinator realignment command (see 7.3.2.5) within this time, the device shall disable its receiver. If a coordinator receives the orphan notification command, it shall search its device list for the device sending the command. If the coordinator finds a record of the device, it shall send a coordinator realignment command to the orphaned device. The process of searching for the device and sending the coordinator realignment command shall occur within aResponseWaitTime symbols. The coordinator realignment command shall contain its current PAN identifier, macPANId, its current logical channel, and the short address of the orphaned device. If a coordinator finds no record of the device, it shall ignore the command and not send a coordinator realignment command. The orphan scan shall terminate when the device receives a coordinator realignment command or the specified set of logical channels has been scanned.”), 94 (“An orphan scan is used to locate the coordinator with which the scanning device had previously associated. The orphan scan is performed on each channel by the MLME first sending an orphan notification command (see 7.3.2.3). The MLME then enables its receiver for at most aResponseWaitTime symbols. If the device receives a coordinator realignment command within this time, the MLME will disable its receiver. Otherwise, the scan is repeated on the next channel in the channel list. The scan terminates when the device receives a coordinator realignment command (see 7.3.2.5) or when every channel in the set of available channels has been scanned.”).

- See, e.g., Bluetooth at 124 (“A connection may break down due to various reasons such as a device moving out of range or a power failure condition. Since this may happen without any prior warning, it is important to monitor the link on both the master and the slave side to avoid possible collisions when the AM_ADDR is reassigned to another slave. To be able to supervise link loss, both the master and the slave use link supervision timers, T supervision. Upon reception of a packet that passes the HEC check and has the correct AM_ADDR, the timer is reset. If at any time in connection state, the timer reaches the supervisionTO value, the connection is reset. The same timeout value is used for both SCO and ACL connections.”), 96 (“When a unit enters the page scan substate, it selects the scan frequency according to the page hopping sequence corresponding to this unit, see Section 11.3.1 on page 134. This is a 32-hop sequence (or a 16-hop sequence in case of a reduced-hop system) in which each hop frequency is unique. The page hopping sequence is determined by the unit’s Bluetooth device address (BD_ADDR). The phase in the sequence is determined by CLKN16-12 of the

unit's native clock (CLKN15-12 in case of a reduced-hop system); that is, every 1.28s a different frequency is selected.”), 126 (“The general block diagram of the hop selection scheme is shown in Figure 11.1 on page 127. The mapping from the input to a particular hop frequency is performed in the selection box. Basically, the input is the native clock and the current address. In CONNECTION state, the native clock (CLKN) is modified by an offset to equal the master clock (CLK). Only the 27 MSBs of the clock are used. In the page and inquiry substates, all 28 bits of the clock are used. However, in page substate the native clock will be modified to the master's estimate of the paged unit.”).

- *See e.g.*, HomeRF at 134 (“MM_LOST Primitive ... Indicates that the I-node has lost connectivity with the network. This indication occurs following a timeout on the receipt of CP beacons as defined in section 5.16.5 Transitions from the Managed Synchronization State.”), 434 (“Loss of Network Connectivity (Informative) ... The MAC layer can indicate that it has lost connectivity with the network by issuing an MM_LOST indication (see section 5.2.5.9 MM_LOST Primitive (I-node only)). ... The effect of this on the I-node is specific to the implementation. For example, the I-node may scan from time to time for known networks for a fixed period, and then to switch off.”).
- *See, e.g.*, Liu '877 at 4:26:37 (“Mobile unit 110 at block 214 may then tune to an available channel in the preferred region, and may look for any IEEE 802.11 wireless network activity such as any traffic, including data packets or management packets, for one or more available channels in the preferred region, and optionally until all available channels are scanned. For each channel, a determination may be made at block 216 whether any IEEE 802.11 activity or packets are detected, and if not, a determination may be made at block 220 whether a maximum waiting time has been reached. If a maximum waiting time has been reached, method 200 may continue at block 234 which is discussed, below.”), 5:11-16 (“A determination may be made at step 234 whether all channels have been scanned in a current, non-eliminated region. In the event not all channels have been scanned, mobile unit 110 may tune to another channel within a non-eliminated region at block 238, and method 200 may continue at block 216 on the next tuned channel. In the event all channels have been scanned, another scan cycle may be started at block 236 within the limited, or valid, regions, using a predetermined time interval, and method 200 may continue accordingly at block 216.”).
- *See, e.g.*, 802.11-1999 at 126 (“11.1.3.1 Passive scanning If a ScanType is passive, the STA shall listen to each channel scanned for no longer than a maximum duration defined by the ChannelTime parameter.”); 127 (“If PHYCCA.indication (busy) has not been detected before the ProbeTimer reaches MinChannel-Time, then clear NAV and scan the next channel, else when ProbeTimer reaches MaxChannelTime, process all received probe responses;”), 381.

- See, e.g., Duong at 35-36 (“Whenever a handover trigger occurs, the MN starts the AP discovery process (box 1 in Figure 2) by cycling through the possible radio channels in search for a new, more suitable AP. The IEEE 802.11 standard [3] specifies two types of scanning, namely passive and active. In the passive scanning mode, the MN switches to a new channel, waits to receive beacons for a period of time $T_{channel}$, and then switches to the next channel. Normally, $T_{channel}$ is set slightly greater than twice the beacon interval (T_{beacon}) so that the MN can receive two beacons on a channel. After cycling through all available channels (possibly several times), the MN can select a new AP based on information gathered from the beacons (discussed below).”).
- See, e.g., Kitchin at Abstract (“Briefly, in accordance with one embodiment of the invention, an access point may preemptively broadcast an alternate channel to switch to, along with an indication of the beacon timing for the alternate channel, prior to any catastrophic interference. The access point may switch to the alternate channel in the event of interference on the original channel without attempting to broadcast the alternate channel during the interference event. A mobile user may then know in advance of the interference event which alternate channel the access point switched to and may switch to the alternate channel.”).
- See, e.g., Abreu at 10:50-60 (“If, while trying to reach a resolution for all entries in the candidate profile table 136, the handset 120 eliminates all entries from the candidate profile table 136, the handset 120 will increment to the next frequency and begin scanning for control channels. If the handset 120 has scanned all frequencies and eliminated all entries from the candidate profile table 136, the handset 120 will enter sleep mode. Once the sleep mode duration expires, the handset 120 will again try to find a suitable base station. The handset 120 will continue scanning until a suitable base station is found or the handset 120 is powered down.”).
- See, e.g., Gilb at 43 (“The last power-save mode is piconet synchronized power save (PSPS) mode. The primary goal of PSPS mode is not power savings, but rather ensuring that DEVs are awake for system changes and announcements. The DEVs in PSPS mode wake up at a time specified in the PS Status IE for the PSPS set (i.e., set 1). However, unlike DSSS modes, the DEVs in PSPS mode are not allowed to specify the interval between wake beacons. Instead the PNC chooses this interval based on requests from the DEVs in PSPS mode. The beacon when DEVs in PSPS mode are required to be in AWAKE state is called the system wake beacon. Because there is only one PSPS set for the entire piconet, the sleep interval, and hence the power savings, is a compromise between the requests of the DEV and the PNC’s desire to change piconet parameters quickly. The PNC is allowed to change the interval between every system awake beacon. The PNC is prohibited from making major piconet changes until at least one system wake beacon has passed. This is intended to improve the chances that a DEV will hear the system changes before they happen. Of course, if any DEV misses the system change announcements, it will be able to recover from the changes by scanning for its piconet.”).

- *See, e.g.*, Lansford at 1666 (“When a SWAP-CA node is turned on, it immediately enters into a network discovery phase in which it tries to determine if another node or CP is present within its range and if a network already exists that it can join. The node accomplishes its discovery phase by operating in a passive scanning mode. In the passive scan mode, the node listens on every channel,³ within its operational frequency band, for a specific amount of time, greater than a single superframe (see Section IV). “Listening” on a channel is accomplished by the physical layer, which forces the node to hop on a known scan pattern that is a good spread of the hopping patterns on all the channels of the network. During a scan, the node receives all network packets regardless of the NWID or destination address. These packets are analyzed by the node’s MAC management module, and a decision is made on whether or not to join the network. The scan can be terminated as soon as the first network is found or when the management module so determines. When a network is found, the node synchronizes to the network by setting its hopping pattern to the discovered network’s hopping pattern and by recording the network’s NWID. The synchronization information is available on every data packet on the network and is used by the “joining” node to set its own parameters.”).
- *See, e.g.*, Karaoguz at [0053] (“In another embodiment of the present invention, and for other communication protocols (for example, Bluetooth), a radio receiver goes into a sleep mode of operation and occasionally “sniffs” for data (wakes up to communicate with the access point to download any queued data or messages). In one embodiment of the invention, a clear channel assessment is periodically made to determine whether a receiver or receiver element should be powered up. For a specific illustration, a low noise amplifier is powered up to determine, with a crude degree of approximation, whether a channel selected by a front end channel select filter detects that the specified channel includes data or transmissions thereon. If the possibility of such transmissions seems to exist, radio receiver elements are powered up to further facilitate determining whether the radio receiver should be brought up to a fully operational state. In one alternate embodiment, a received signal strength indicator (RSSI) is used to determine whether any powered down elements should be powered back on.”).
- *See, e.g.*, Smith at 10:19-34 (“FIG. 5 shows a block diagram of an enhanced passive scanning system for a wireless local area network, in accordance with one embodiment of the present invention at 500. Enhanced passive scanning system 500 includes a mobile station 510. Mobile station 510 includes a controller 550, a transmitter/receiver 552, a pair of diversified antennas 554 a and 554 b, a memory 556, and a set of timers 558. Running computer program code stored in memory 556, controller 550 directs transmitter/receiver 552 to receive beacon signals and GPRs. A site timing table entry in a site timing table stored in memory 556 may be updated based on the received beacon signals or GPRs. A scan start time may be set and stored in a set of timers 558. Based on the scan start time, mobile station 510 may determine a power mode and enter into a low-power mode when sufficient time is available before receiving the next beacon signal or GPR.”), FIG. 5; *see also* Smith at 8:33-36, 9:7-64, 10:57-12:51, FIGs. 4, 6.

- See, e.g., Hoang at [0023]-[0024] (“Since all nodes within a given piconet will transmit and receive on a particular channel within a frame, and since relay nodes must monitor the beacons of all the piconets it is spanning with only one radio, those beacons must occur at different times-preferably spaced far enough to allow sufficient channel switching time. Thus, relay nodes will listen to a first beacon from a first piconet on a first channel at a first period of time (start of first frame), and then switch to a second channel, listening for a second beacon from a second piconet, at a second time period (start of second frame). Thus, it follows that the meshing piconets must use the same superframe period and maintain beacon synchronization and spacing. On start up, each PNC scans the radio channels for pre-existing piconets and selects an unused channel for its piconet. If there is no unused channel, it then follows the child/neighbor piconet startup procedure as defined in IEEE 802.15.3. If there is no pre-existing piconet or no piconet which meshing is desired, the PNC sets up its own piconet in independent mode with a self-selected superframe size. Operation then continues as defined in 802.15.3 for a PNC. If there are one or more existing piconets & meshing is desired, the PNC selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. The PNC applies a fixed delay from the reference beacon to its own beacon in its own channel. One method of generating non-overlapping delays is to use the radio channel number to space the beacons within a superframe. For example, if the radio supports 8 channels, then the beacons are placed at $\frac{1}{8}$ superframe spacing, in order of channel 1, 2, to 8. The PNC monitors the reference beacon (requiring a switch to the reference’s radio channel and back) every superframe and follows the reference’s superframe size in case it changes. FIG. 4 shows a possible channel timing diagram for network 100 to permit maximum throughput over a multi-hop link between nodes 208 and 206, using node 207 as a relay node. Assuming the radio system supports 8 channels and piconets 201 and 202 use channel 1 and 3 respectively. The beacons will be placed at $\frac{1}{8}$ superframe intervals based on the channel number. Thus, the beacon for channel 3 will be placed at $\frac{1}{4}$ ($2 \times \frac{1}{8}$) superframe delay from channel 1’s beacon. The scheduling shown requires an average of 1 radio channel switch at every beacon spacing interval ($\frac{1}{8}$ superframe). Other channel time allocations are possible if the amount of channel switching should be minimized. Each channel is occupied only about half of the time for the multi-hop link. The remaining time, depicted as blank areas in the channel-specific (CH x) time line, is available for other traffic.”), [0028] (“FIG. 6 is a flow chart showing operation of node 500 when acting as a PNC. The logic flow begins at step 601 where logic circuitry 501 determines that node 500 is to become a PNC. This procedure is defined in IEEE 802.15.3. At step 603 logic circuitry 501 determines if any other piconets are within range. This is accomplished by circuitry 501 instructing transceiver 505 to scan available channels to determine if any other piconet controllers’ beacons are heard. If, at step 603 it is determined that no other piconets are heard, the logic flow continues to step 605 where standard IEEE 802.15.3 formation techniques are utilized to form a piconet. If, however, at step 603 it is determined that other piconets are heard, the logic flow continues to step 607 where logic circuitry 501 determines if any unused channels exist. If at step

607 it is determined that channels are not available, the logic flow returns to step 605 where the child/neighbor piconet startup procedure is executed as defined in IEEE 802.15.3. If, however, it is determined that channels are available, the logic flow continues to step 609 where logic circuitry 501 selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. A frequency of operation is chosen by logic circuitry 501 (step 611) and a fixed delay from the reference beacon is chosen (step 613) for beacon transmissions. As discussed above, the fixed delay is based on the frequency of operation with beacons being placed at $1/n$ superframe intervals (with n being the number of channels utilized by the system). Finally PNC operations begin at step 615.”), FIGs. 3, 6.

15. *Resetting Timers If No Beacon is Detected*

Resetting a timer, for example a timer used to determine when to sleep, if no beacon is detected was well known at the time of the alleged invention(s) of the Asserted Patents, at least under Proxense’s apparent interpretation of the claims.

- *See, e.g., 802.15.4 at 15* (“An orphan scan allows a device to attempt to relocate its coordinator following a loss of synchronization. During an orphan scan, the MAC sublayer shall discard all frames received over the PHY data service that are not coordinator realignment MAC command frames. An orphan scan over a specified set of logical channels is requested using the MLME-SCAN.request primitive with the ScanType parameter set to indicate an orphan scan. For each logical channel, the device shall first switch to the channel, by setting phyCurrentChannel accordingly, and then send an orphan notification command (see 7.3.2.3). The device shall then enable its receiver for at most aResponseWaitTime symbols. If the device successfully receives a coordinator realignment command (see 7.3.2.5) within this time, the device shall disable its receiver. If a coordinator receives the orphan notification command, it shall search its device list for the device sending the command. If the coordinator finds a record of the device, it shall send a coordinator realignment command to the orphaned device. The process of searching for the device and sending the coordinator realignment command shall occur within aResponseWaitTime symbols. The coordinator realignment command shall contain its current PAN identifier, macPANId, its current logical channel, and the short address of the orphaned device. If a coordinator finds no record of the device, it shall ignore the command and not send a coordinator realignment command. The orphan scan shall terminate when the device receives a coordinator realignment command or the specified set of logical channels has been scanned.”).
- *See, e.g., Bluetooth at 124* (“A connection may break down due to various reasons such as a device moving out of range or a power failure condition. Since this may happen without any prior warning, it is important to monitor the link on both the master and the slave side to avoid possible collisions when the AM_ADDR is

reassigned to another slave. To be able to supervise link loss, both the master and the slave use link supervision timers, T supervision. Upon reception of a packet that passes the HEC check and has the correct AM_ADDR, the timer is reset. If at any time in connection state, the timer reaches the supervisionTO value, the connection is reset. The same timeout value is used for both SCO and ACL connections.”), 96 (“When a unit enters the page scan substate, it selects the scan frequency according to the page hopping sequence corresponding to this unit, see Section 11.3.1 on page 134. This is a 32-hop sequence (or a 16-hop sequence in case of a reduced-hop system) in which each hop frequency is unique. The page hopping sequence is determined by the unit’s Bluetooth device address (BD_ADDR). The phase in the sequence is determined by CLKN16-12 of the unit’s native clock (CLKN15-12 in case of a reduced-hop system); that is, every 1.28s a different frequency is selected.”), 126 (“The general block diagram of the hop selection scheme is shown in Figure 11.1 on page 127. The mapping from the input to a particular hop frequency is performed in the selection box. Basically, the input is the native clock and the current address. In CONNECTION state, the native clock (CLKN) is modified by an offset to equal the master clock (CLK). Only the 27 MSBs of the clock are used. In the page and inquiry substates, all 28 bits of the clock are used. However, in page substate the native clock will be modified to the master’s estimate of the paged unit.”).

- *See e.g.,* HomeRF at 134 (“MM_LOST Primitive ... Indicates that the I-node has lost connectivity with the network. This indication occurs following a timeout on the receipt of CP beacons as defined in section 5.16.5 Transitions from the Managed Synchronization State.”), 434 (“Loss of Network Connectivity (Informative) ... The MAC layer can indicate that it has lost connectivity with the network by issuing an MM_LOST indication (see section 5.2.5.9 MM_LOST Primitive (I-node only)). ... The effect of this on the I-node is specific to the implementation. For example, the I-node may scan from time to time for known networks for a fixed period, and then to switch off.”).
- *See, e.g.,* Liu ’827 at Abstract (“A mobile station in an 802.11 wireless network dynamically adjusts a number of 802.11 beacon intervals to sleep based on a power savings level and a required wake-up time to receive packets from an access point. The power savings level is based on data traffic activity in a current period. The mobile station wakes up to receive a beacon, and if a beacon is not received, the mobile station sleeps for one additional beacon period.”).
- *See, e.g.,* 802.11-1999 at 126 (“11.1.3.1 Passive scanning If a ScanType is passive, the STA shall listen to each channel scanned for no longer than a maximum duration defined by the ChannelTime parameter.”).
- *See, e.g.,* Ye at 1569 (“The basic scheme is shown in Figure 1. Each node goes to sleep for some time, and then wakes up and listens to see if any other node wants to talk to it. During sleep, the node turns off its radio, and sets a timer to awake itself later.”).

- See, e.g., Duong at 34 (“In general, handover triggers are obtained from observations that the link with the current AP is deteriorating. These observations could include failed retransmissions of packets, missing beacons, or degradation of Signal-To-Noise Ratio (SNR) below a threshold. In addition, handover triggers may be based on service parameters other than link quality. Load-balancing between APs is an example. If the current AP is highly loaded, while another AP is serving a lighter load, then a handover to the lightly loaded AP may be triggered. Ideally, a combination of factors would be used to trigger a handover such that a satisfactory level of service is maintained in the network. In practice, there are various different implementations, but nearly all include at least some link quality factors in triggering handovers.”); 35 (“In the active scanning mode, the MN follows the above process of cycling through channels but instead of waiting for beacons, the MN sends a Probe Request frame and waits for a Probe Response from an AP. Once a Probe Request has been sent, the MN starts a timer, and if there is no activity on the channel within a given time ($T_{MinChannel}$), the MN switches to the next channel. If the channel has activity, the MN waits until time $T_{MaxChannel}$, processes all received Probe Response frames and then scans the next channel. The MN uses information collected during the scanning process to select a new AP.”).
- See, e.g., Tanach at 3:17-44 (“It should be noted that if the STA goes to sleep right when a frame is starting to be received, there is a probability of waking up in time to receive the retransmission given by: $P_{retrans-receive} = (64-16)/64 = 0.75$. There is also a probability that the first retransmission will not be received, but the second retransmission will be received, since the indication of CcaStatus on the missed frame can be used to reset AdvanceIdleTimer, viz: $P_{retrans-not-receive} = 0.25$.

