

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner

v.

DSS TECHNOLOGY MANAGEMENT, INC.
Patent Owner

Case IPR2015-00369
Patent 6,128,290

DECLARATION OF DR. JING HU

APL 1014
IPR2015-00369

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I, Dr. Jing Hu, hereby declare as follows:

I. Introduction

1. I am over the age of eighteen (18) and otherwise competent to make this declaration.

2. I have been retained as an expert witness on behalf of APPLE INC. for the above-captioned *inter partes* review (IPR). I am being compensated for my time in connection with this IPR at my standard legal consulting rate, which is \$250 per hour.

3. I understand that this *inter partes* review involves U.S. Patent No. 6,128,290 (the '290 patent'), APL 1001, which issued from U.S. Patent Application No. 08/949,999 (the '999 application'), filed on October 14, 1997. The '290 patent names Phillip P. Carvey as the sole inventor. The '290 patent issued on October 3, 2000, from the '999 application. It is my understanding that the '290 patent is currently owned by DSS Technology Management, Inc.

4. In preparing this Declaration, I have reviewed the '290 patent and considered each of the documents cited herein in light of the general knowledge in the art at the time of the alleged inventions. In formulating my opinions, I have relied upon my experience, education, and knowledge in the relevant art(s). I have also considered the viewpoint of a person of ordinary skill in the art ("POSA") at the relevant time period.

II. My Background and Qualifications

5. I hold a doctoral degree (PhD) in Electrical and Computer Engineering, granted by University of California, Santa Barbara in 2007, as well as a Master's degree in Electrical and Computer Engineering from Rice University in 2003, and a Bachelor's degree in Precision Instruments from Tsinghua University, Beijing, China in 2001.

6. I worked as a research scientist and embedded software engineer at Cisco Systems, Inc. between the years of 2007 and 2012. At Cisco Systems, I worked on a series of projects that included wide area network optimization, video quality monitoring, and multimedia conferencing systems on digital signal processing parts of enterprise network routers. I designed algorithms, wrote production source code and conducted unit testing on these projects.

7. I have conducted research in both academia and industry for over ten years. My research topics include wireless network optimization, information theory, video compression, and communication over wireless networks. I have published numerous peer-reviewed research papers on these topics. My research paper "Video capacity of Wireless LANs with a multiuser perceptual quality constraint" won Best Paper Award of IEEE Transactions on Multimedia over the years of 2007 to 2009. Please see my *Curriculum Vitae* (CV) for the list of my

other published research papers. I have been a visiting researcher at University of California, Santa Barbara since early 2013.

8. I am an inventor of four awarded or pending U.S. patents, on topics ranging from wide area network optimization to video quality monitoring in the network and in the endpoints. Please see my CV for the list of my patents and patent applications.

9. I have co-authored a book titled “Rate Distortion Bounds for Voice and Video,” published in the prestigious Foundations and Trends in Communications and Information Theory Series, in February 2014. In this book, my co-author and I teach the current best-performing voice and video codecs for communication over wired, wireless, and cellular networks and present the first rate distortion bounds for voice and video that lower bound the operational rate distortion performance of these codecs.

10. In the course of my research and product development related to data communication over wireless and wired networks, I worked extensively with communication protocols across various layers of the networks, including, for example, IEEE 802.11, Asynchronous Transfer Mode (ATM), Ethernet, and High-Level Data Link Control (HDLC) on the data link layer. I have both designed data communication algorithms and developed relevant products that function over and/or interoperate with the networks governed by these protocols.

11. I have been engaged as an expert consultant in many technology-based matters for the past three years, with a focus on patent infringement and patent portfolio evaluation. My cases have covered diverse areas such as Bluetooth technologies, cellular networks, smart handheld devices, banking and security related software, video compression related software, and television systems.

12. Additional information concerning my qualifications are set forth in my current CV, a copy of which is attached hereto as Exhibit APL 1015.

III. List of Documents Considered in Formulating My Opinions

13. In formulating my opinions, I have considered the following documents and any other documents cited herein:

Exhibit / Paper #	Description
1	Apple's Petition for <i>Inter Partes</i> Review of U.S Patent No. 6,128,290
9	Institution Decision by Patent Trial and Appeal Board
17	Patent Owner DSS Technology, Inc.'s Response to Petition
APL 1001	Carvey, U.S. Patent No. 6,128,290, "Personal Data Network," (filed October 14, 1997; issued October 3, 2000) ("the '290 patent").
APL 1003	Natarajan <i>et al.</i> , U.S. Patent No. 5,241,542, "Battery Efficient Operation of Scheduled Access Protocol," (filed August 23, 1991; issued August 31, 1993) ("Natarajan").
APL 1004	Neve <i>et al.</i> , U.S. Patent No. 4,887,266, "Communication System," (filed April 29, 1986; issued December 12, 1989) ("Neve").
APL 1005	File history of U.S. Patent No. 6,128,290

Exhibit / Paper #	Description
APL 1006	Application No. 08/611,695 (as-filed)
APL 1007	Apple's Claim Construction Brief in Case No. 6:13-cv-00919-JDL (EDTX)
APL 1011	Deposition Transcript of Robert Dezmelyk, IPR2015-00369 and IPR2015-00373, December 15, 2015 ("Dezmelyk Depo.")
APL 1012	Mischa Schwartz, Telecommunications Networks: Protocols, Modeling and Analysis, Addison-Wesley, 1988 ("Schwartz")
APL 1013	Tom Sheldon, Encyclopedia of Networking & Telecommunications, Lisa Wolters-Broder ed., McGraw Hill, 2001 (other excerpts submitted as DSS 2010)
DSS 2001	U.S. Patent No. 5,699,357
DSS 2002	Definition of " <i>e.g.</i> ," Black's Law Dictionary (9th ed. 2009)
DSS 2003	Myk Dormer, <i>Low Duty