To assist in calculating T_{idle} , additional considerations may be observed. For example, during sleep or idle time a unicast frame may be transmitted. Therefore, after waking up the device should stay awake at least until transmission of the next frame begins, so that CcaStatus is asserted. Designing for the worst case, a retransmission backoff of 64 slots may be assumed, and a time period equal to a function of a SIFS time, an ACK time, and a DIFS time may be added, as if the previous transmission ended right before wakeup occurs. Therefore, the “awake” time, or T_{idle} , may be calculated as:

$$T_{idle} = 10(SIFS) + 24(Ack) + 2 * 6(signal-ext) + 28(DIFS) + 64 * 9(SlotTime) = 650 \mu sec$$

In some embodiments, implementation may result in saving power when a medium is idle without resorting to use of an explicit IEEE 802.11 power saving mode. Further, some implementations may occur without real time involvement of firmware, such as when firmware is used to control the timing parameters and/or use of the various embodiments responsive to specific operational conditions.”).

- See, e.g., Abreu at 10:50-60 (“If, while trying to reach a resolution for all entries in the candidate profile table 136, the handset 120 eliminates all entries from the

candidate profile table 136, the handset 120 will increment to the next frequency and begin scanning for control channels. If the handset 120 has scanned all frequencies and eliminated all entries from the candidate profile table 136, the handset 120 will enter sleep mode. Once the sleep mode duration expires, the handset 120 will again try to find a suitable base station. The handset 120 will continue scanning until a suitable base station is found or the handset 120 is powered down.”).

- *See, e.g.,* Gilb at 124 (“When a DEV joins the PSPS set and switches to PSPS mode, it is required to listen to all system wake beacons, i.e., the wake beacons for PS set 1. If it misses receiving a system wake beacon, the DEV is required to continue to listen for beacons until it successfully receives a beacon. One reason for this is that if the DEV does receive a beacon, it will not know the beacon number of the next system wake beacon. A DSPS DEV, on the other hand, does not need to listen to subsequent beacons because it knows that the Wake Beacon Interval is fixed and so it can calculate the beacon number of the next DSPS wake beacon.”).
- *See, e.g.,* Lansford at 1671 (“For A-nodes, the behavior of the power management service depends on the type of packet being transmitted. Fig. 7 illustrates the process of sending broadcast messages to power-saving asynchronous nodes. The process is described with the help of an example in which two asynchronous nodes (Node A and Node B) send broadcast packets, and Node C, a power saving node, is a receiver of these packets: a) Node C powers up and receives a “dwells-to-wake-up” counter of three, which is broadcast in the CPB. The maximum value of the “dwells-to-broadcast” counter is a system design parameter that allows the designer to trade off latency, CP buffer size, and broadcast reliability against battery life. The CP maintains a countdown to the next dwell when power saving (PS) nodes would wake up. b) Node A transmits a broadcast message, which is received and stored by the CP. c) Node B transmits a broadcast message, which is received and stored by the CP. d) Node C wakes up when its dwells-to-wake-up counter reaches zero. It checks the CPB and sees an indication from the CP that packets are available for it and consequently stays powered up. e) The CP transmits the buffered broadcast messages during the dwell. f) Node C receives the broadcast messages and then goes back to sleep mode.”).
- *See, e.g.,* Karaoguz at [0051] (“A beacon is used, in one embodiment of the present invention, to inform a radio receiver of whether it has an allocated time slot with data. Thus, the radio receiver is able to determine whether to power an element down and when to power an element back up. Further, however, in an 802.15.3 device, the radio receiver communicates with an access point to advise it of a duration in which it will be operating in a sleep mode or powered down mode. Accordingly, the access point, upon receiving such an indication from a transmitter coupled to the radio receiver, can queue or buffer messages for the radio receiver until the expiration of the power down or sleep mode of operation.”).

- *See, e.g.,* Smith at 10:19-34 (“FIG. 5 shows a block diagram of an enhanced passive scanning system for a wireless local area network, in accordance with one embodiment of the present invention at 500. Enhanced passive scanning system 500 includes a mobile station 510. Mobile station 510 includes a controller 550, a transmitter/receiver 552, a pair of diversified antennas 554 a and 554 b, a memory 556, and a set of timers 558. Running computer program code stored in memory 556, controller 550 directs transmitter/receiver 552 to receive beacon signals and GPRs. A site timing table entry in a site timing table stored in memory 556 may be updated based on the received beacon signals or GPRs. A scan start time may be set and stored in a set of timers 558. Based on the scan start time, mobile station 510 may determine a power mode and enter into a low-power mode when sufficient time is available before receiving the next beacon signal or GPR.”), FIG. 5; *see also* Smith at 8:33-36, 9:7-64, 10:57-12:51, FIGs. 4, 6.
- *See, e.g.,* Hoang at [0023]-[0024] (“Since all nodes within a given piconet will transmit and receive on a particular channel within a frame, and since relay nodes must monitor the beacons of all the piconets it is spanning with only one radio, those beacons must occur at different times-preferably spaced far enough to allow sufficient channel switching time. Thus, relay nodes will listen to a first beacon from a first piconet on a first channel at a first period of time (start of first frame), and then switch to a second channel, listening for a second beacon from a second piconet, at a second time period (start of second frame). Thus, it follows that the meshing piconets must use the same superframe period and maintain beacon synchronization and spacing. On start up, each PNC scans the radio channels for pre-existing piconets and selects an unused channel for its piconet. If there is no unused channel, it then follows the child/neighbor piconet startup procedure as defined in IEEE 802.15.3. If there is no pre-existing piconet or no piconet which meshing is desired, the PNC sets up its own piconet in independent mode with a self-selected superframe size. Operation then continues as defined in 802.15.3 for a PNC. If there are one or more existing piconets & meshing is desired, the PNC selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. The PNC applies a fixed delay from the reference beacon to its own beacon in its own channel. One method of generating non-overlapping delays is to use the radio channel number to space the beacons within a superframe. For example, if the radio supports 8 channels, then the beacons are placed at $\frac{1}{8}$ superframe spacing, in order of channel 1, 2, to 8. The PNC monitors the reference beacon (requiring a switch to the reference’s radio channel and back) every superframe and follows the reference’s superframe size in case it changes. FIG. 4 shows a possible channel timing diagram for network 100 to permit maximum throughput over a multi-hop link between nodes 208 and 206, using node 207 as a relay node. Assuming the radio system supports 8 channels and piconets 201 and 202 use channel 1 and 3 respectively. The beacons will be placed at $\frac{1}{8}$ superframe intervals based on the channel number. Thus, the beacon for channel 3 will be placed at $\frac{1}{4}$ ($2 \times \frac{1}{8}$) superframe delay from channel 1’s beacon. The scheduling shown requires an average of 1 radio channel switch at every beacon spacing interval ($\frac{1}{8}$ superframe). Other channel time allocations

are possible if the amount of channel switching should be minimized. Each channel is occupied only about half of the time for the multi-hop link. The remaining time, depicted as blank areas in the channel-specific (CH x) time line, is available for other traffic.”), [0028] (“FIG. 6 is a flow chart showing operation of node 500 when acting as a PNC. The logic flow begins at step 601 where logic circuitry 501 determines that node 500 is to become a PNC. This procedure is defined in IEEE 802.15.3. At step 603 logic circuitry 501 determines if any other piconets are within range. This is accomplished by circuitry 501 instructing transceiver 505 to scan available channels to determine if any other piconet controllers' beacons are heard. If, at step 603 it is determined that no other piconets are heard, the logic flow continues to step 605 where standard IEEE 802.15.3 formation techniques are utilized to form a piconet. If, however, at step 603 it is determined that other piconets are heard, the logic flow continues to step 607 where logic circuitry 501 determines if any unused channels exist. If at step 607 it is determined that channels are not available, the logic flow returns to step 605 where the child/neighbor piconet startup procedure is executed as defined in IEEE 802.15.3. If, however, it is determined that channels are available, the logic flow continues to step 609 where logic circuitry 501 selects a reference piconet, monitors its beacon to get the superframe size and uses the same superframe size for its own piconet. A frequency of operation is chosen by logic circuitry 501 (step 611) and a fixed delay from the reference beacon is chosen (step 613) for beacon transmissions. As discussed above, the fixed delay is based on the frequency of operation with beacons being placed at 1/n superframe intervals (with n being the number of channels utilized by the system). Finally PNC operations begin at step 615.”), FIGs. 3, 6.

D. Anticipation and Obviousness Under 35 U.S.C. §§ 102 and 103

1. Disclosure of Invalidity Due to Anticipation

Subject to the reservation of rights above and based on Intel’s present understanding of the Asserted Claims and Proxense’s apparent interpretation of the Asserted Claims as applied in its Preliminary Infringement Contentions and Amended Preliminary Infringement Contentions, the prior art references identified in these contentions invalidate the Asserted Claims under 35 U.S.C. § 102, at least under Proxense’s apparent infringement theories. For each of its primary prior art references, Intel has provided a claim chart (Exhibits A1-A5 and B1-B5) to identify where the elements of the Asserted Claims can be found in these references, including at least under Proxense’s apparent infringement theories.

2. Disclosure of Invalidity Due to Obviousness

To the extent any claim is not anticipated, it is invalid as obvious under 35 U.S.C. § 103, at least under Proxense's apparent infringement theories. No Asserted Claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those of skill in the art. At least under Proxense's apparent infringement theories, the Asserted Claims are rendered obvious when considered in view of: (1) information known to persons of ordinary skill in the art at the time of the alleged invention; (2) any of the prior art references for which Intel has provided a claim chart; (3) any of the additional prior art identified in these contentions; and/or (4) statements in the intrinsic record of the Asserted Patents.

In the Appendix to these Preliminary Invalidity Contentions, Intel identifies certain references and combinations of references that, including at least under Proxense's apparent infringement theories, anticipate and/or render obvious one or more of the Asserted Claims. Where a single reference is identified with respect to a claim, that claim is invalid as anticipated and/or as obvious based on the reference alone and/or in combination with the knowledge of a person of ordinary skill in the art at the time of the alleged invention, at least under Proxense's apparent infringement theories. The identified combinations of references are provided in the alternative and are not to be construed to suggest that any reference included in the combinations does not itself render the claims anticipated or obvious.

Each of the references cited in these contentions is analogous art to the claimed invention of the Asserted Patents, including because: (1) each reference is from the same field of endeavor as the Asserted Patents' alleged invention (wireless communications), even if the reference addresses a different problem; and/or (2) each reference is reasonably pertinent to the alleged problem the Asserted Patents purport to address (coordinating network traffic and/or maintaining

a network connection during sleep periods), even if the reference is not in the same field of endeavor as the claimed invention. It therefore would have been obvious for someone of ordinary skill in the art to identify and combine elements from these references and devices.

The Supreme Court identified in *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), a number of rationales that would support a finding that the Asserted Claims are obvious:

- A. the claims combine prior art elements according to known methods to yield predictable results;
- B. the claims involve the simple substitution of one known element for another to obtain predictable results;
- C. the claims involve the use of a known technique to improve similar devices (methods, or products) in the same way;
- D. the claims apply a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- E. the claims involve combinations of prior art references that would have been “obvious to try”—*i.e.*, a person of ordinary skill in the art could have reached the Asserted Claims by choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and/or
- F. the claims are simply variations of work from one field of endeavor or a different one that would have been prompted based on design incentives or other market forces because the variations were predictable to one of ordinary skill in the art.

KSR, 550 U.S. at 414-18 (rejecting Federal Circuit’s “rigid” application of motivation-to-combine test, and instead espousing “expansive and flexible” approach); *see also* Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court

Decision in *KSR International Co. v. Teleflex Inc.*, 72 Fed. Reg. 57,526 (Oct. 10, 2007). The Supreme Court has also held that a person of ordinary skill in the art is “a person of ordinary creativity, not an automaton,” that a motivation to combine may be simply “common sense,” and that “familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle.” *KSR*, 550 U.S. at 420-21; *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197-98 (Fed. Cir. 2014) (“Our precedent ... does not require that the motivation be the best option, only that it be a suitable option from which the prior art did not teach away.”). The Supreme Court further held that it is sufficient that a combination of elements was “obvious to try,” holding that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *Id.* at 421.

The various elements of the Asserted Claims were well known in the prior art at the time of the alleged invention, and the use of these features in combination simply: (a) combines prior art elements according to known methods to yield predictable results; (b) involves the simple substitution of one known element for another to obtain predictable results; (c) involves the use of a known technique to improve similar devices (methods or products) in the same way; (d) applies a known technique to a known device, method, or product ready for improvement to yield predictable results; (e) involves combinations of prior art references that would have been “obvious to try”—*i.e.*, a person of ordinary skill in the art could have reached the Asserted Claims by choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and/or (f) would have been prompted by known work in the field of wireless networks based on design incentives or other market forces, because such variations

were predictable to one of ordinary skill in the art. *See Lincoln Engineering Co. v. Stewart-Warner Corp.*, 303 U. S. 545, 549 (1938) (“The mere aggregation of a number of old parts or elements which, in the aggregation, perform or produce no new or different function or operation than that theretofore performed or produced by them, is not patentable invention.”); *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 152 (1950) (“The conjunction or concert of known elements must contribute something; only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable. Elements may, of course, especially in chemistry or electronics, take on some new quality or function from being brought into concert, but this is not a usual result of uniting elements old in mechanics.”); *id.* at 152-53 (“Courts should scrutinize combination patent claims with a care proportioned to the difficulty and improbability of finding invention in an assembly of old elements. The function of a patent is to add to the sum of useful knowledge. Patents cannot be sustained when, on the contrary, their effect is to subtract from former resources freely available to skilled artisans. A patent for a combination which only unites old elements with no change in their respective functions, such as is presented here, obviously withdraws what already is known into the field of its monopoly and diminishes the resources available to skillful men. This patentee has added nothing to the total stock of knowledge, but has merely brought together segments of prior art and claims them in congregation as a monopoly.”)

3. *Motivations to Combine*

A patent claim may also be invalidated as obvious based on a teaching-suggestion-motivation rationale—*i.e.*, that some teaching, suggestion, or motivation would have led one of ordinary skill to modify the prior art reference teachings or to combine the teachings to arrive at the Asserted Patents’ alleged invention. Teachings, suggestions, motivations, and/or reasons to

modify or combine elements or disclosures can come from many sources, including the prior art (specific and as a whole), common knowledge, common sense, predictability, expectations, industry trends, design incentives or need, market demand or pressure, market forces, obviousness to try, the nature of the problem faced, and/or knowledge possessed by a person of ordinary skill.

Although not required under D.I. 18 or the Court's Standing Order Governing Proceedings (OGP) 4.4—Patent Cases, Intel below identifies certain exemplary motivations to combine various teachings in the prior art, at least under Proxense's apparent infringement theories. These examples are given to illustrate various motivations to combine and are not intended to provide motivations to combine for every reference cited in these contentions, or to identify an exhaustive set of every possible motivation to combine the references listed below. Intel reserves its right to identify additional motivations to combine and contends that the motivations described below apply to additional references. Intel also reserves the right to rely on any of the prior art products identified above in Section III.A. For example, Intel reserves the right to rely on any of the prior art products identified above in Section III.A combined with the teachings from prior art references identified below. As another example, Intel reserves the right to rely on any of the references below combined with the teachings of one or more of the prior art products identified above in Section III.A.

a) Motivation to Combine the Teachings of the Prior Art to Prioritize Time Slot Assignment Based on Classes of Users or Devices

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that assigns time slots with (2) the teachings of any of the cited prior art references that assigns time slots based on the class of user(s) or device(s), at least under Proxense's apparent interpretation of the claims.

As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, (each of which disclose, at least in one embodiment, assigning time slots to devices or groups of devices) with references such as 802.15.4, Livet, Kim, 802.11e, Ward, Turina, Rabenko, Odman, Lan, Brown, Ben-Eli, Huang, Gilb, Mansfield, and/or Lansford (which disclose assigning time slots based on the class of user(s) or device(s) at least under Proxense's apparent interpretation of the claims). Such a combination would render obvious, for example, limitations containing the phrases "assigning a first specific time slot for a first client device to wirelessly communicate with a fixed proximity-based reader device, the first specific time slot set according to a first class;" "assigning a second specific time slot for a second client device to wirelessly communicate with the fixed proximity-based reader device, the second specific time slot set according to a second class;" "wherein the first and second specific time slots are determined based on synchronization information wirelessly received by the first and second client devices and priority level data associated with the first class and with the second class;" "wherein the first class is associated with one or more of the first client device and a user of the first client device, and the second class is associated with one or more of the second client device and a user of the second client device;" "the time slot being determined according to a priority level data associated with a class, the class associated with the one or more of the portable client device and the user of the portable client device;" and "the time slot being determined according to priority level data associated with a class, the class associated with one or more of the portable client device and the user of the portable client device" in claims 1, 16, and 18 of the '129 patent; limitations containing the phrase "determining a first specified time slot based on synchronization information wirelessly

received by the first client device and priority level data associated with a first class,” “the first specific time slot reset based on synchronization information wirelessly received by the second client device and priority level data associated with a second class,” and “wherein the first class is associated with one or more of the first client device and a user of the first client device, and the second class is associated with one or more of the second client device and a user of the second client device” in claim 1 of the ’672 patent; and limitations containing the phrase “determining a first specified time slot based on synchronization information wirelessly received by the first portable client device and priority level data associated with a first class, wherein the first class is associated with one or more of the first portable client device and a user of the first portable client device” and “the first specific time slot to which the first portable client device is assigned to wirelessly communicate with a fixed location proximity reader based on the priority level data associated with the first class associated with one or more of the first portable client device and the user of the first portable client device” in claim 1 of the ’043 patent.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (coordinating network traffic and managing device power) in similar ways (based on information/data/classes of users or devices) to achieve similar purported benefits (e.g., giving users preferential treatment in particular types of networks). *See e.g.*, 802.15.4 at 159 (“A GTS shall be allocated before use, with the PAN coordinator deciding whether to allocate a GTS based on the requirements of the GTS request and the current available capacity in the superframe. GTSs shall be allocated on a first-come-first-served basis, and all GTSs shall be placed contiguously at the end of the superframe and after the CAP. Each GTS shall be deallocated when the GTS is no longer required, and a GTS can be deallocated at

any time at the discretion of the PAN coordinator or by the device that originally requested the GTS. A device that has been allocated a GTS may also operate in the CAP.”), Livet at 2:55-3:2 (“In a time-slotted communication system, a communication is transmitted over time slots. One or more time slots are designated to a particular user for either uplink or downlink communication. The system 100 of the present invention assigns one of a plurality of designations to time slots based upon the QoS of a user. In a preferred embodiment, the system 100 uses three designations: high QoS time slots, high capacity time slots, and balanced time slots. ... The priority scheme of the present invention may be used for either an uplink or a downlink channel.”); 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. The RRM function can use the admission control, congestion control, handover, user link maintenance and real time (RT) or non-real time (NRT) packet Switching algorithm as a basis for allocating time slots for a particular user. In one embodiment, a system receives a request for radio resources from a user. In response to the request, the system allocates a particular time slot to the user according to the user’s QoS information obtained from a core network. QoS criterion includes a status of user Subscription, nature of user application, information regarding geographic region where the user requests radio resource, or the like. The system controls initial allocation of radio resources to a particular user based on the category designation associated with the user. After initial allocation is established, the system constantly monitors the traffic conditions. If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 3:46-58 (“In a preferred embodiment of the present invention, users are classified into three classes: a high QoS

service subscriber, a high capacity service Subscriber, and a balanced service subscriber. It should be understood that this classification is merely for illustration of the preferred embodiment of the present invention, and any number or title may be used. With some exceptions, high QoS time slots are assigned to high QoS service Subscribers, balanced time slots are assigned to balanced service Subscribers, and high capacity time slots are assigned to high capacity service subscribers. The system 100 controls the initial allocation of radio resources to a particular user based on the status of the subscription of the user.”); Kim at 695 (“2.1 Service Differentiation by Contention Window Size All devices within the network are divided into multiple different priority classes by differentiating the contention window size in phase. A CW value is set to $CW[q]$ according to the priority of the device. Namely, the early stage of network forming phase, every sensor device is assigned with the different priority according to the importance of the function by differentiating the CW value. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If $q=0$, then $CW=CW[0]$ and it means the priority 0 class (high class), while for $q=1$ and 2, $CW=CW[1]$ and $CW=CW[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows.: $CW[0] < CW[1] < CW[2]$ Such a setting of the differentiated CW value within the 802.15.4 plays a similar role in AIFS differentiation depending on traffics within the 802.11e EDCF. 2.2 Service Differentiation by Backoff Exponent In the early stage of the network forming phase, every sensor device is assigned with the different priority according to the functional importance by differentiating the backoff exponent. A BE value is set to $BE[q]$ according to the functional importance of the device. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If $q=0$, then $BE=BE[0]$ and

it means the priority 0 class (high class), while for $q=1$ and 2 , $BE=BE[1]$ and $BE=BE[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows: $BE[0] < BE[1] < BE[2]$.”); 802.11e at 73 (“9.1.3.2 HCF controlled channel access (HCCA) The HCCA mechanism uses a QoS-aware centralized coordinator, called a *hybrid coordinator* (HC), and operates under rules that are different from the PC of the PCF. The HC is collocated with the QAP of the QBSS and uses the HC’s higher priority of access to the WM to initiate frame exchange sequences and to allocate TXOPs to itself and other QSTAs in order to provide limited-duration controlled access phase (CAP) for contention-free transfer of QoS data. The HC traffic delivery and TXOP allocation may be scheduled during the CP and any locally generated CFP (generated optionally by the HC) to meet the QoS requirements of a particular TC or TS. TXOP allocations and contention-free transfers of QoS traffic can be based on the HC’s QBSS-wide knowledge of the amounts of pending traffic belonging to different TS and/or TCs and are subject to QBSS-specific QoS policies.”); Ward at [0058] (“It is possible to offer a premium service, which may not be available for everyone but which may be made available to nervous small-scale traders who wish to take advantage of a stock-crash feature and for which they pay a small additional fee. Thus, if the value of a stock in an investor’s portfolio falls to less than, for example, half of what they paid for it, the scheduler allocates the next available time slot to that investor so that they may be informed of a market catastrophe with minimal latency, thus allowing the investor to sell the investment immediately.”); Turina at 6:37-55 (“FIG. 3 is a diagram that illustrates the downlink and uplink frames for packet transfers between a network and a VIP MS, in accordance with the preferred embodiment of the present invention. For the illustrative embodiment, a series of TDMA frames is shown with eight time slots per frame. For example, the GSM employs eight

time slots per TDMA frame. However, it should be understood that the invention is not intended to be limited to a certain number of time slots per frame. Any practical number of TDMA time slots per frame could be used. As shown, the downlink physical channels dedicated to the VIP MS are realized as dedicated time slots in each frame, which are reserved in the first place for the VIP MS. However, as discussed below, during idle periods between VIP packets, these reserved VIP MS time slots can be temporarily utilized for other traffic. Consequently, the network throughput is significantly improved over conventional systems, because the dedicated VIP MS physical channels can be accessed for packet data traffic to/from other mobile stations during idle periods.”); Rabenko at 6:64-7:5 (“The time slot allocations 92 defined by CM transmit opportunities 114 may optionally be defined, at least in part, on the basis of priorities established by the CMTS 1042 for different CMs 1046. For example, priorities may be established for individual CMs 1046 on the basis of an election made by the subscribers, which is typically dependent upon the type of service desired. Thus, a subscriber may elect to have either a premium (high priority) service or a regular (low priority) service.”); Odman at [0099]-[0100] (“Although the disclosed embodiment uses a plurality of GTS 640, a plurality of ATS 770, one uplink MTS 630 placed before the GTS 640, and one downlink MTS 650 placed after the ATS 770, the number, distribution, and placement of GTS 640, ATS 770, and MTS 630, 650 may be varied in alternate embodiments. In this embodiment the management time slots (MTS) are for management frames and high priority asynchronous data frames under 256 bytes, the guaranteed time slots (GTS) are for medium priority isochronous data, and the asynchronous time slots (ATS) are for asynchronous low priority data and high priority asynchronous data over 255 bytes.”); Lan at [0186] (“In a second embodiment, the basic operation of the present invention corresponding to the second object will be described. In a third embodiment, a method in which

a timeslot is assigned by a QoS (quality of service) request according to a traffic state at the time of packet transmission acceptance. In this embodiment, giving a higher priority to after-mentioned class 2 users, quality for the class 2 users is degraded in higher priority when congestion occurs.”), [0223] (“In the third embodiment, packet transmission is prioritized and timeslots are assigned by using the QoS request according to traffic state at the time of packet transmission acceptance.”); Brown at 14:21-40 (“As can be seen from the foregoing, the present invention provides a communication system and method for efficiently communicating both asynchronous data and isochronous data. An isochronous beacon is transmitted at the start of each frame by a base station to provide control information and timing for all stations in the communication system. In response to the beacon, isochronous data is communicated with mobile stations on designated isochronous time slots. Following the isochronous time slots, the remainder of the frame is used for communication of asynchronous data. This protocol permits flexibility, as the communication system is able to accommodate variable amounts of both isochronous data and asynchronous data. Additional isochronous time slots may be allocated if necessary to accommodate additional isochronous data channels. Similarly, the bandwidth allocated to asynchronous data may be maximized in the absence of isochronous data and tailored to the number of isochronous data channels required. Priority is given to communication of isochronous data, which is real-time data.”); Ben-Eli at Abstract (“Network resources such as in a wireless system may be allocated to user devices on the network based upon at least one or more minimum user requirements being satisfied. A user may be determined as satisfied when minimum requirements of rate and delay are reached or maintained. The network may optimize throughput on the network by allowing a maximum number of users on the network to be satisfied. Users may be ranked according to signal quality, and network resources may be

allocated to users according to rank to satisfy users until the resources of the network are allocated.”); Huang at 3932 (“(2) Priority Assignment: By using the above state diagram, the PAN coordinator can monitor the recent transmission behaviors of devices, and classify the devices into proper traffic types. However, with scarce GTS resources (i.e., 7 time-slots) of IEEE 802.15.4-based networks, the four-state classification for devices is somewhat rough and can not be sufficient for precisely classifying transmission behaviors of devices. Thus the state diagram in Figure 3 is further revised so that each device is dynamically assigned a priority number for GTS allocation. Upon the occurrence of GTS hit of a device, the priority number of the device is decreased by the PAN coordinator, and the priority of GTS allocation for the device upgrades. On the other hand, when GTS miss occurs to a device, the PAN coordinator increases the priority number of the device, and hence the opportunity for obtaining a GTS for the device reduces. Maintenance of priority numbers of devices depends on the transmission feedback as well as the traffic-level states of devices, and the details for maintaining priority numbers of devices are presented below.”); Gilb at 57 (“Although every CTA has a stream index, the source DEV may send data with any stream index during the CTA. If the DEV has higher priority traffic it needs to send to the destination, it can use any or all of the CTAs that it has allocated to the destination to send the data. This includes sending asynchronous data or commands to the destination DEV. In general, once the DEV has been given the CTA, it is allowed to use the time for any purpose.”); Lansford at 1668 (“The contention-free periods are divided into a number of pairs of fixed length slots, two per voice connection. The first slot in each pair is used to transmit voice data from the CP to a node (downlink), and the second is used to transmit voice data from a node to the CP (uplink). CFP2 at the end of the superframe is used for the initial transmission of the voice data, while CFP1 at the start of the superframe is used for the optional retransmission of

any voice packet that was not received or was incorrectly received in the previous dwell. Each voice packet transmitted by an I-node includes in the packet header a piggyback acknowledgment (ACK) of the last voice data message received by the node, i.e., in the up-link packet the voice node ACKs the downlink packet sent by the CP. This allows the CP to determine prior to a hop which voice data transmissions were lost, and determine whether or not retransmissions are required. Retransmissions are advertised in the beacon at the start of the next superframe; each voice data packet is retransmitted only once.”); Mansfield at 6:21-44 (“Referring specifically to FIG. 4, base station 102 informs user device 104 whether it is permitted to transmit in the next uplink time slot 210, e.g., by transmitting the uplink transmission schedule (represented by scheduling bits 214) to user device 104 at the beginning of each time slot 208. As illustrated, the scheduling bits 214 may be transmitted as part of the user data (as shown in FIG. 4, time slots 1 and 5) or as part of the low data rate maintenance link (as shown in FIG. 4, time slots 2-4). For purposes of illustration, the scheduling bits 214 that indicate that the user device 104 is not permitted to transmit during the next uplink time slot 210 are dark, and the scheduling bits 214 that indicate that the user device 104 is permitted to transmit during the next uplink time slot 210 are light. Thus, as can be seen, user device 104 transmits user data in the uplink time slot 3 only after the base station 102 transmits scheduling bits 214 in the downlink time slot 2 indicating that user device 104 is permitted to transmit during the next uplink time slot 210. Base station 102 is thus able to readily control the Quality of Service (QoS) offered to each user device 104 according to the user data throughput requirements of user device 104. Scheduling for downlink transmissions is trivial since base station 102 simply transmits according to its predetermined schedule.”).

A person of ordinary skill in the art would have been motivated to assign time slots based on the class of user(s) or device(s) because for some networks, it can be beneficial to provide specific users priority treatment. While preferred treatment of users or devices is not desirable in many networks (such as the networks used by the Intel products at issue), it may be useful in smaller, closed systems like those in certain implementations of 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, Mansfield, and/or Lan. It was known in these types of systems to group users in order to give preferred access. A person of ordinary skill in the art working within one of these types of systems would have understood that a network operator or protocol designer could use user and/or device-based priority to assign time slots to give certain users preferential treatment.

References such as 802.15.4, Livet, Kim, 802.11e, Ward, Turina, Rabenko, Odman, Lan, Brown, Ben-Eli, Huang, Gilb, Mansfield, and/or Lansford disclose the purported benefits of assigning time slots based on the class of user(s) or device(s) in these types of systems at least under Proxense's apparent interpretation of the claims, such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan. *See, e.g.*, Livet at 1:43-45 ("A method and system for more efficiently managing radio resources in a time-slotted communication system are desired."); Kim at 694 ("In this paper, we observe the data packets that are transmitted by the different devices which have different levels of importance in the sensor networks using in the home networking and the industrial application [3]. Considering the home networking, for the sensor devices performing the gate security system and the temperature sensor of the fire-warning facilities, the data packet losses for the sensor devices could be fatal. On the contrary, the data packet losses for the sensor devices which belong to TVs or refrigerators might be negligible. In addition, considering the

sensor devices belong to the production line in the industrial application, each device requires the different bandwidth in a network. If there are two lines producing 30 and 60 products per second, each device in each line requires the different processing rates and the bandwidths in a network. Obviously, devices which require the high bandwidths and produce the emergency data have to take the priorities prior to other devices.”); 802.11e at 8 (“When used to support applications with QoS requirements, each IEEE 802.11 LAN provides a link within an end-to-end QoS environment that may be established between, and managed by, higher layer entities. ... The IEEE 802.11 QoS facility provides MAC enhancements to support LAN applications with QoS requirements. ... The first mechanism, designated the enhanced distributed channel access (EDCA), delivers traffic based on differentiating user priorities (UPs).”), 9 (“This mechanism may be used for applications such as voice and video, which may need periodic service from the HC. If the application constraints dictate the use of this mechanism, the application initiates this mechanism by using the management service primitives.”), 10 (“IEEE 802.11 uses a shared medium and provides differentiated control of access to the medium to handle data transfers with QoS requirements. The QoS facility (per MSDU traffic class and TSPEC negotiation) allows an IEEE 802.11 LAN to become part of a larger network providing end-to-end QoS delivery or to function as an independent network providing transport on a per-link basis with specified QoS commitments.”); Ward at [0058] (“It is possible to offer a premium service, which may not be available for everyone but which may be made available to nervous small-scale traders who wish to take advantage of a stock-crash feature and for which they pay a small additional fee. Thus, if the value of a stock in an investor’s portfolio falls to less than, for example, half of what they paid for it, the scheduler allocates the next available time slot to that investor so that they may be informed of a market catastrophe with minimal latency, thus allowing the investor to sell the

investment immediately.”); Turina at 6:37-55 (“FIG. 3 is a diagram that illustrates the downlink and uplink frames for packet transfers between a network and a VIP MS, in accordance with the preferred embodiment of the present invention. For the illustrative embodiment, a series of TDMA frames is shown with eight time slots per frame. For example, the GSM employs eight time slots per TDMA frame. However, it should be understood that the invention is not intended to be limited to a certain number of time slots per frame. Any practical number of TDMA time slots per frame could be used. As shown, the downlink physical channels dedicated to the VIP MS are realized as dedicated time slots in each frame, which are reserved in the first place for the VIP MS. However, as discussed below, during idle periods between VIP packets, these reserved VIP MS time slots can be temporarily utilized for other traffic. Consequently, the network throughput is significantly improved over conventional systems, because the dedicated VIP MS physical channels can be accessed for packet data traffic to/from other mobile stations during idle periods.”); Rabenko at 6:64-7:5 (“The time slot allocations 92 defined by CM transmit opportunities 114 may optionally be defined, at least in part, on the basis of priorities established by the CMTS 1042 for different CMs 1046. For example, priorities may be established for individual CMs 1046 on the basis of an election made by the subscribers, which is typically dependent upon the type of service desired. Thus, a subscriber may elect to have either a premium (high priority) service or a regular (low priority) service.”); Odman at [0128] (“The IEEE 802 standard (e.g., the 802.1 and 802.15.3 protocols) offers eight possible priority codes, 0-7. In the preferred embodiment, seven of these codes are used. As shown in Table 1, the preferred embodiment used these priority codes to determine both the priority of the data, and the kind of delivery service the MAC layer 420 should use for the data frames it creates.”); Lan at [0270] (“As mentioned above, according to the present invention corresponding to the second

object, timeslots are allocated while allowing uplink/downlink conversion a plurality of times as requested instead of dividing timeslots into timeslots for uplink and timeslots for downlink as a conventional TDD system. Therefore, a timeslot assignment method can be realized in which timeslots can be allocated dynamically according to uplink/downlink traffic such that asymmetric traffic can be accommodates effectively.”), [0271] (“In addition, service quality is categorized to service classes in which desired quality for a high class user is satisfied maximally and a best effort service is provided for a low class user according to excess of resources. Therefore, a timeslot assignment method can be realized in which timeslot assignment is performed according to the service class and allowance of resources. In addition, efficiency of timeslot use and throughput are improved and high service quality is provided maximally.”); Brown at 14:21-40 (“As can be seen from the foregoing, the present invention provides a communication system and method for efficiently communicating both asynchronous data and isochronous data. An isochronous beacon is transmitted at the start of each frame by a base station to provide control information and timing for all stations in the communication system. In response to the beacon, isochronous data is communicated with mobile stations on designated isochronous time slots. Following the isochronous time slots, the remainder of the frame is used for communication of asynchronous data. This protocol permits flexibility, as the communication system is able to accommodate variable amounts of both isochronous data and asynchronous data. Additional isochronous time slots may be allocated if necessary to accommodate additional isochronous data channels. Similarly, the bandwidth allocated to asynchronous data may be maximized in the absence of isochronous data and tailored to the number of isochronous data channels required. Priority is given to communication of isochronous data, which is real-time data.”); Ben-Eli at 4:26-52 (“In one or more alternative embodiments of the invention, method

300 may be modified to provide other optional bases for allocating resources. For example, block 314 may be modified in one embodiment to rank users according to delay, or some variation of delay, for example users having a tighter delay constraint may be ranked higher than users having a less tight delay constraint. A user may be determined to be satisfied at block 316 in the event quality exceeds a predetermined threshold, although the scope of the present invention is not limited in this respect. In another embodiment, block 314 may be modified to rank users according to the delay and the quality. In yet another embodiment, block 314 may be modified to rank users according to a percentage of resources required to keep the user satisfied for the next N time slots, N being a parameter, although the scope of the present invention is not limited in this respect. In a further alternative embodiment, a velocity estimator per user may be provided by making a ranking of delay or quality and delay. In particular, a lower speed user may be given priority over a higher speed user in terms of channel quality, but not on delay. In such an embodiment, a higher speed user may have greater fluctuation in quality, and thus may not stay in a lower quality condition for long time periods, whereas a lower speed user may suffer from longer periods of lower quality, although the scope of the present invention is not limited in this respect.”); Huang at 3929-3930 (“In this paper, we propose an adaptive GTS allocation (AGA) scheme for IEEE 802.15.4 with the considerations of low-latency and fairness. There are two phases for the proposed scheme: In the classification phase, devices are assigned priorities in a dynamic fashion based on recent GTS usage feedbacks. Devices that need more attention from the coordinator are given higher priorities. In the GTS scheduling phase, GTSs are given to devices in a non-decreasing order of their priorities. A starvation-avoidance mechanism is presented to regain service attention for lower-priority devices that need more GTSs for data transmissions. The scheme is designed based on the existing IEEE 802.15.4 medium access

control (MAC) protocol without any modification. A simulation model validated by the developed mathematical analysis is presented to investigate average packet waiting times and fairness for our adaptive scheme. The capability of the proposed scheme is evaluated by a series of experiments. It is shown that the proposed scheme significantly outperforms the existing implementations with FCFS.”); Gilb at 57 (“Although every CTA has a stream index, the source DEV may send data with any stream index during the CTA. If the DEV has higher priority traffic it needs to send to the destination, it can use any or all of the CTAs that it has allocated to the destination to send the data. This includes sending asynchronous data or commands to the destination DEV. In general, once the DEV has been given the CTA, it is allowed to use the time for any purpose.”); Lansford at 1668 (“The contention-free periods are divided into a number of pairs of fixed length slots, two per voice connection. The first slot in each pair is used to transmit voice data from the CP to a node (downlink), and the second is used to transmit voice data from a node to the CP (uplink). CFP2 at the end of the superframe is used for the initial transmission of the voice data, while CFP1 at the start of the superframe is used for the optional retransmission of any voice packet that was not received or was incorrectly received in the previous dwell. Each voice packet transmitted by an I-node includes in the packet header a piggyback acknowledgment (ACK) of the last voice data message received by the node, i.e., in the up-link packet the voice node ACKs the downlink packet sent by the CP. This allows the CP to determine prior to a hop which voice data transmissions were lost, and determine whether or not retransmissions are required. Retransmissions are advertised in the beacon at the start of the next superframe; each voice data packet is retransmitted only once.”); Mansfield at Abstract (“A telecommunications system supports a variety of packet data services with throughputs ranging from low to high data rates. The system controls the user data transmission over a channel according to the user data throughput requirements of the application. By properly scheduling the time that particular

transmission takes place, high data rate applications may be supported without the need for code aggregation, and low rate users may be supported without the requirement of multiple spreading factors. Base stations may transmit scheduling information to user devices in downlink time slots and user devices may transmit status information to base stations in uplink time slots.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, relating to, in at least one embodiment, assigning time slots, with the teachings of references such as 802.15.4, Livet, Kim, 802.11e, Ward, Turina, Rabenko, Odman, Lan, Brown, Ben-Eli, Huang, Gilb, Mansfield, and/or Lanford. Combining the teachings of the prior art in this manner would merely apply a known technique (prioritizing time slot assignments) to a known device (a device using a time slotted protocol) to yield predictable results. The references use similar well-known components and techniques such that combining the references to assign time slots based on the class of user(s) or device(s) in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

b) Motivation to Combine the Teachings of the Prior Art to Determine/Assign Time Slot Assignment Using Bitmasks

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that assigns time slots, with (2) the teachings of any of the cited prior art references that determines and/or assigns time slots using bitmasks, at least under Proxense’s apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan (which disclose, at least in one

embodiment, assigning time slots to particular identified devices or groups of devices) with references such as Brawn, Marko, and/or Pallassini (which discloses identifying devices using bitmasks) to assign and determine time slots. Such a combination would render obvious, for example, limitations containing the phrases “the first and second specific time slots are determined based on synchronization information wirelessly received by the first and second client devices,” “a network device configured to wirelessly broadcast synchronization information,” “a portable client device configured to wirelessly receive the synchronization information, the received synchronization information comprising information assigning a specific time slot during which the client device can receive data from the network device,” “wirelessly broadcasting synchronization information to a portable client device, the synchronization information comprising information assigning a time slot during which the client device can receive data” in claims 1, 16, and 18 of the ’129 patent; limitations containing the phrases “determining a first specified time slot based on synchronization information wirelessly received by the first client device” and “the first specific time slot reset based on synchronization information wirelessly received by the second client device” in claim 1 of the ’672 patent; and limitations containing the phrase “determining a first specified time slot based on synchronization information wirelessly received by the first portable client device and priority level data associated with a first class” in claim 1 of the ’043 patent.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (coordinating network traffic) in similar ways (based on information communicated by a router, access point, base station, or other network coordinating node) to achieve similar purported benefits (assignment of network resources in specific types of

wireless systems). *See e.g.*, Brawn at [0028] (“FIG. 1A is an example of a bitmap network mask 100 in accordance with an embodiment of the present invention. In this example, the network parameter is an Internet Protocol address. The mask 100 comprises a starting address 102 of 16.3.15.58, a bitmap length 104 of 5 and a mask sequence 106 of entries with an entry size of one bit. The starting parameter, in this case, starting address 102 is an indexing parameter used in conjunction with another indexing parameter, the bitmap length 104 which in this example of one bit entries maps directly to the number of parameters covered in the range of the mask sequence 106, to locate a bit in the mask sequence 106 corresponding to a target address, hereafter referred to as the target bit. For example, a data packet from IP address 16.3.15.62 is received. In order to determine if an ACL allows data from this address, it is determined whether the bitmap mask 100 applies. In this example, the starting address 102 16.3.15.58 is subtracted from the target address 16.3.15.62 resulting in a difference of four (4). The bitmap length 104 of five (5) indicates that there are five (5) network addresses, 16.3.15.58, 16.3.15.59, 16.3.15.60, 16.3.15.61, and 16.3.15.62, in the range of this bitmap mask 100. The first bit 110 of the mask sequence 106 corresponds to the starting address 102 of 16.3.15.58, and each subsequent bit in the sequence corresponds to each subsequent address in the range. The difference of four indicates that the target address is in the range of the bitmap mask 100, and this difference is used to index the target bit 108 in the mask sequence 106. The first bit is treated as bit number 0, so bit number 4, the fifth bit in the sequence is the target bit 108. In this example, a “1” value indicates that the bitmap applies, and a “0” indicates that it does not apply. The target bit 108 is a “1” so data from this address is allowed access. This bitmap network mask 100 also applies to 16.3.15.58 and 16.3.15.61 as indicated by bit 0 and bit 3 of the mask sequence also having values of one.”); Marko at 6:65-7:15 (“Accordingly, the receiver mask delay circuit 404 is enabled by

the transceiver receive control signal RX CNTL and sets a delay according to the receiver mask delay value programmed by the base controller (not shown). If MUX 3 operation is selected as a low input to an OR gate 429, a low signal for the predetermined number of bits from the receiver mask delay circuit 404 will disable the AND gate 431 from providing the correct frame synchronization character to the sync detector 350 until the receiver mask delay circuit 404 has expired. The first AND gate 431 is then enabled by a high output signal from the receiver mask delay circuit 404 after the receiver mask expiration period to allow the limited data from the data detector 330 to be clocked into the frame synchronization detector 350. On subsequent frames where the received data is assumed valid, the control circuitry 400 will allow the receive detection circuit 300 to be enabled during the desired period of the particular submux.”);

Pallassini at 70-71 (“The underlying idea of the protocol is to schedule the transmissions of the nodes in order to have a data flow that converges from the furthest node toward the base station. In such a solution, when nodes one hop away from the base station get a transmission right, can send their information with the information coming from their children, thus reducing the number of transmissions needed to have all the data collected at the base station. Each step of the protocol implementation is described below: 1. The fusion center generates an empty reservation packet which consists of as many time slots as the number of nodes minus one. This assumption requires that the fusion center knows exactly the number of nodes N in the network. 2. Once the reservation packet is generated, the fusion center makes as many copies of it as the number of its branches. Then for each of its branches, it sends one copy of the packet with as many free slots as the number of its children in that branch and the other slots blocked. 3. At the lower level, the node receiving the reservation packet, assigns itself the last free time slot inside the free field assigned him by its father. Then it acts like the fusion center, i.e. it makes as many copies of the

received packet as the number of its branches and again reserves/blocks the remaining slots (inside the free field let available for him by its father) for its branches taking into account once again the number of children per each branch. 4. This procedure keeps going until the reservation packet reaches the leaf nodes. 5. Each leaf node finds available only one slot, reserved for it by its father in the reservation packet. This allows the leaf nodes to transmit before their parents. Therefore, the data flow begins to converge toward the base station.”).

Bit masks were a well-known technique for reducing the amount of data required to transmit information. For some networks, but not all, this can be important. For example, while large networks like those used by the Intel products at issue can handle large amounts of data and do not need to use bitmasks, smaller and lower power networks that cannot handle large amounts of data or would waste battery life doing so, may benefit from the use of bit masks. A person of ordinary skill in the art trying to assign time slots in one of these low data, low power systems would have known that bit masks could be used to reduce data and assign time slots in such circumstances.

References such as Brawn, Marko, and/or Pallassini disclose the purported benefits of identifying devices using bitmasks (e.g., for network routing or resource assignment purposes) in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan. *See, e.g.*, Brawn at [0003] (“[0003] A network masking scheme that can efficiently describe a collection of network parameters, in particular a random collection of network parameters, and which can be applied to many common network functions such as applying network access control lists (ACL), and network packet forwarding is highly desirable.”), [0053] (“These examples illustrate that a large number of ordinary masks (e.g. an ACL with dozens of entries) can be reduced to a single

bitmap network mask, thus, greatly simplifying ACL administration and operation.”); Marko at 6:36-48 (“A receive mask register in the receive mask delay circuit 404 is then programmed for a predetermined number of masking bits such as from 0 to 16 bits. This receiver mask delay value governs the number of bits to mask such that if a frame synchronization character is present in the current submux, it will not be detected by the frame sync detector 350 because some of the frame synchronization character bits will be masked and therefore will not be recognized. However, since the receive window is wide enough to accommodate up to two submuxes, if a frame synchronization character CHMP is present in a later occurring submux, it will be detected after the expiration of the mask delay.”); Pallassini at 71-72 (“Nodes are now scheduled in the way that ensures the minimal latency, that is the information converges from the furthest nodes toward the base station. This optimal solution is not unique, but there exist several possibilities to reach it. The relevant aspect is that at each level, children should transmit before their parents, so that the information can converge toward the fusion center.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, relating to, in at least one embodiment, assigning time slots, with the teachings of references such as Brawn, Marko, and/or Pallassini. Combining the teachings of the prior art in this manner would merely apply a known technique (identifying devices using bitmasks) to a known device (a device using a time slotted protocol) to yield predictable results. The references use similar well-known components and techniques such that combining the references to determine and/or assign time slots using bitmasks in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

c) Motivation to Combine the Teachings of the Prior Art to Reassign/Unassign Time Slots

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that assigns time slots, with (2) the teachings of any of the cited prior art references that reassigns and/or unassigns time slots, at least under Proxense's apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan (which disclose, at least in one embodiment, assigning time slots) with references such as 802.15.4, HomeRF, Livet, Kim, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb (which disclose reassigning and/or unassigning time slots). Such a combination would render obvious, for example, limitations containing the phrase "reassigning the first specific time slot for a second client device to wirelessly communicate with the fixed proximity-based reader device, the first specific time slot reset based on synchronization information wirelessly received by the second client device and priority level data associated with a second class" in claim 1 of the '672 patent; and limitations containing the phrase "unassigning, responsive to the change in the network traffic" in claim 1 of the '043 patent.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (coordinating network traffic) in similar ways (based on information known to a router, access point, base station, or other network coordinating node) to achieve similar purported benefits (assignment of network resources in specific types of wireless systems). *See e.g.*, 802.15.4 at 159 ("A GTS shall be allocated before use, with the PAN

coordinator deciding whether to allocate a GTS based on the requirements of the GTS request and the current available capacity in the superframe. GTSs shall be allocated on a first-come-first-served basis, and all GTSs shall be placed contiguously at the end of the superframe and after the CAP. Each GTS shall be deallocated when the GTS is no longer required, and a GTS can be deallocated at any time at the discretion of the PAN coordinator or by the device that originally requested the GTS. A device that has been allocated a GTS may also operate in the CAP.”), 17 (“7.5.7.5 GTS reallocation The deallocation of a GTS may result in the superframe becoming fragmented. For example, Figure 65 shows three stages of a superframe with allocated GTSs. In stage 1, three GTSs are allocated starting at slots 14, 10, and 8, respectively. If GTS 2 is now deallocated (stage 2), there will be a gap in the superframe during which nothing can happen. To solve this, GTS 3 will have to be shifted to fill the gap, thus increasing the size of the CAP (stage 3). ... The PAN coordinator shall ensure that any gaps occurring in the CFP, appearing due to the deallocation of a GTS, are removed to maximize the length of the CAP. When a GTS is deallocated by the PAN coordinator, it shall add a GTS descriptor into its beacon frame indicating that the GTS has been deallocated. If the deallocation is initiated by a device, the PAN coordinator shall not add a GTS descriptor into its beacon frame to indicate the deallocation. For each device with an allocated GTS having a starting slot lower than the GTS being deallocated, the PAN coordinator shall update the GTS with the new starting slot and add a GTS descriptor to its beacon corresponding to this adjusted GTS. The new starting slot is computed so that no space is left between this GTS and either the end of the CFP, if the GTS appears at the end of the CFP, or the start of the next GTS in the CFP. In situations where multiple reallocations occur at the same time, the PAN coordinator may choose to perform the reallocation in stages. The PAN coordinator shall keep each GTS descriptor in its beacon for

aGTSDescPersistenceTime superframes.”), FIG. 65; HomeRF at 370 (“When an existing connection is destroyed, the CP might need to adjust the main slot allocation in order to minimize the duration of the CFP and avoid holes in the TDMA frame. Only one main slot allocation can be changed at a time. CP does not delay this re-ordering, because until it has, CFP2 has a “hole” in it that may allow CSMA devices in other networks to jump in. ... To limit the number of nodes that have to move slots, the node allocated the earliest (highest-numbered) slot position in CFP2 is moved to the vacant position. If a connection to the highest-numbered main slot position is closed, no reallocation of main slots allocated to TDMA connections needs to be performed. ... The ICBS-channel is always allocated the highest-numbered main slot. Its position is adjusted when TDMA connections are created and destroyed. ... The Connection Point notifies the node of its new slots using the Main Slots field of the TDMA Beacon. On receipt of the Beacon the node starts using the new slot and will transmit up-link data in the new slot.”), FIG. 182; Livet at 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. The RRM function can use the admission control, congestion control, handover, user link maintenance and real time (RT) or non-real time (NRT) packet Switching algorithm as a basis for allocating time slots for a particular user. In one embodiment, a system receives a request for radio resources from a user. In response to the request, the system allocates a particular time slot to the user according to the user’s QoS information obtained from a core network. QoS criterion includes a status of user Subscription, nature of user application, information regarding geographic region where the user requests radio resource, or the like. The system controls initial allocation of radio resources to a particular user based on the category designation associated with the user. After initial allocation is established, the system constantly

monitors the traffic conditions. If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 3:46-58 (“In a preferred embodiment of the present invention, users are classified into three classes: a high QoS service subscriber, a high capacity service Subscriber, and a balanced service subscriber. It should be understood that this classification is merely for illustration of the preferred embodiment of the present invention, and any number or title may be used. With some exceptions, high QoS time slots are assigned to high QoS service Subscribers, balanced time slots are assigned to balanced service Subscribers, and high capacity time slots are assigned to high capacity service subscribers. The system 100 controls the initial allocation of radio resources to a particular user based on the status of the subscription of the user.”); Kim at 695 (“2.1 Service Differentiation by Contention Window Size All devices within the network are divided into multiple different priority classes by differentiating the contention window size in phase. A CW value is set to $CW[q]$ according to the priority of the device. Namely, the early stage of network forming phase, every sensor device is assigned with the different priority according to the importance of the function by differentiating the CW value. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If $q=0$, then $CW=CW[0]$ and it means the priority 0 class (high class), while for $q=1$ and 2, $CW=CW[1]$ and $CW=CW[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows.: $CW[0] < CW[1] < CW[2]$ Such a setting of the differentiated CW value within the 802.15.4 plays a similar role in AIFS differentiation depending on traffics within the 802.11e EDCF.”); 802.11-1999 at 88 (“The PC may terminate any CFP at or before the

aCFPMaxDuration, based on available traffic and size of the polling list. Because the transmission of any beacon may be delayed due to a medium busy condition at the nominal beacon transmission time, a CFP may be foreshortened by the amount of the delay. In the case of a busy medium due to DCF traffic, the beacon shall be delayed for the time required to complete the current DCF frame exchange. In cases where the beacon transmission is delayed, the CFPDurRemaining value in the beacon at the beginning of the CFP shall specify a time that causes the CFP to end no later than TBTT plus the value of aCFPMaxDuration. This is illustrated in Figure 61.”); 802.11e at 91 (“Non-AP QSTAs may send TXOP requests during polled TXOPs or EDCA TXOPs using the QoS Control field in the QoS data or QoS Null frame directed to the HC, with the TXOP Duration Requested or Queue Size subfield value and TID subfield value indicated to the HC. QAPs indicate whether they process TXOP request or queue size in the QoS Info field in the Beacon, Probe Response, and (Re)Association Response frames. QAPs shall process requests in at least one format. The QAP may reallocate TXOPs if the request belongs to TS or update the EDCA parameter set if the above request belongs to TC. Non-AP QSTAs shall use only the request format that the QAP indicates it can process.”), 188-189 (“If a new stream is admitted with a maximum SI smaller than the current SI, the scheduler needs to change the current SI to a smaller number than the maximum SI of the newly admitted stream. Therefore, the TXOP duration for the current admitted streams needs also to be recalculated with the new SI. If a stream is dropped, the scheduler might use the time available to resume contention. The scheduler might also choose to move the TXOPs for the QSTAs following the QSTA dropped to use the unused time. An example is shown in Figure K.3, when the stream for QSTA j is removed. However, this option might require the announcement of a new schedule to all QSTAs.”); Ward at [0048] (“When the step 53 detects that a priority request

has been received, a step 56 selects the address of the signalling transponder which made the priority request, for example by retrieving the relevant address from the memory 45 and supplying it to the scheduler 48. A step 57 effectively causes the base system to wait until the present time slot has been completed and then causes, in a step 58, the polling signal for the transponder which made the priority request to be inserted into the schedule so as to create a “new schedule” as shown in FIG. 6. For the four transponder or “Bat” system whose scheduling is illustrated in FIG. 1, it is assumed that Bat 3 has made the priority request. Thus, in the next available time slot, the location polling signal for Bat 3 is transmitted. The old schedule is therefore effectively interrupted in order to form location detection of Bat 3 as quickly as possible.”); Turina at 8:5-18 (“Notably, when a VIP MS (e.g., located in one cell) moves into a different cell, the MS can be granted the same exclusive resources. This grant can be made either in response to the MS renegotiating those resources in the new cell, or the same effect can be obtained from signalling within the network. For the latter case, during the handover from the one cell to the other (e.g., when the MS “presents” itself to the new cell), the cell update process can be performed by the MS, and if enough resources are available in the new cell, the network can automatically “transfer” or reallocate the VIP resources from the old cell. This automatic reallocation of resources can be accomplished, for example, using a special signalling procedure, such as the type used for a conventional handover.”); Odman at [0153] (“Regardless of the destination, after the frames are sent, the CTA needs to be deallocated for a given device. There are several possible schemes provided for deallocation.”), [0161] (“Using a fourth alternative, every allocation could last forever. In this case the requesting device is responsible for freeing the CTA when it no longer has any traffic. Under one preferred embodiment, every time the transmit controller 930 has a CTA for a certain destination device, and the asynchronous transmit

queue 920 reports that it has no frames for that destination device, the transmit controller 930 of the source device must send a CTA-free message using the destination device's address as the identifier."); Lan at [0187] ("In a fourth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of available timeslots decreases or increases during packet transmission. In addition, in the case that timeslots need to be deleted when the number of available timeslots is decreased, the quality for class 2 users is degraded in higher priority."), [0188] ("In a fifth embodiment, a method in which timeslots are assigned according to a QoS request in consideration of a traffic state at the time of packet transmission acceptance. The difference between the third embodiment and the fifth embodiment is as follows. In the third embodiment, quality for the class 2 users is degraded in higher priority when congestion occurs at the time of acceptance. On the other hand, in the fifth embodiment, excess timeslots which are assigned in excess of a minimum timeslot number or a desired timeslot number are deleted in higher priority."), [0189] ("In a sixth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of available timeslots decreases or increases during packet transmission. The difference between the fourth embodiment and the sixth embodiment is as follows. In the fourth embodiment, quality of class 2 users is degraded in higher priority when congestion occurs in transmission. On the other hand, in the sixth embodiment, excess timeslots which are assigned beyond a minimum timeslot number or a desired timeslot number are deleted in higher priority when congestion occurs in transmission."); Huang at 3931-3932 ("In original IEEE 802.15.4 specification [3], the devices intending to utilize GTSs for data transmission may wait for the expiration of GTSs (i.e., the allocated GTSs that have not been used for a specific period) of high-priority transmissions. This passively deallocation scheme for GTS resources

would result in starvation of light-traffic devices. Conversely, by using our AGA scheme, starvation of light-traffic devices can be avoided since these devices can be gradually promoted to the heavy-traffic state with the existing GTS-request facility to notify the PAN coordinator for traffic-level promotion.”); Gilb at 91 (“The PNC may also wish to terminate an asynchronous allocation. The PNC’s resources may have become overloaded, and so it is unable to handle the asynchronous allocation. If the destination DEV is disassociated from the piconet, either by its own request, by ATP timeout, or because the PNC requests it, the PNC may want to explicitly terminate the allocation and inform the source DEV. When the PNC wants to terminate an asynchronous allocation, it simply stops allocating the channel time and sends a channel time response command to the source DEV. The reason codes that the PNC might send when it terminates an asynchronous allocation include the following: • Target DEV unassociated • Target DEV not a member • Stream terminated by PNC.”); Mansfield at 7:35-63 (“Alternatively, each base station 102 may also determine the user data throughput requirement of each user device 104 by identifying the application used by user device 104. For example, a short bit stream or preamble code (not shown) that is unique to or identifies a particular application may be transmitted. In response, base stations 102 may allocate an associated average data transmission rate to user device 104. Alternatively, an application may result in the transmitted user data itself having certain features that may identify the application. Base station 102 optionally correlates or recognizes the characteristics, and thereby identifies the corresponding application. In another example, user device 104 may be associated with a particular application, so that when user device 104 attempts to communicate, base station 102 may recognize the fixed application for a particular user device 104 and, in response, allocate an associated average data transmission rate to user device 104. Alternatively, user device 104 may change applications and base station 102

could recognize when user device 104 changed applications, and thereby appropriately allocate an associated average data transmission rate. In all the examples, a significant point is that base station 102 may recognize the type of application a user device 104 desires to use from a data stream, subscriber identification feature, preamble or one of various other features, and in response, associate a particular data throughput. Base station 102 may also allocate average data transmission rates by considering the applications used by other user device 104 and reprioritize data throughputs accordingly.”).

In systems where speed and high throughput are not paramount, unassigning and reassigning time slots that had previously been allocated to one or more of a user and a device can save network resources and battery life. While unassigning and reassigning time slots is not desirable or feasible for many systems (like those used by the Intel products at issue) in which speed and high throughput are important, for smaller systems that are resource constrained and have few enough transmissions to be able to plan network traffic well into the future, this can be beneficial. Therefore, a person of ordinary skill in the art working with one of these low data, low power systems would have understood that reassigning and unassigning time slots could help to save resources.

References such as 802.15.4, HomeRF, 802.11e, 802.11-1999, Kim, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb disclose the purported benefits of reassigning and/or unassigning time slots in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, which can include ensuring that higher priority users are given sufficient resources. *See, e.g.*, 802.15.4 at 159 (describing filling “gaps” in superframe structure and avoiding “fragmentation”); HomeRF at 369 (“When a connection is destroyed, the CP may need

to re-order existing main slot allocations to avoid introducing a gap in the contention-free period. See also section Section [sic] 5.20.1.1 Connection Reordering (Informative).”); Livet at 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. ... If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 1:43-45 (“A method and system for more efficiently managing radio resources in a time-slotted communication system are desired.”); Kim at 694 (“In this paper, we observe the data packets that are transmitted by the different devices which have different levels of importance in the sensor networks using in the home networking and the industrial application [3]. Considering the home networking, for the sensor devices performing the gate security system and the temperature sensor of the fire-warning facilities, the data packet losses for the sensor devices could be fatal. On the contrary, the data packet losses for the sensor devices which belong to TVs or refrigerators might be negligible. In addition, considering the sensor devices belong to the production line in the industrial application, each device requires the different bandwidth in a network. If there are two lines producing 30 and 60 products per second, each device in each line requires the different processing rates and the bandwidths in a network. Obviously, devices which require the high bandwidths and produce the emergency data have to take the priorities prior to other devices.”); 802.11-1999 at 88 (“Because the transmission of any beacon may be delayed due to a medium busy condition at the nominal beacon transmission time, a CFP may be foreshortened by the amount of the delay. In the case of a busy medium due to DCF traffic, the beacon shall be delayed for the time required to complete the current DCF frame exchange.”); 802.11e at 91 (“Non-AP QSTAs may send TXOP requests during polled

TXOPs or EDCA TXOPs using If a stream is dropped, the scheduler might use the time available to resume contention. The scheduler might also choose to move the TXOPs for the QSTAs following the QSTA dropped to use the unused time.”); Ward at [0019] (“The sequence of time slots may be delayed by a time slot following the or each substantially immediate interrogation. As an alternative, the or each substantially immediate interrogation may replace interrogation of another of the devices which would have been interrogated in the absence of the signal from the one device.”), Turina at 8:5-18 (“Notably, when a VIP MS (e.g., located in one cell) moves into a different cell, the MS can be granted the same exclusive resources. This grant can be made either in response to the MS renegotiating those resources in the new cell, or the same effect can be obtained from signalling within the network. For the latter case, during the handover from the one cell to the other (e.g., when the MS “presents” itself to the new cell), the cell update process can be performed by the MS, and if enough resources are available in the new cell, the network can automatically “transfer” or reallocate the VIP resources from the old cell. This automatic reallocation of resources can be accomplished, for example, using a special signalling procedure, such as the type used for a conventional handover.”); Odman at [0153] (“Regardless of the destination, after the frames are sent, the CTA needs to be deallocated for a given device. There are several possible schemes provided for deallocation.”), [0162] (“This works well at the cost of increased traffic, since CTA freeing has to be done per destination device. The biggest cost is that transmit controller 930 must send a new frame for every CTA that is not needed. It cannot combine several free messages into one, since it must pull frames out of the queue individually for every CTA (one or more times) and free them as they are not needed. The transmit controller 930 cannot queue up requests since it’s strictly a real-time handler of the TDMA protocol that needs to process events as they occur. In other words, it

cannot use non-deterministic processing.”); Lan at [0270] (“As mentioned above, according to the present invention corresponding to the second object, timeslots are allocated while allowing uplink/downlink conversion a plurality of times as requested instead of dividing timeslots into timeslots for uplink and timeslots for downlink as a conventional TDD system. Therefore, a timeslot assignment method can be realized in which timeslots can be allocated dynamically according to uplink/downlink traffic such that asymmetric traffic can be accommodates effectively.”), [0271] (“In addition, service quality is categorized to service classes in which desired quality for a high class user is satisfied maximally and a best effort service is provided for a low class user according to excess of resources. Therefore, a timeslot assignment method can be realized in which timeslot assignment is performed according to the service class and allowance of resources. In addition, efficiency of timeslot use and throughput are improved and high service quality is provided maximally.”); Huang at 3929-3930 (“In this paper, we propose an adaptive GTS allocation (AGA) scheme for IEEE 802.15.4 with the considerations of low-latency and fairness. There are two phases for the proposed scheme: In the classification phase, devices are assigned priorities in a dynamic fashion based on recent GTS usage feedbacks. Devices that need more attention from the coordinator are given higher priorities. In the GTS scheduling phase, GTSs are given to devices in a non-decreasing order of their priorities. A starvation-avoidance mechanism is presented to regain service attention for lower-priority devices that need more GTSs for data transmissions. The scheme is designed based on the existing IEEE 802.15.4 medium access control (MAC) protocol without any modification. A simulation model validated by the developed mathematical analysis is presented to investigate average packet waiting times and fairness for our adaptive scheme. The capability of the proposed scheme is evaluated by a series of experiments. It is shown that the proposed scheme

significantly outperforms the existing implementations with FCFS.”); Gilb at 91 (“The PNC may also wish to terminate an asynchronous allocation. The PNC’s resources may have become overloaded, and so it is unable to handle the asynchronous allocation. If the destination DEV is disassociated from the piconet, either by its own request, by ATP timeout, or because the PNC requests it, the PNC may want to explicitly terminate the allocation and inform the source DEV. When the PNC wants to terminate an asynchronous allocation, it simply stops allocating the channel time and sends a channel time response command to the source DEV. The reason codes that the PNC might send when it terminates an asynchronous allocation include the following: • Target DEV unassociated • Target DEV not a member • Stream terminated by PNC.”); Mansfield at Abstract (“A telecommunications system supports a variety of packet data services with throughputs ranging from low to high data rates. The system controls the user data transmission over a channel according to the user data throughput requirements of the application. By properly scheduling the time that particular transmission takes place, high data rate applications may be supported without the need for code aggregation, and low rate users may be supported without the requirement of multiple spreading factors. Base stations may transmit scheduling information to user devices in downlink time slots and user devices may transmit status information to base stations in uplink time slots.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, relating to, in at least one embodiment, assigning time slots, with the teachings of references such as 802.15.4, HomeRF, Livet, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb. Combining the teachings of the prior art in this manner would merely apply a known technique (reassigning and/or unassigning time slots) to a known device (a device using a time slotted protocol) to yield predictable results. The

references use similar well-known components and techniques such that combining the references to unassign and/or reassign time slots in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

d) Motivation to Combine the Teachings of the Prior Art to Reassign Time Slots in Response to a Change in Network Traffic

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that assigns time slots, with (2) the teachings of any of the cited prior art references that reassigns time slots responsive to determining a change in network traffic, at least under Proxense's apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan (which disclose, at least in one embodiment, assigning time slots) with references such as 802.15.4, Livet, Kim, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb (which disclose reassigning responsive to determining a change in network traffic. Such a combination would render obvious, for example, limitations containing the phrase "reassigning the first specific time slot for a second client device to wirelessly communicate with the fixed proximity-based reader device, the first specific time slot reset based on synchronization information wirelessly received by the second client device and priority level data associated with a second class" in claim 1 of the '672 patent.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (coordinating network traffic) in similar ways (based on

information known to a router, access point, base station, or other network coordinating node) to achieve similar purported benefits (assignment of network resources in specific types of wireless systems). *See e.g.*, 802.15.4 at 159 (“A GTS shall be allocated before use, with the PAN coordinator deciding whether to allocate a GTS based on the requirements of the GTS request and the current available capacity in the superframe. GTSs shall be allocated on a first-come-first-served basis, and all GTSs shall be placed contiguously at the end of the superframe and after the CAP. Each GTS shall be deallocated when the GTS is no longer required, and a GTS can be deallocated at any time at the discretion of the PAN coordinator or by the device that originally requested the GTS. A device that has been allocated a GTS may also operate in the CAP.”), 17 (“7.5.7.5 GTS reallocation The deallocation of a GTS may result in the superframe becoming fragmented. For example, Figure 65 shows three stages of a superframe with allocated GTSs. In stage 1, three GTSs are allocated starting at slots 14, 10, and 8, respectively. If GTS 2 is now deallocated (stage 2), there will be a gap in the superframe during which nothing can happen. To solve this, GTS 3 will have to be shifted to fill the gap, thus increasing the size of the CAP (stage 3). ... The PAN coordinator shall ensure that any gaps occurring in the CFP, appearing due to the deallocation of a GTS, are removed to maximize the length of the CAP. When a GTS is deallocated by the PAN coordinator, it shall add a GTS descriptor into its beacon frame indicating that the GTS has been deallocated. If the deallocation is initiated by a device, the PAN coordinator shall not add a GTS descriptor into its beacon frame to indicate the deallocation. For each device with an allocated GTS having a starting slot lower than the GTS being deallocated, the PAN coordinator shall update the GTS with the new starting slot and add a GTS descriptor to its beacon corresponding to this adjusted GTS. The new starting slot is computed so that no space is left between this GTS and either the end of the CFP, if the GTS

appears at the end of the CFP, or the start of the next GTS in the CFP. In situations where multiple reallocations occur at the same time, the PAN coordinator may choose to perform the reallocation in stages. The PAN coordinator shall keep each GTS descriptor in its beacon for aGTSDescPersistenceTime superframes.”), FIG. 65; Livet at 2:39-54 (“The present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout. Hereafter, a base station includes but is not limited to a Node-B, site controller, access point or any other type of interfacing device in a wireless environment. FIG. 1 is a block diagram of a wireless communication system 100, wherein a plurality of WTRUs 105 communicate with base stations 110. The base stations 110 are controlled by a radio network controller (RNC) 115. The RNC 115 is connected to a core network 120. Either the RNC 115 or the base stations 110 include a means for sorting a plurality of time slots of a radio resources into a plurality of different categories, and a means for mapping a user to a particular designation of time slots based on QoS information of the user which is obtained from a core network 120, as described in more detail below.”); Kim at 695 (“2.1 Service Differentiation by Contention Window Size All devices within the network are divided into multiple different priority classes by differentiating the contention window size in phase. A CW value is set to $CW[q]$ according to the priority of the device. Namely, the early stage of network forming phase, every sensor device is assigned with the different priority according to the importance of the function by differentiating the CW value. For example, if three priority classes, high, middle, and low, are considered, q may take the values of 0, 1, or 2. If $q=0$, then $CW=CW[0]$ and it means the priority 0 class (high class), while for $q=1$ and 2, $CW=CW[1]$ and $CW=CW[2]$ mean the priority 1 class (middle class) and the priority 2 class (low class) respectively. To guarantee the priority, the relation among the three values has to be as follows.: $CW[0] < CW[1] < CW[2]$ Such a setting of

the differentiated CW value within the 802.15.4 plays a similar role in AIFS differentiation depending on traffics within the 802.11e EDCF.”); 802.11-1999 at 88 (“The PC may terminate any CFP at or before the aCFPMaxDuration, based on available traffic and size of the polling list. Because the transmission of any beacon may be delayed due to a medium busy condition at the nominal beacon transmission time, a CFP may be foreshortened by the amount of the delay. In the case of a busy medium due to DCF traffic, the beacon shall be delayed for the time required to complete the current DCF frame exchange. In cases where the beacon transmission is delayed, the CFPDurRemaining value in the beacon at the beginning of the CFP shall specify a time that causes the CFP to end no later than TBTT plus the value of aCFPMaxDuration. This is illustrated in Figure 61.”); 802.11e at 91 (“Non-AP QSTAs may send TXOP requests during polled TXOPs or EDCA TXOPs using the QoS Control field in the QoS data or QoS Null frame directed to the HC, with the TXOP Duration Requested or Queue Size subfield value and TID subfield value indicated to the HC. QAPs indicate whether they process TXOP request or queue size in the QoS Info field in the Beacon, Probe Response, and (Re)Association Response frames. QAPs shall process requests in at least one format. The QAP may reallocate TXOPs if the request belongs to TS or update the EDCA parameter set if the above request belongs to TC. Non-AP QSTAs shall use only the request format that the QAP indicates it can process.”), 188-189 (“If a new stream is admitted with a maximum SI smaller than the current SI, the scheduler needs to change the current SI to a smaller number than the maximum SI of the newly admitted stream. Therefore, the TXOP duration for the current admitted streams needs also to be recalculated with the new SI. If a stream is dropped, the scheduler might use the time available to resume contention. The scheduler might also choose to move the TXOPs for the QSTAs following the QSTA dropped to use the unused time. An example is shown in Figure K.3, when

the stream for QSTA j is removed. However, this option might require the announcement of a new schedule to all QSTAs.”); Ward at [0048] (“When the step 53 detects that a priority request has been received, a step 56 selects the address of the signalling transponder which made the priority request, for example by retrieving the relevant address from the memory 45 and supplying it to the scheduler 48. A step 57 effectively causes the base system to wait until the present time slot has been completed and then causes, in a step 58, the polling signal for the transponder which made the priority request to be inserted into the schedule so as to create a “new schedule” as shown in FIG. 6. For the four transponder or “Bat” system whose scheduling is illustrated in FIG. 1, it is assumed that Bat 3 has made the priority request. Thus, in the next available time slot, the location polling signal for Bat 3 is transmitted. The old schedule is therefore effectively interrupted in order to form location detection of Bat 3 as quickly as possible.”); Turina at 8:5-18 (“Notably, when a VIP MS (e.g., located in one cell) moves into a different cell, the MS can be granted the same exclusive resources. This grant can be made either in response to the MS renegotiating those resources in the new cell, or the same effect can be obtained from signalling within the network. For the latter case, during the handover from the one cell to the other (e.g., when the MS “presents” itself to the new cell), the cell update process can be performed by the MS, and if enough resources are available in the new cell, the network can automatically “transfer” or reallocate the VIP resources from the old cell. This automatic reallocation of resources can be accomplished, for example, using a special signalling procedure, such as the type used for a conventional handover.”); Odman at [0153] (“Regardless of the destination, after the frames are sent, the CTA needs to be deallocated for a given device. There are several possible schemes provided for deallocation.”), [0161] (“Using a fourth alternative, every allocation could last forever. In this case the requesting device is responsible for freeing

the CTA when it no longer has any traffic. Under one preferred embodiment, every time the transmit controller 930 has a CTA for a certain destination device, and the asynchronous transmit queue 920 reports that it has no frames for that destination device, the transmit controller 930 of the source device must send a CTA-free message using the destination device's address as the identifier.”), [0162] (“This works well at the cost of increased traffic, since CTA freeing has to be done per destination device. The biggest cost is that transmit controller 930 must send a new frame for every CTA that is not needed. It cannot combine several free messages into one, since it must pull frames out of the queue individually for every CTA (one or more times) and free them as they are not needed. The transmit controller 930 cannot queue up requests since it's strictly a real-time handler of the TDMA protocol that needs to process events as they occur. In other words, it cannot use non-deterministic processing.”); Lan at [0187] (“In a fourth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of available timeslots decreases or increases during packet transmission. In addition, in the case that timeslots need to be deleted when the number of available timeslots is decreased, the quality for class 2 users is degraded in higher priority.”), [0188] (“In a fifth embodiment, a method in which timeslots are assigned according to a QoS request in consideration of a traffic state at the time of packet transmission acceptance. The difference between the third embodiment and the fifth embodiment is as follows. In the third embodiment, quality for the class 2 users is degraded in higher priority when congestion occurs at the time of acceptance. On the other hand, in the fifth embodiment, excess timeslots which are assigned in excess of a minimum timeslot number or a desired timeslot number are deleted in higher priority.”), [0189] (“In a sixth embodiment, a method is described in which the number of timeslots is changed according to a service class and the QoS request when the number of

available timeslots decreases or increases during packet transmission. The difference between the fourth embodiment and the sixth embodiment is as follows. In the fourth embodiment, quality of class 2 users is degraded in higher priority when congestion occurs in transmission. On the other hand, in the sixth embodiment, excess timeslots which are assigned beyond a minimum timeslot number or a desired timeslot number are deleted in higher priority when congestion occurs in transmission.”); Huang at 3931-3932 (“In original IEEE 802.15.4 specification [3], the devices intending to utilize GTSs for data transmission may wait for the expiration of GTSs (i.e., the allocated GTSs that have not been used for a specific period) of high-priority transmissions. This passively deallocation scheme for GTS resources would result in starvation of light-traffic devices. Conversely, by using our AGA scheme, starvation of light-traffic devices can be avoided since these devices can be gradually promoted to the heavy-traffic state with the existing GTS-request facility to notify the PAN coordinator for traffic-level promotion.”); Gilb at 91 (“The PNC may also wish to terminate an asynchronous allocation. The PNC’s resources may have become overloaded, and so it is unable to handle the asynchronous allocation. If the destination DEV is disassociated from the piconet, either by its own request, by ATP timeout, or because the PNC requests it, the PNC may want to explicitly terminate the allocation and inform the source DEV. When the PNC wants to terminate an asynchronous allocation, it simply stops allocating the channel time and sends a channel time response command to the source DEV. The reason codes that the PNC might send when it terminates an asynchronous allocation include the following: • Target DEV unassociated • Target DEV not a member • Stream terminated by PNC.”); Mansfield at 7:35-63 (“Alternatively, each base station 102 may also determine the user data throughput requirement of each user device 104 by identifying the application used by user device 104. For example, a short bit stream or preamble code (not shown) that is unique to or

identifies a particular application may be transmitted. In response, base stations 102 may allocate an associated average data transmission rate to user device 104. Alternatively, an application may result in the transmitted user data itself having certain features that may identify the application. Base station 102 optionally correlates or recognizes the characteristics, and thereby identifies the corresponding application. In another example, user device 104 may be associated with a particular application, so that when user device 104 attempts to communicate, base station 102 may recognize the fixed application for a particular user device 104 and, in response, allocate an associated average data transmission rate to user device 104. Alternatively, user device 104 may change applications and base station 102 could recognize when user device 104 changed applications, and thereby appropriately allocate an associated average data transmission rate. In all the examples, a significant point is that base station 102 may recognize the type of application a user device 104 desires to use from a data stream, subscriber identification feature, preamble or one of various other features, and in response, associate a particular data throughput. Base station 102 may also allocate average data transmission rates by considering the applications used by other user device 104 and reprioritize data throughputs accordingly.”).

In a system where time or high data rates are not critical, reassigning network resources based on changes in network traffic can save resources. This is not desirable or feasible for many systems (like those used by the Intel products at issue) that handle many transmissions and change constantly—it would not be realistic to try to use traffic to reassign time slots. However, for smaller systems that are operate with lower power and less data, it can be beneficial to specifically reassign time slots based on changes in network traffic. Therefore, a person of ordinary skill in the art working with one of these systems would have understood that time slots could be reassigned based on network traffic to save resources in a low power, low data system.

References such as 802.15.4, Livet, Kim, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb disclose the purported benefits of reassigning time slots responsive to determining a change in network traffic in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, which can include, for example, adjusting resource allocations based on traffic congestion, ensuring that higher priority users are given sufficient resources, and allocating time slots that would not be used otherwise due to a device leaving the network. *See, e.g.*, 802.15.4 at 159 (describing filling “gaps” in superframe structure and avoiding “fragmentation” when users leave the network); Livet at 1:63-2:18 (“A Radio Resource Management (RRM) function assigns the appropriate designation to a number of time slots based on statistical information of traffic patterns. ... If the system detects traffic congestion at time slots having a higher level of QoS, the system may increase the number of time slots having the higher level of QoS, and decrease the number of time slots having the lower level of QoS.”), 1:43-45 (“A method and system for more efficiently managing radio resources in a time-slotted communication system are desired.”); Kim at 694 (“In this paper, we observe the data packets that are transmitted by the different devices which have different levels of importance in the sensor networks using in the home networking and the industrial application [3]. Considering the home networking, for the sensor devices performing the gate security system and the temperature sensor of the fire-warning facilities, the data packet losses for the sensor devices could be fatal. On the contrary, the data packet losses for the sensor devices which belong to TVs or refrigerators might be negligible. In addition, considering the sensor devices belong to the production line in the industrial application, each device requires the different bandwidth in a network. If there are two lines producing 30 and 60 products per second, each device in each line

requires the different processing rates and the bandwidths in a network. Obviously, devices which require the high bandwidths and produce the emergency data have to take the priorities prior to other devices.”); 802.11-1999 at 88 (“Because the transmission of any beacon may be delayed due to a medium busy condition at the nominal beacon transmission time, a CFP may be foreshortened by the amount of the delay. In the case of a busy medium due to DCF traffic, the beacon shall be delayed for the time required to complete the current DCF frame exchange.”); 802.11e at 91 (“Non-AP QSTAs may send TXOP requests during polled TXOPs or EDCA TXOPs using If a stream is dropped, the scheduler might use the time available to resume contention. The scheduler might also choose to move the TXOPs for the QSTAs following the QSTA dropped to use the unused time.”); Ward at [0019] (“The sequence of time slots may be delayed by a time slot following the or each substantially immediate interrogation. As an alternative, the or each substantially immediate interrogation may replace interrogation of another of the devices which would have been interrogated in the absence of the signal from the one device.”), Turina at 8:5-18 (“Notably, when a VIP MS (e.g., located in one cell) moves into a different cell, the MS can be granted the same exclusive resources. This grant can be made either in response to the MS renegotiating those resources in the new cell, or the same effect can be obtained from signalling within the network. For the latter case, during the handover from the one cell to the other (e.g., when the MS “presents” itself to the new cell), the cell update process can be performed by the MS, and if enough resources are available in the new cell, the network can automatically “transfer” or reallocate the VIP resources from the old cell. This automatic reallocation of resources can be accomplished, for example, using a special signalling procedure, such as the type used for a conventional handover.”); Odman at [0153] (“Regardless of the destination, after the frames are sent, the CTA needs to be deallocated for a given device. There

are several possible schemes provided for deallocation.”), [0162] (“This works well at the cost of increased traffic, since CTA freeing has to be done per destination device. The biggest cost is that transmit controller 930 must send a new frame for every CTA that is not needed. It cannot combine several free messages into one, since it must pull frames out of the queue individually for every CTA (one or more times) and free them as they are not needed. The transmit controller 930 cannot queue up requests since it’s strictly a real-time handler of the TDMA protocol that needs to process events as they occur. In other words, it cannot use non-deterministic processing.”); Lan at [0270] (“As mentioned above, according to the present invention corresponding to the second object, timeslots are allocated while allowing uplink/downlink conversion a plurality of times as requested instead of dividing timeslots into timeslots for uplink and timeslots for downlink as a conventional TDD system. Therefore, a timeslot assignment method can be realized in which timeslots can be allocated dynamically according to uplink/downlink traffic such that asymmetric traffic can be accommodates effectively.”), [0271] (“In addition, service quality is categorized to service classes in which desired quality for a high class user is satisfied maximally and a best effort service is provided for a low class user according to excess of resources. Therefore, a timeslot assignment method can be realized in which timeslot assignment is performed according to the service class and allowance of resources. In addition, efficiency of timeslot use and throughput are improved and high service quality is provided maximally.”); Huang at 3929-3930 (“In this paper, we propose an adaptive GTS allocation (AGA) scheme for IEEE 802.15.4 with the considerations of low-latency and fairness. There are two phases for the proposed scheme: In the classification phase, devices are assigned priorities in a dynamic fashion based on recent GTS usage feedbacks. Devices that need more attention from the coordinator are given higher priorities. In the GTS scheduling phase,

GTSs are given to devices in a non-decreasing order of their priorities. A starvation-avoidance mechanism is presented to regain service attention for lower-priority devices that need more GTSs for data transmissions. The scheme is designed based on the existing IEEE 802.15.4 medium access control (MAC) protocol without any modification. A simulation model validated by the developed mathematical analysis is presented to investigate average packet waiting times and fairness for our adaptive scheme. The capability of the proposed scheme is evaluated by a series of experiments. It is shown that the proposed scheme significantly outperforms the existing implementations with FCFS.”); Gilb at 91 (“The PNC may also wish to terminate an asynchronous allocation. The PNC’s resources may have become overloaded, and so it is unable to handle the asynchronous allocation. If the destination DEV is disassociated from the piconet, either by its own request, by ATP timeout, or because the PNC requests it, the PNC may want to explicitly terminate the allocation and inform the source DEV. When the PNC wants to terminate an asynchronous allocation, it simply stops allocating the channel time and sends a channel time response command to the source DEV. The reason codes that the PNC might send when it terminates an asynchronous allocation include the following: • Target DEV unassociated • Target DEV not a member • Stream terminated by PNC.”); Mansfield at Abstract (“A telecommunications system supports a variety of packet data services with throughputs ranging from low to high data rates. The system controls the user data transmission over a channel according to the user data throughput requirements of the application. By properly scheduling the time that particular transmission takes place, high data rate applications may be supported without the need for code aggregation, and low rate users may be supported without the requirement of multiple spreading factors. Base stations may transmit scheduling information to user devices in downlink time slots and user devices may transmit status information to base stations in uplink time slots.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, relating to, in at least one embodiment, assigning time slots, with the teachings of references such as 802.15.4, Livet, Kim, 802.11e, 802.11-1999, Ward, Turina, Odman, Lan, Huang, Mansfield, and/or Gilb. Combining the teachings of the prior art in this manner would merely apply a known technique (reassigning time slots responsive to determining a change in network traffic) to a known device (a device using a time slotted protocol) to yield predictable results. The references use similar well-known components and techniques such that combining the references so as to reassign time slots responsive to determining a change in network traffic in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

e) Motivation to Combine the Teachings of the Prior Art That Disclose Assigning Time Slots with the Teachings of Prior Art That Discloses a Fixed Router, Base Station, or Other Network Coordinating Node

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that has a router, base station, or other network coordinating node, with (2) the teachings of any of the cited prior art references that discloses fixing such a node in place, at least under Proxense's apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan (which disclose, at least in one embodiment, a router, base station, or other network coordinating node) with references such as 802.15.3, 802.15.4, Bluetooth, HomeRF, Livet, Ward, Turina, Odman, and/or Brown (which disclose fixing such nodes). Such a combination would render obvious, for

example, limitations containing the phrase “fixed proximity-based reader device” in claim 1 of the ’129 patent and claim 1 of the ’672 patent; and limitations containing the phrases “fixed location proximity reader” and “fixed location proximity[-based] reader [device]” in claim 1 of the ’043 patent.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (coordinating network traffic) in similar ways (with a router, base station, or other network coordinating node) to achieve similar purported benefits (reliable network operation in specific types of wireless systems). *See e.g.*, 802.15.3 at 1 (“This standard defines the PHY and MAC specifications for high data rate wireless connectivity with fixed, portable and moving devices within or entering a personal operating space.”); 802.15.4 at 1 (“The scope of this project is to define the physical layer (PHY) and medium access control (MAC) sublayer specifications for low data rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements typically operating in the personal operating space (POS) of 10 m.”); Bluetooth at 41 (“Bluetooth is a short-range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. Key features are robustness, low complexity, low power, and low cost.”), HomeRF at 26 (“Fixed networks are likely to include a CP, and so will not be ad-hoc networks.”); 440 (“A Connection Point (CP) is a HomeRF device that provides management of a HomeRF network, and can provide (depending on its class) a connection between the On-Air interface, the public telephone network and a personal computer.”), FIGs. 1-3, 5-6; Livet at 2:39-54 (“The present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout. Hereafter, a base station includes but is not limited to a Node-B, site

controller, access point or any other type of interfacing device in a wireless environment. FIG. 1 is a block diagram of a wireless communication system 100, wherein a plurality of WTRUs 105 communicate with base stations 110. The base stations 110 are controlled by a radio network controller (RNC) 115. The RNC 115 is connected to a core network 120. Either the RNC 115 or the base stations 110 include a means for sorting a plurality of time slots of a radio resources into a plurality of different categories, and a means for mapping a user to a particular designation of time slots based on QoS information of the user which is obtained from a core network 120, as described in more detail below.”); Ward at [0037] (“The room also contains part of a transponder location system. This system comprises a computer 9 connected by any suitable communication link, such as wiring, to ceiling-mounted transducers 10 to 13 which convert ultrasonic acoustic energy into corresponding electrical signals and supply these signals to the computer 9.”); Turina at 5:20-34 (“FIG. 1 is a simplified schematic block diagram of a telecommunications system that can be used to implement a method of transferring packet data with a VIP Mobile Station, in accordance with the preferred embodiment of the present invention. System 10 includes a communications network 12. Network 12 includes a base station/transceiver section 14. Network 12 can be a local or wide area network (LAN or WAN), or a Public Land Mobile Network (PLMN) such as the cellular network in the GSM. Generally, network 12 can be any type of communications network that provides packet data services using shared packet data channels. In the preferred embodiment shown (for illustrative purposes only), network 12 is a digital TDMA cellular mobile radio network.”); Odman at [0015] (“The various non-coordinator devices 320 are confined to a usable physical area 350, which is set based on the extent to which the coordinator 310 can successfully communicate with each of the non-coordinator devices 320. Any non-coordinator device 320 that is able to communicate with the coordinator 310 (and vice

versa) is within the usable area 350 of the network 300. As noted, however, it is not necessary for every non-coordinator device 320 in the network 300 to communicate with every other non-coordinator device 320.”); Brown at 3:1-18 (“The base station 102 provides an interface between radio communication with the mobile stations and wireline communication with a telephone network, local area network or other data source. The base station 102 includes a wireline interface 114, a controller 116, a memory 118, a user interface 120, a base receiver or a receiver circuit 122, a base transmitter or a transmitter circuit 124, an antenna switch 126 and an antenna 128. The wireline interface 114 is coupled to an input 130 which is configured for coupling to external data sources, such as a public switched telephone network PSTN 103 or local area network or LAN 105. The wireline interface 114 provides functions such as tone generation for dual tone, multi-frequency (DTMF) dialing and detection of an incoming ringing signal from the telephone network. The wireline interface 114 also communicates signals representative of speech between the telephone network and the controller 116 and communicates signals representative of asynchronous data between the local area network and the controller 116.”).

In some systems, such as small or closed systems, having a fixed router, base station or coordinating node can be beneficial because it can prevent tampering and help ensure stable operation. This is not the case for many networks-- such as the wireless networks used by the Intel devices at issue in this case—that handle millions of transmissions each second. These systems use other technologies to provide security and stability. But for a smaller, simpler, closed system, a fixed router, base station, or other network node can help ensure security and stability and provide a more persistent or reliable power source. As a result, a person of ordinary skill in the art working on one of these systems would have understood that combining the teachings of the prior art that assign time slots with prior art that discloses using a fixed router,

base station, or coordinating node could provide such security and/or stability and/or power benefits.

References such as 802.15.3, 802.15.4, Bluetooth, HomeRF, Livet, Ward, Turina, Odman, and/or Brown disclose purported benefits of fixing a router, base station, or other network coordinating node in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan. *See, e.g.*, 802.15.3 at 3 (“3.13 device-host: The equipment that incorporates an 802.15.3™ device. The device-host may have more than one device incorporated in it as well as other networking connections, both wired and wireless.”), 802.15.4 at 1 (describing “ultra-low complexity, ultra-low cost” devices and suitability for “interactive toys, but scalable down to the needs of sensor and automation needs (20 kb/s or below) for wireless communications”); Bluetooth at 397 (“Where the communication segment is another network, Bluetooth wireless technology is used for the path between the device and a network connection device like a modem”); HomeRF at 23 (“The incoming PSTN line is connected to the Connection-point to handle voice calls. It is also connected to a modem in the PC to provide Internet connectivity, and to a wired handset. The C1 connected PC and the Anode connected PC is networked together using the HomeRF asynchronous data service. The two S-nodes are networked together using the priority asynchronous data service. The CP manages any active streams between the two S-nodes.”); Livet at 2:44-54 (“FIG. 1 is a block diagram of a wireless communication system 100, wherein a plurality of WTRUs 105 communicate with base stations 110. The base stations 110 are controlled by a radio network controller (RNC) 115. The RNC 115 is connected to a core network 120. Either the RNC 115 or the base stations 110 include a means for sorting a plurality of time slots of a radio resources into a plurality of different categories, and a means for

mapping a user to a particular designation of time slots based on QoS information of the user which is obtained from a core network 120, as described in more detail below.”); Ward at [0034] (“It is thus possible to provide a location system which is capable of locating a device with low latency when a signal requesting such a location update is received from the device.”); Turina at 5:53-58 (“The communications between terminal 26 and the network are via a wireless radio connection through base station and/or transceiver section 14. Consequently, communications to/from phones 22 and terminals 24 and 26 can be routed to/from mobile station(s) 20 or VIP MS 16 by network 12.”); Odman at [0015] (“The various non-coordinator devices 320 are confined to a usable physical area 350, which is set based on the extent to which the coordinator 310 can successfully communicate with each of the non-coordinator devices 320. Any non-coordinator device 320 that is able to communicate with the coordinator 310 (and vice versa) is within the usable area 350 of the network 300.”); Brown at 3:1-18 (“The base station 102 provides an interface between radio communication with the mobile stations and wireline communication with a telephone network, local area network or other data source. The base station 102 includes a wireline interface 114, a controller 116, a memory 118, a user interface 120, a base receiver or a receiver circuit 122, a base transmitter or a transmitter circuit 124, an antenna switch 126 and an antenna 128. The wireline interface 114 is coupled to an input 130 which is configured for coupling to external data sources, such as a public switched telephone network PSTN 103 or local area network or LAN 105. The wireline interface 114 provides functions such as tone generation for dual tone, multi-frequency (DTMF) dialing and detection of an incoming ringing signal from the telephone network. The wireline interface 114 also communicates signals representative of speech between the telephone network and the controller 116 and

communicates signals representative of asynchronous data between the local area network and the controller 116.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mote 1, Mote 2, Odman, and/or Lan, relating to, in at least one embodiment, a router, base station, or other network coordinating node, with the teachings of references such as 802.15.3, 802.15.4, Bluetooth, HomeRF, Livet, Ward, Turina, Odman, and/or Brown. Combining the teachings of the prior art in this manner would merely apply a known technique (a fixed router, base station, or other network coordinating node) to a known device (a network node using a time slotted protocol) to yield predictable results. The references use similar well-known components and techniques such that combining the references to fix a router, base station, or other network coordinating node in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

f) Motivation to Combine the Teachings of the Prior Art to Increase a Channel Number If No Beacon is Detected

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that has active and sleep modes, with (2) the teachings of any of the cited prior art references that increase a channel number if no beacon is detected, at least under Proxense’s apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2 (which disclose, at least in one embodiment, active and sleep modes) with references such as HomeRF, Liu ’877, 802.11-1999, Duong, Kitchin, Abreu, Gilb, and/or Lansford (which disclose increasing a channel

number if no beacon is detected). Such a combination would render obvious, for example, limitations containing the phrase “the processing circuitry also arranged to monitor a first channel for a beacon during the active mode and, if no beacon is detected, increasing a channel number to a second channel” and “monitoring a first channel for a beacon; if no beacon is detected, increasing a channel number to a second channel;” in claims 1 and 7 of the ’129 patent, respectively.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (maintaining a network connection during sleep periods) in similar ways (increasing a channel number if no beacon is detected) to achieve similar purported benefits (establishing connection to a network in certain types of systems). *See e.g.*, HomeRF at 134 (“MM_LOST Primitive ... Indicates that the I-node has lost connectivity with the network. This indication occurs following a timeout on the receipt of CP beacons as defined in section 5.16.5 Transitions from the Managed Synchronization State.”), 434 (“Loss of Network Connectivity (Informative) ... The MAC layer can indicate that it has lost connectivity with the network by issuing an MM_LOST indication (see section 5.2.5.9 MM_LOST Primitive (I-node only)). ... The effect of this on the I-node is specific to the implementation. For example, the I-node may scan from time to time for known networks for a fixed period, and then to switch off.”), 326-327 (“The procedures defined in this section are used by the MAC entity to find a HomeRF network. This section defines common scanning procedures used by the specific scanning procedures: scanning for a known network, and learning a NWID. ... To start the scan, the node shall set its Hop Pattern to ScanHopPattern and Hop Index to ScanHopIndex[]. These select the PHY channel. The scanning process involves listening on different PHY channels, for

up to MaxNumScanChannels channels, and listening on each channel for ScanDurationPerChannel.[] ... The scan can be terminated if the specific scanning procedure so determines. If the scan has not been terminated, at the end of ScanDurationPerChannel on one channel, the MAC shall hop to the next channel defined by incrementing its HopIndex.”); Liu ’877 at 4:26:37 (“Mobile unit 110 at block 214 may then tune to an available channel in the preferred region, and may look for any IEEE 802.11 wireless network activity such as any traffic, including data packets or management packets, for one or more available channels in the preferred region, and optionally until all available channels are scanned. For each channel, a determination may be made at block 216 whether any IEEE 802.11 activity or packets are detected, and if not, a determination may be made at block 220 whether a maximum waiting time has been reached. If a maximum waiting time has been reached, method 200 may continue at block 234 which is discussed, below.”), 5:11-16 (“A determination may be made at step 234 whether all channels have been scanned in a current, non-eliminated region. In the event not all channels have been scanned, mobile unit 110 may tune to another channel within a non-eliminated region at block 238, and method 200 may continue at block 216 on the next tuned channel. In the event all channels have been scanned, another scan cycle may be started at block 236 within the limited, or valid, regions, using a predetermined time interval, and method 200 may continue accordingly at block 216.”); 802.11-1999 at 126 (“11.1.3.1 Passive scanning If a ScanType is passive, the STA shall listen to each channel scanned for no longer than a maximum duration defined by the ChannelTime parameter.”); 127 (“If PHYCCA.indication (busy) has not been detected before the ProbeTimer reaches MinChannel-Time, then clear NAV and scan the next channel, else when ProbeTimer reaches MaxChannelTime, process all received probe responses;”); Duong at 35-36 (“Whenever a handover trigger occurs, the MN starts the AP

discovery process (box 1 in Figure 2) by cycling through the possible radio channels in search for a new, more suitable AP. The IEEE 802.11 standard [3] specifies two types of scanning, namely passive and active. In the passive scanning mode, the MN switches to a new channel, waits to receive beacons for a period of time $T_{channel}$, and then switches to the next channel. Normally, $T_{channel}$ is set slightly greater than twice the beacon interval (T_{beacon}) so that the MN can receive two beacons on a channel. After cycling through all available channels (possibly several times), the MN can select a new AP based on information gathered from the beacons (discussed below).”); Kitchen at Abstract (“Briefly, in accordance with one embodiment of the invention, an access point may preemptively broadcast an alternate channel to switch to, along with an indication of the beacon timing for the alternate channel, prior to any catastrophic interference. The access point may switch to the alternate channel in the event of interference on the original channel without attempting to broadcast the alternate channel during the interference event. A mobile user may then know in advance of the interference event which alternate channel the access point switched to and may switch to the alternate channel.”); Abreu at 10:50-60 (“If, while trying to reach a resolution for all entries in the candidate profile table 136, the handset 120 eliminates all entries from the candidate profile table 136, the handset 120 will increment to the next frequency and begin scanning for control channels. If the handset 120 has scanned all frequencies and eliminated all entries from the candidate profile table 136, the handset 120 will enter sleep mode. Once the sleep mode duration expires, the handset 120 will again try to find a suitable base station. The handset 120 will continue scanning until a suitable base station is found or the handset 120 is powered down.”); Gilb at 43 (“The last power-save mode is piconet synchronized power save (PSPS) mode. The primary goal of PSPS mode is not power savings, but rather ensuring that DEVs are awake for system changes and announcements.

The DEVs in PSPS mode wake up at a time specified in the PS Status IE for the PSPS set (i.e., set 1). However, unlike DSPS modes, the DEVs in PSPS mode are not allowed to specify the interval between wake beacons. Instead the PNC chooses this interval based on requests from the DEVs in PSPS mode. The beacon when DEVs in PSPS mode are required to be in AWAKE state is called the system wake beacon. Because there is only one PSPS set for the entire piconet, the sleep interval, and hence the power savings, is a compromise between the requests of the DEV and the PNC's desire to change piconet parameters quickly. The PNC is allowed to change the interval between every system awake beacon. The PNC is prohibited from making major piconet changes until at least one system wake beacon has passed. This is intended to improve the chances that a DEV will hear the system changes before they happen. Of course, if any DEV misses the system change announcements, it will be able to recover from the changes by scanning for its piconet.”); Lansford at 1666 (“When a SWAP-CA node is turned on, it immediately enters into a network discovery phase in which it tries to determine if another node or CP is present within its range and if a network already exists that it can join. The node accomplishes its discovery phase by operating in a passive scanning mode. In the passive scan mode, the node listens on every channel,³ within its operational frequency band, for a specific amount of time, greater than a single superframe (see Section IV). “Listening” on a channel is accomplished by the physical layer, which forces the node to hop on a known scan pattern that is a good spread of the hopping patterns on all the channels of the network. During a scan, the node receives all network packets regardless of the NWID or destination address. These packets are analyzed by the node's MAC management module, and a decision is made on whether or not to join the network. The scan can be terminated as soon as the first network is found or when the management module so determines. When a network is found, the node synchronizes to the

network by setting its hopping pattern to the discovered network's hopping pattern and by recording the network's NWID. The synchronization information is available on every data packet on the network and is used by the "joining" node to set its own parameters.").

In some systems, such as small or closed systems in which time or high data rates are not critical, increasing the channel number when no beacon is detected can provide a way to reconnect to the network. This is not the case for many networks – such as the wireless networks used by the Intel devices at issue in this case – that handle millions of transmissions each second and cannot waste time automatically increasing the channel number without knowing if doing so will establish a network connection. But for a smaller, closed system, using this method can provide a way to reconnect to the network by incrementally trying increased channel numbers without expending resources and/or time to identify the correct channel.. As a result, a person of ordinary skill in the art working on one of these systems would understand to combine the teachings of any of the prior art references that has active and sleep modes, with the teachings of any of the cited prior art references that increase a channel number if no beacon is detected.

References such as HomeRF, Liu '877, 802.11-1999, Duong, Kitchin, Abreu, Gilb, and/or Lansford disclose the purported benefits of increasing a channel number if no beacon is detected in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2. *See, e.g.*, HomeRF at 434 (describing low-power process to connect to another known network); Liu '877 at Abstract ("Briefly, in accordance with one embodiment of the invention, a mobile unit may detect and connect to a wireless local area network, contemplating worldwide multiband networks and multiple regulatory domains, with a shorter searching time."); 802.11-1999 ("Upon completion of scanning, an MLME-SCAN.confirm is issued by the MLME

indicating all of the BSS information received.”); Duong at 35 (“The MN uses information collected during the scanning process to select a new AP.”); Kitchin at Abstract (“Briefly, in accordance with one embodiment of the invention, an access point may preemptively broadcast an alternate channel to switch to, along with an indication of the beacon timing for the alternate channel, prior to any catastrophic interference. The access point may switch to the alternate channel in the event of interference on the original channel without attempting to broadcast the alternate channel during the interference event. A mobile user may then know in advance of the interference event which alternate channel the access point switched to and may switch to the alternate channel.”); Abreu at 19:25-35 (“As can be seen from the foregoing, the present invention provides a method and apparatus for identifying a suitable base station from among a plurality of base stations transmitting beacons or control channels which are received by a radiotelephone handset. The handset locates base stations 30 whose control channel signals are unsynchronized with and 2. A method as defined in claim 1 wherein the associated 25 location parameter comprises a bit count and a slot count lag another control channel signals. The handset enters a sleep mode to conserve battery power when no control channel signals are present. The invention allows the handset to synchronize to a base station having acceptable signal 35 strength, access rights identity and system capability.”); Gilb at 43 (“The last power-save mode is piconet synchronized power save (PSPS) mode. The primary goal of PSPS mode is not power savings, but rather ensuring that DEVs are awake for system changes and announcements. The DEVs in PSPS mode wake up at a time specified in the PS Status IE for the PSPS set (i.e., set 1). However, unlike DSPS modes, the DEVs in PSPS mode are not allowed to specify the interval between wake beacons. Instead the PNC chooses this interval based on requests from the DEVs in PSPS mode. The beacon when DEVs in PSPS mode are required to be in AWAKE state is

called the system wake beacon. Because there is only one PSPS set for the entire piconet, the sleep interval, and hence the power savings, is a compromise between the requests of the DEV and the PNC's desire to change piconet parameters quickly. The PNC is allowed to change the interval between every system awake beacon. The PNC is prohibited from making major piconet changes until at least one system wake beacon has passed. This is intended to improve the chances that a DEV will hear the system changes before they happen. Of course, if any DEV misses the system change announcements, it will be able to recover from the changes by scanning for its piconet."); Lansford at 1666 ("When a SWAP-CA node is turned on, it immediately enters into a network discovery phase in which it tries to determine if another node or CP is present within its range and if a network already exists that it can join. The node accomplishes its discovery phase by operating in a passive scanning mode. In the passive scan mode, the node listens on every channel,³ within its operational frequency band, for a specific amount of time, greater than a single superframe (see Section IV). "Listening" on a channel is accomplished by the physical layer, which forces the node to hop on a known scan pattern that is a good spread of the hopping patterns on all the channels of the network. During a scan, the node receives all network packets regardless of the NWID or destination address. These packets are analyzed by the node's MAC management module, and a decision is made on whether or not to join the network. The scan can be terminated as soon as the first network is found or when the management module so determines. When a network is found, the node synchronizes to the network by setting its hopping pattern to the discovered network's hopping pattern and by recording the network's NWID. The synchronization information is available on every data packet on the network and is used by the "joining" node to set its own parameters.").

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2, relating to, in at least one embodiment, active and sleep modes, with the teachings of references such as HomeRF, Liu '877, 802.11-1999, Duong, Kitchen, Gilb, and/or Lansford. Combining the teachings of the prior art in this manner would merely apply a known technique (increasing a channel number if no beacon is detected) to a known device (devices with active and sleep modes) to yield predictable results. The references use similar well-known components and techniques such that combining the references to increase a channel number if no beacon is detected in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

g) Motivation to Combine the Teachings of the Prior Art to Reset a Sleep Timer If No Beacon is Detected

A person of ordinary skill in the art would have been motivated to combine (1) the teachings of any of the prior art references cited in these invalidity contentions that has active and sleep modes, with (2) the teachings of any of the cited prior art references that reset a sleep timer if no beacon is detected, at least under Proxense's apparent interpretation of the claims. As an illustrative, non-limiting example, a person of ordinary skill in the art would have been motivated to combine the teachings of references such 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2 (which disclose, at least in one embodiment, active and sleep modes) with references such as Liu '827, Ye, Tanach, Abreu, Gilb, and/or Lansford (which disclose resetting a sleep timer if no beacon is detected). Such a combination would render obvious, for example, limitations containing the phrases "the processing circuitry also arranged to monitor a first channel for a beacon during the active mode and, if no beacon is

detected, ... resetting the timer” and “monitoring a first channel for a beacon; if no beacon is detected, ... resetting the timer” in claims 1 and 7 of the ’152 patent, respectively.

A person of ordinary skill in the art would have been motivated to combine such references because the references are all in the same field (wireless communications) and address the same purported problem or objective (maintaining a network connection during sleep periods) in similar ways (using active and sleep modes) to achieve similar purported benefits (saving power in specific types of wireless systems). *See e.g.*, Liu ’827 at Abstract (“A mobile station in an 802.11 wireless network dynamically adjusts a number of 802.11 beacon intervals to sleep based on a power savings level and a required wake-up time to receive packets from an access point. The power savings level is based on data traffic activity in a current period. The mobile station wakes up to receive a beacon, and if a beacon is not received, the mobile station sleeps for one additional beacon period.”); Ye at 1569 (“The basic scheme is shown in Figure 1. Each node goes to sleep for some time, and then wakes up and listens to see if any other node wants to talk to it. During sleep, the node turns off its radio, and sets a timer to awake itself later.”); Tanach at 3:17-44 (“It should be noted that if the STA goes to sleep right when a frame is starting to be received, there is a probability of waking up in time to receive the retransmission given by: $P_{\text{retrans-receive}} = (64-16)/64 = 0.75$. There is also a probability that the first retransmission will not be received, but the second retransmission will be received, since the indication of CcaStatus on the missed frame can be used to reset AdvanceIdleTimer, viz: $P_{\text{retrans-not-receive}} = 0.25$. To assist in calculating Tidle, additional considerations may be observed. For example, during sleep or idle time a unicast frame may be transmitted. Therefore, after waking up the device should stay awake at least until transmission of the next frame begins, so that CcaStatus is asserted. Designing for the worst case, a retransmission backoff of 64 slots may be assumed, and

a time period equal to a function of a SIPS time, an ACK time, and a DIPS time may be added, as if the previous transmission ended right before wakeup occurs. Therefore, the “awake” time,

or T_{idle} , may be calculated as:
$$T_{idle} = 10(SIFS) + 24(Ack) + 2 * 6(\text{signal-ext}) + 28(DIFS) + 64 \times 9(\text{SlotTime}) = 650 \text{ u sec}$$
 In some

embodiments, implementation may result in saving power when a medium is idle without resorting to use of an explicit IEEE 802.11 power saving mode. Further, some implementations may occur without real time involvement of firmware, such as when firmware is used to control the timing parameters and/ or use of the various embodiments responsive to specific operational conditions.”); Abreu at 10:50-60 (“If, while trying to reach a resolution for all entries in the candidate profile table 136, the handset 120 eliminates all entries from the candidate profile table 136, the handset 120 will increment to the next frequency and begin scanning for control channels. If the handset 120 has scanned all frequencies and eliminated all entries from the candidate profile table 136, the handset 120 will enter sleep mode. Once the sleep mode duration expires, the handset 120 will again try to find a suitable base station. The handset 120 will continue scanning until a suitable base station is found or the handset 120 is powered down.”); Gilb at 124 (“When a DEV joins the PSPS set and switches to PSPS mode, it is required to listen to all system wake beacons, i.e., the wake beacons for PS set 1. If it misses receiving a system wake beacon, the DEV is required to continue to listen for beacons until it successfully receives a beacon. One reason for this is that if the DEV does receive a beacon, it will not know the beacon number of the next system wake beacon. A DSPS DEV, on the other hand, does not need to listen to subsequent beacons because it knows that the Wake Beacon Interval is fixed and so it can calculate the beacon number of the next DSPS wake beacon.”); Lansford at 1671 (“For A-nodes, the behavior of the power management service depends on the type of packet being transmitted. Fig. 7 illustrates the process of sending broadcast messages to power-saving

asynchronous nodes. The process is described with the help of an example in which two asynchronous nodes (Node A and Node B) send broadcast packets, and Node C, a power saving node, is a receiver of these packets: a) Node C powers up and receives a “dwells-to-wake-up” counter of three, which is broadcast in the CPB. The maximum value of the “dwells-to-broadcast” counter is a system design parameter that allows the designer to trade off latency, CP buffer size, and broadcast reliability against battery life. The CP maintains a countdown to the next dwell when power saving (PS) nodes would wake up. b) Node A transmits a broadcast message, which is received and stored by the CP. c) Node B transmits a broadcast message, which is received and stored by the CP. d) Node C wakes up when its dwells-to-wake-up counter reaches zero. It checks the CPB and sees an indication from the CP that packets are available for it and consequently stays powered up. e) The CP transmits the buffered broadcast messages during the dwell. f) Node C receives the broadcast messages and then goes back to sleep mode.”).

In some systems, such as small or closed systems, saving power is paramount—even if it results in a time delay or sending less data. This is not the case for many networks – such as the wireless networks used by the Intel devices at issue in this case – that handle millions of transmissions each second in which time is critical, and delays are unacceptable. But for a smaller, closed system in which speed is not critical, resetting the sleep time when no beacon is detected can save power because it allows the device to go back to sleep when a connection was lost. As a result, a person of ordinary skill in the art working on one of these smaller, low power systems would have understood to combine the teachings of the prior art that has active and sleep modes with the teachings of any of the cited prior art references that reset a sleep timer if no beacon is detected.

References such as Liu '827, Ye, Tanach, Abreu, Gilb, and/or Lansford disclose the purported benefits of resetting a sleep timer if no beacon is detected in these types of systems such as, for example, small or closed systems that use 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2. *See, e.g.*, Liu '827 at 3:33-46 (“The desired sleep interval, expressed in numbers of beacon intervals in Table 1, refers to a desired amount of time that a mobile station may sleep to conserve power until waking up to receive the next beacon, where longer desired sleep intervals correspond to more power conservation. The desired wake-up time describes when a mobile station would wake up based only on the desired sleep interval. As described above, however, mobile stations may need to receive broadcast or multicast packets at broadcast times. Some embodiments determine the actual wake-up time based on the desired sleep interval and the broadcast time. Various embodiments that are described below use both the desired sleep interval and the broadcast time to determine the actual wake-up time.”); Ye at Abstract (“The experiment results show that, on a source node, an 802.11-like MAC consumes 2–6 times more energy than S-MAC for traffic load with messages sent every 1–10s.”); Tanach at 1:61-65 (“However, as will be shown below, there are circumstances when it may be possible to turn off various elements within the STA to save power, such as portions of the receive chain, even when the AP may not be aware that such activity is taking place.”); Abreu at 19:25-35 (“As can be seen from the foregoing, the present invention provides a method and apparatus for identifying a suitable base station from among a plurality of base stations transmitting beacons or control channels which are received by a radiotelephone handset The handset locates base stations 30 whose control channel signals are unsynchronized with and 2. A method as defined in claim 1 wherein the associated 25 location parameter comprises a bit count and a slot count lag another control channel signals. The handset

enters a sleep mode to conserve battery power when no control channel signals are present. The invention allows the handset to synchronize to a base station having acceptable signal strength, access rights identity and system capability.”); Gilb at 124 (“When a DEV joins the PSPS set and switches to PSPS mode, it is required to listen to all system wake beacons, i.e., the wake beacons for PS set 1. If it misses receiving a system wake beacon, the DEV is required to continue to listen for beacons until it successfully receives a beacon. One reason for this is that if the DEV does receive a beacon, it will not know the beacon number of the next system wake beacon. A DSPS DEV, on the other hand, does not need to listen to subsequent beacons because it knows that the Wake Beacon Interval is fixed and so it can calculate the beacon number of the next DSPS wake beacon.”); Lansford at 1671 (“For A-nodes, the behavior of the power management service depends on the type of packet being transmitted. Fig. 7 illustrates the process of sending broadcast messages to power-saving asynchronous nodes. The process is described with the help of an example in which two asynchronous nodes (Node A and Node B) send broadcast packets, and Node C, a power saving node, is a receiver of these packets: a) Node C powers up and receives a “dwells-to-wake-up” counter of three, which is broadcast in the CPB. The maximum value of the “dwells-to-broadcast” counter is a system design parameter that allows the designer to trade off latency, CP buffer size, and broadcast reliability against battery life. The CP maintains a countdown to the next dwell when power saving (PS) nodes would wake up. b) Node A transmits a broadcast message, which is received and stored by the CP. c) Node B transmits a broadcast message, which is received and stored by the CP. d) Node C wakes up when its dwells-to-wake-up counter reaches zero. It checks the CPB and sees an indication from the CP that packets are available for it and consequently stays powered up. e) The CP

transmits the buffered broadcast messages during the dwell. f) Node C receives the broadcast messages and then goes back to sleep mode.”).

Accordingly, a person of ordinary skill in the art would have been motivated to combine the teachings of references such as 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Liu827, Abreu, Gilb, Ye, Mote 1, and/or Mote 2, relating to, in at least one embodiment, devices with active and sleep modes, with the teachings of references such as Liu '827, Ye, Tanach, Abreu, Gilb, and/or Lansford. Combining the teachings of the prior art in this manner would merely apply a known technique (resetting a sleep timer if no beacon is detected) to a known device (devices with active and sleep modes) to yield predictable results. The references use similar well-known components and techniques such that combining the references to reset a sleep timer if no beacon is detected in the proposed combinations would have been a routine, predictable design for a person of ordinary skill in the art and would not have involved any undue experimentation.

IV. INVALIDITY BASED ON 35 U.S.C. § 112

Intel provides the following initial disclosures of invalidity contentions based on 35 U.S.C. § 112. Intel reserves the right to revise, amend, and/or supplement its Preliminary Invalidity Contentions, including its contentions based on 35 U.S.C. § 112, subject to the reservations discussed in Section II and III.D, as discovery proceeds and as permitted by the Federal Rules of Civil Procedure and the Court’s Standing Order Governing Proceedings (OGP) 4.4—Patent Cases, and the Scheduling Order (Dkt. 18).

The written description and enablement requirements of patent law are provided in 35 U.S.C. § 112, first paragraph, which reads as follows:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact

terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

See Ariad Pharmaceuticals, Inc. v. Eli Lilly and Co., 598 F.3d 1336, 1344 (Fed. Cir. 2010) (en banc) (holding “that § 112, first paragraph, contains two separate description requirements: a written description [i] of the invention, and [ii] of the manner and process of making and using [the invention]”).

The test for the sufficiency of a claim’s written description is “whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor ha[d] possession of the claimed subject matter as of the filing date.” *Synthes USA, LLC v. Spinal Kinetics, Inc.*, 734 F.3d 1332, 1341 (Fed. Cir. 2013). The specification must “describe an invention understandable to [a] skilled artisan and show that the inventor actually invented the invention claimed.” *Ariad*, 598 F.3d at 1351-52. “The appearance of mere indistinct words in a specification or a claim, even an original claim, does not necessarily satisfy that requirement. ... If a purported description of an invention does not meet the requirements of the statute, the fact that it appears as an original claim or in the specification does not save it. A claim does not become more descriptive by its repetition, or its longevity.” *Enzo Biochem, Inc. v. Gen-Probe Inc.*, 323 F.3d 956, 968-69 (Fed. Cir. 2002).

The enablement requirement requires that the specification “teach those skilled in the art how to make and use the full scope of the claimed invention without ‘undue experimentation.’” *Harris Corp. v. IXYS Corp.*, 114 F.3d 1149, 1155 (Fed. Cir. 1997). “Enablement serves the dual function in the patent system of ensuring adequate disclosure of the claimed invention and of preventing claims broader than the disclosed invention.” *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1380-81 (Fed. Cir. 2012).

A. Lack of Written Description

Under Proxense's apparent infringement theories, the specifications of the Asserted Patents do not describe the full scope of the Asserted Claims as required by 35 U.S.C. § 112, first paragraph, and the Asserted Claims are therefore invalid. At least under Proxense's apparent infringement theories, Proxense's Asserted Patents do not provide any substantive or meaningful description of many of the elements of its claims—*e.g.*, there is no substantial description of the internal hardware, firmware, or software required to implement many of the claim elements. This is not sufficient to show that Proxense was in possession of the claimed inventions as of the filing of the applications for the Asserted Patents. *See Ariad*, 598 F.3d at 1351. Each Asserted Claim that requires the following claim elements are invalid for lack of written description. *See id.*

- **“Synchronization Information.”** Many of the Asserted Claims require a time slot to be determined or reset based on synchronization information, or that synchronization information be used to assign a time slot. For example, claim 1 of the '129 patent recites “the first and second specific time slots are determined based on synchronization information” and claim 18 of the '129 patent recites “the synchronization information comprising information assigning a time slot.” *See also, e.g.*, '129 patent claim 16; '672 patent claim 1; '043 patent claim 1. The specification describes determining a time slot based on synchronization information as using a bitmask. *See* '129 patent at Abstract; 11:7-19; 14:53-20:5. To the extent that Proxense alleges that “synchronization information” does not require bitmasks, all Asserted Claims of the '129, '672, and '043 patents are invalid because the specification lacks written description support for the use of anything other than bitmasks to assign or determine a time slot.
- **“Class[es]” “associated with” “device[s]” or “user[s].”** All asserted claims of the '129, '672, and '043 patents require one or more classes associated with devices and users of the devices that are used to assign or determine time slots. *See, e.g.*, '129 Patent Claims 1, 16, 18; '672 Patent Claim 1; '043 Patent Claim 1. The patents' specifications only disclose one way for “certain ones of the client devices may be afforded some level of priority:” “masks may be set according to a *class of a user* of a PDK or to a *class of the PDK itself*.” *See, e.g.*, '129 Patent at 16:13-17. During prosecution, Proxense emphasized that other types of classes, such as classes associated with network characteristics/data to be transmitted by a device or user does not meet this limitation. *See, e.g.*, PROX_INTEL-00000354 at PROX_INTEL-00000386-89. To the extent that Proxense alleges that one or more classes associated with devices and users can include classes associated with network characteristics/data that is transmitted, all Asserted Claims of the '129, '672, and '043 patents are invalid for lack of written description because, according to Proxense's own representations to the Patent Office, the patents do not cover classes other than class of a user and the user's device.

- **“Unassigning.”** Claim 1 of the ’043 patent require “unassigning, responsive to the change in the network traffic, the first specific time slot.” The term “unassigning” is never mentioned in the patent outside of the claims. The specification states that “once a specific client exits the network, previously reserved time slots of that client may be reassigned to one or more other client devices in the network.” ’043 patent at 15:60-63. But this does not describe “unassigning” because a client device leaving a network is not “unassigning” its time slot. There is no description as to how a reader device unassigns a time slot. Moreover, *unassigning* a time slot is different from *reassigning* a time slot—indeed claims 5 and 8 of the ’043 patent require a *separate* step of “reassigning the first specific time slot” in addition to the “unassigning” step recited in claim 1. Disclosure regarding “reassign[ing]” time slots when “a specific client exits the network” (*see, e.g.*, ’043 patent at 15:60-63) does not provide written description support for the claimed “unassigning” step. The specification fails to describe how a reader device “unassigns” a time slot—and therefore the claim 1 of the ’043 patent is invalid for lack of written description. *See Ariad*, 598 F.3d at 1351.
- **“A timer ... used to indicate when to switch from sleep mode to active mode based on time slot assignment information.”** Claim 1 of the ’152 patent requires “a timer operatively coupled to the wireless transceiver used to indicate when to switch from sleep mode to active mode based on time slot assignment information received by the wireless transceiver.” Claim 7 of the ’152 patent contains a similar requirement: “setting a timer to indicate when to switch from sleep mode to an active mode based on the time slot assignment information.” During prosecution, Proxense argued that merely powering a device down during periods of inactivity is different from the claimed use of a timer. *See, e.g.*, PROX_INTEL-00000831 at PROX_INTEL-00000983-84. To the extent that Proxense alleges that such sleep periods based on periods of inactivity satisfies the claims, claims 1 and 6 of the ’152 patent are invalid for lack of written description.
- **“If no beacon is detected, increasing a channel number to a second channel.”** Claims 1 and 7 of the ’152 patent require “if no beacon is detected, increasing a channel number to a second channel.” The specification provides only that a channel number is “incremented” if no beacon is detected. ’152 Patent at 24:64-25:4; *see also* FIG. 26. During prosecution, Proxense represented that determining the best channel does not meet these claim limitations. *See, e.g.*, PROX_INTEL-0000000831 at PROX_INTEL-00000859- PROX_INTEL-00000865. To the extent that Proxense alleges that determining the best channel is covered by the claims, claims 1 and 7 of the ’152 patent are invalid for lack of written description because, according to Proxense’s own representations to the Patent Office, the patents do not cover determining the best channel.
- **“If no beacon is detected, ... resetting the timer.”** Claims 1 and 7 of the ’152 patent require “if no beacon is detected, ... resetting the timer.” The ’152 patent specification only discloses embodiments in which a timer is reset after failure to detect a beacon. *See, e.g.*, FIG. 16 and description thereof. To the extent that Proxense alleges that this limitation is met by anything other than a timer that is reset in response to missing a beacon, claims 1 and 7 of the ’152 patent are invalid for lack of written description.

B. Lack of Enablement

The Asserted Claims are invalid for failure to meet the enablement requirement for multiple independent reasons. At least under Proxense's apparent infringement theories, the Asserted Patents do not provide any substantive or meaningful teaching regarding how to enable the claimed inventions. Accordingly, the patent specifications do not enable a person of ordinary skill in the art, as of the filing date of the asserted patents' applications, to practice the claimed inventions without undue experimentation—and thus the Asserted Claims are invalid for lack of enablement. *MagSil*, 687 F.3d at 1380.

Each of the Asserted Claims that requires any of the following claim elements is invalid for lack of enablement.

- **“Synchronization Information.”** Many of the asserted patent claims require a time slot to be determined or reset based on synchronization information, or that synchronization information be used to assign a time slot. For example, claim 1 of the '129 patent recites “the first and second specific time slots are determined based on synchronization information” and claim 18 of the '129 patent recites “the synchronization information comprising information assigning a time slot.” *See also, e.g.*, '129 patent claim 16; '672 patent claim 1; '043 patent claim 1. The specification describes determining a time slot based on synchronization information as using a bitmask. *See* '129 patent at Abstract; 11:7-19; 14:53-20:5. To the extent that Proxense alleges that “synchronization information” does not require bitmasks, all Asserted Claims of the '129, '672, and '043 patents are invalid because the patents do not enable a person of skill in the art to assign or determine time slots without using bitmasks.
- **“Unassigning.”** Claim 1 of the '043 patent recites “unassigning, responsive to the change in the network traffic, the first specific time slot.” The term “unassigning” is never mentioned in the specification outside of the claims, much less with any description of a signaling technique or protocol that would allow for a time slot to be unassigned after an initial assignment. The specification states that “once a specific client exits the network, previously reserved time slots of that client may be reassigned to one or more other client devices in the network.” '043 patent at 15:60-63. But according to the '043 patent, reassigning is different from unassigning. *Compare* '043 patent claim 1 (reciting “unassigning”) *with* claims 5, 8 (reciting “reassigning”). Therefore, this disclosure does not describe “unassigning” because a client device leaving a network and/or reassigning a time slot is not “unassigning.” Moreover, during prosecution, the Examiner rejected the “unassigning” limitation as indefinite, noting that it was unclear what device was being unassigned its time slot. PROX_INTEL-00000086 (April 21, 2015 Rejection) at PROX_INTEL-00000091. Proxense amended the “unassigning” limitation as a result, but did not provide any specification support for the limitation or explain how a POSITA

would perform or implement the claimed unassigning limitation. PROX_INTEL-00000070 (Applicant's July 21, 2015 Response) at PROX_INTEL-00000071, PROX_INTEL-00000077. As a result, to the extent that Proxense argues the prior art cited in this cover pleading and Intel's charts fails to disclose "unassigning" a time slot because the art does not describe how to unassign a time slot, the '043 patent specification fails to enable a reader device "unassigning" a time slot—and therefore claim 1 of the '043 patent is invalid for lack of enablement. *See MagSil*, 687 F.3d at 1380.

V. INEQUITABLE CONDUCT

Intel provides the following initial disclosures of invalidity contentions based on unenforceability due to inequitable conduct. A patentee commits inequitable conduct when it "acted with the specific intent to deceive the PTO," for example when it "knew of the reference" material to patentability, "knew that it was material, and made a deliberate decision to withhold it." *Therasense Inc. v. Becton Dickinson and Co.*, 649 F.3d 1276, 1290 (Fed. Cir. 2011). The Asserted Patents are unenforceable for at least the following reasons:

- **Failure to Disclose the Relevant Standards:** all Asserted Patents "rely [on], or [are] at least partially based, on an IEEE 802.15.4 protocol." *See, e.g.*, '129 patent at 11:5-7. The inventors and prosecuting attorney(s) therefore knew that the 802.15.4 protocol was material to the patentability of the Asserted Patents. As shown above and in Exhibits B1 and B2, all Asserted Claims of the Asserted Patents are anticipated or rendered obvious by the 802.15.4 protocol, at least under Proxense's apparent infringement theories. However, neither of the inventors listed on the Asserted Patents nor the prosecuting attorney(s) cited the 802.15.4 protocol on an information disclosure statement or otherwise provided it to the United States Patent and Trademark Office. *See generally* PROX_INTEL-00000001, PROX_INTEL-00000354, PROX_INTEL-00000831, PROX_INTEL-00001181. Moreover, the patents also recognize that other wireless protocols are also relevant. *See, e.g.*, '129 patent at 8:50-55. The inventors and/or prosecuting attorney(s)

would have been aware of the materiality of such protocols, which would have included the 802.11, 802.15.3, Bluetooth, and/or HomeRF protocols that anticipate and/or render obvious the Asserted Claims but withheld them from the Patent Office. The inventors and prosecuting attorney(s) committed inequitable conduct by deliberately withholding material information (e.g., the 802.15.4, 802.15.3, 802.11, Bluetooth, and/or HomeRF protocols) with the specific intent to deceive the Patent Office, thereby rendering the Asserted Patents unenforceable. *Therasense*, 649 F.3d at 1287.

- **Failure to Disclose Inventors' Own Prior Art:** Named inventor David L. Brown committed inequitable conduct by withholding his own earlier prior art patents that, as shown above, render obvious the Asserted Patents in view of the above-mentioned wireless standards:
 - US 6,011,784 (“’784 patent): the ’784 patent discloses prioritizing time slot assignments based on data type (i.e., isochronous data vs. asynchronous data), which is material to the ’129, ’043, and ’672 patents under Proxense’s apparent infringement theories. *See, e.g.*, ’784 patent at Abstract, 8:24-9:7, 14:21-39, FIG. 4. Mr. Brown was aware of his own ’784 patent and committed inequitable conduct by deliberately withholding it with the specific intent to deceive the Patent Office, thereby rendering the ’129, ’043, and ’672 patents unenforceable. *Therasense*, 649 F.3d at 1287.
 - US 5,754,956 (“’956 patent): the ’956 patent discloses searching for a base station after waking up from a sleep interval, and then returning to sleep, which is material to the ’152 patent under Proxense’s apparent infringement

theories. *See, e.g.*, '956 patent at 4:65-5:5, 5:49-65, 8:30-59, 9:11-17, 10:50-60. Mr. Brown was aware of his own '956 patent and committed inequitable conduct by deliberately withholding it with the specific intent to deceive the Patent Office, thereby rendering the '152 patent unenforceable. *Therasense*, 649 F.3d at 1287.

- US 5,325,405 ("405 patent): the '405 patent discloses using a mask to receive synchronization information, which is material to the '129, '043, and '672 patents. *See, e.g.*, '405 patent at Claim 4. Mr. Brown was aware of his own '405 patent and committed inequitable conduct by deliberately withholding it with the specific intent to deceive the Patent Office, thereby rendering the '129, '043, and '672 patents unenforceable. *Therasense*, 649 F.3d at 1287.
- **Misrepresenting the '129 Patent Family Claims:** During prosecution, Proxense represented to the Patent Office that limitations of the '129 patent claims requiring a class "associated with one or more of [a] ... client device and a user of the ... device" does not cover classes associated with network characteristics/data that the device will send. *See, e.g.*, '129 Patent Claims 1, 16, 18; '672 Patent Claim 1; '043 Patent Claim 1; PROX_INTEL-00000354 at PROX_INTEL-00000386-89; *see also id.* at PROX_INTEL-00000435-38, PROX_INTEL-00000526, PROX_INTEL-00000528-29. However, Proxense alleges infringement by Intel's products based on the purported use of classes associated with network characteristics/data. *See, e.g.*, Amended Preliminary Infringement Contentions Exhibit A at 5 (accusing QoS/access categories communicated in buffer status

report (BSR) as the claimed “class”); 802.11ax Standard at §3.2 (defining “access category (AC)” as “A label for the common set of enhanced distributed channel access (EDCA) parameters that are used by a quality-of-service (QoS) station (STA) to contend for the channel in order to transmit medium access control (MAC) service *data units* (MSDUs) with certain priorities.”) (emphasis added), §9.2.4.6a.4 (showing BSR information including indicating “access categories for which the buffer status is reported”), Table 9-154 (defining access categories based on types of data, including “Best Effort,” “Background,” “Video,” and “Voice” data), Table 10-1 (similar). Similarly, during prosecution, Proxense argued that “[s]imultaneous receipt of data regardless of class teaches away from a priority level being associated with the class of device.” PROX_INTEL-00000354 at PROX_INTEL-00000388-89. However, Proxense alleges infringement by Intel’s products based on the purported use of OFDMA technology, which permits multiple differently situated users to transmit or receive data at the same time. *See, e.g.*, Amended Preliminary Infringement Contentions Exhibit A at 1-6 (accusing OFDMA features in Wi-Fi 6). The inventors and prosecuting attorney(s) committed inequitable conduct by deliberately misrepresenting their view of the scope of the Asserted Claims of the ’129 patent family with the specific intent to deceive the Patent Office, thereby rendering the ’129 patent family unenforceable. *Therasense*, 649 F.3d at 1287. The ’672 and ’043 are related to the ’129 patent and carry a similar disclaimer (*Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1333 (Fed. Cir. 2003)), and are therefore unenforceable for similar reasons.

- **Misrepresenting the '152 Patent Claims:** During prosecution, Proxense represented to the Patent Office that “merely...powering down [a system] and powering up components during a period of inactivity” is not the claimed “timer” that switches from sleep mode to active mode based on time slot information. *See, e.g.,* PROX_INTEL-00000831 at PROX_INTEL-00000983-84. To the extent that Proxense alleges the Asserted Claims nonetheless cover a system that powers down and powers up based on level of activity, the inventors and prosecuting attorney(s) committed inequitable conduct by deliberately misrepresenting their view of the scope of the Asserted Claims of the '152 patent with the specific intent to deceive the Patent Office, thereby rendering the patent unenforceable. *Therasense*, 649 F.3d at 1287.

The conduct above is identified based on facts known to date. Intel reserves the right to identify additional facts and/or information that may establish different acts of inequitable conduct-based discovery, which has not yet begun.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that all counsel of record are being served with a copy of the foregoing document via electronic mail on November 26, 2024.

/s/ Brittany Amadi

APPENDIX

In this Appendix, Intel identifies certain references and combinations of references that, including at least under Proxense's apparent interpretation of the claims, anticipate and/or render obvious one or more of the Asserted Claims. Where a single reference is identified with respect to a claim, that claim is invalid as anticipated and/or as obvious based on the reference alone and/or in combination with the knowledge of a person of ordinary skill in the art at the time of the alleged invention, at least under Proxense's apparent interpretation of the claims.¹⁰ The identified combinations of references are provided in the alternative and are not to be construed to suggest that any reference included in the combinations does not itself render the claims anticipated or obvious.

U.S. Patent No. 8,219,129

Claim 1

At least under Proxense's apparent interpretation, claim 1 is invalid based on the following grounds:

- A. 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mansfield, Mote 1, Mote 2, Odman, or Lan
- B. Ground A in combination with (Brawn, Marko, or Pallassini)
- C. Ground A in combination with (802.11e, 802.15.3, 802.15.4, Ben-Eli, Bluetooth, Brown, Gilb, HomeRF, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward)
- D. Ground C in combination with (Brawn, Marko, or Pallassini)
- E. Ground A in combination with (802.11e, 802.15.4, Ben-Eli, Brown, Gilb, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward) and (802.15.3, 802.15.4, Bluetooth, Brown, HomeRF, Livet, Odman, Turina, or Ward)
- F. Ground E in combination with (Brawn, Marko, or Pallassini)

Claim 16

At least under Proxense's apparent interpretation, claim 16 is invalid based on the following grounds:

¹⁰ Intel reserves the right to present the references in any order. For example, where a ground encompasses "reference A in combination with reference B," such ground includes "reference A in view of reference B" and "reference B in view of reference A."

- A. 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mansfield, Mote 1, Mote 2, Odman, or Lan
- B. Ground A in combination with (Brawn, Marko, or Pallassini)
- C. Ground A in combination with (802.11e, 802.15.4, Ben-Eli, Brown, Gilb, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward)
- D. Ground C in combination with (Brawn, Marko, or Pallassini)

Claim 18

At least under Proxense's apparent interpretation, claim 18 is invalid based on the following grounds:

- A. 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mansfield, Mote 1, Mote 2, Odman, or Lan
- B. Ground A in combination with (Brawn, Marko, or Pallassini)
- C. Ground A in combination with (802.11e, 802.15.4, Ben-Eli, Brown, Gilb, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward)
- D. Ground C in combination with (Brawn, Marko, or Pallassini)

U.S. Patent No. 8,457,672

Claim 1

At least under Proxense's apparent interpretation, claim 1 is invalid based on the following grounds:

- A. 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mansfield, Mote 1, Mote 2, Odman, or Lan
- B. Ground A in combination with (Brawn, Marko, or Pallassini)
- C. Ground A in combination with (802.11e, 802.11-1999, 802.15.3, 802.15.4, Ben-Eli, Bluetooth, Brown, Gilb, HomeRF, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward)
- D. Ground C in combination with (Brawn, Marko, or Pallassini)
- E. Ground A in combination with (802.11e, 802.15.4, Ben-Eli, Brown, Gilb, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward) and (802.11e,

802.11-1999, 802.15.3, 802.15.4, Bluetooth, Brown, Gilb, HomeRF, Huang, Kim, Lan, Livet, Mansfield, Odman, Turina, or Ward)

F. Ground E in combination with (Brawn, Marko, or Pallassini)

U.S. Patent No. 9,265,043

Claim 1

At least under Proxense's apparent interpretation, claim 1 is invalid based on the following grounds:

- A. 802.15.4, 802.15.3, Bluetooth, HomeRF, 802.11e, Mansfield, Mote 1, Mote 2, Odman, or Lan
- B. Ground A in combination with (Brawn, Marko, or Pallassini)
- C. Ground A in combination with (802.11e, 802.11-1999, 802.15.3, 802.15.4, Ben-Eli, Bluetooth, Brown, Gilb, HomeRF, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward)
- D. Ground C in combination with (Brawn, Marko, or Pallassini)
- E. Ground A in combination with (802.11e, 802.15.4, Ben-Eli, Brown, Gilb, Huang, Kim, Lan, Lansford, Livet, Mansfield, Odman, Rabenko, Turina, or Ward) and (802.11e, 802.11-1999, 802.15.3, 802.15.4, Bluetooth, Brown, Gilb, HomeRF, Huang, Kim, Lan, Livet, Mansfield, Odman, Turina, or Ward)
- F. Ground E in combination with (Brawn, Marko, or Pallassini)

U.S. Patent No.8,036,152

Claim 1

At least under Proxense's apparent interpretation, claim 1 is invalid based on the following grounds:

- A. 802.11e, 802.15.4, 802.15.3, Abreu, Bluetooth, Gilb, HomeRF, Liu827, Mote 1, Mote 2, or Ye
- B. Ground A in combination with (802.11-1999, Abreu, Duong, Gilb, HomeRF, Kitchin, Lansford, Liu '827, Liu '877, Tanach, or Ye)

- C. Ground A in combination with (802.11-1999, Abreu, Duong, Gilb, HomeRF, Kitchin, Lansford, or Liu '877) and (Abreu, Gilb, Lansford, Liu '827, Tanach, or Ye)

Claim 7

At least under Proxense's apparent interpretation, claim 7 is invalid based on the following grounds:

- A. 802.11e, 802.15.4, 802.15.3, Abreu, Bluetooth, Gilb, HomeRF, Liu827, Mote 1, or Mote 2
- B. Ground A in combination with (802.11-1999, Abreu, Duong, Gilb, HomeRF, Kitchin, Lansford, Liu '827, Liu '877, Tanach, or Ye)
- C. Ground A in combination with (802.11-1999, Abreu, Duong, Gilb, HomeRF, Kitchin, Lansford, or Liu '877) and (Abreu, Gilb, Lansford, Liu '827, Tanach, or Ye)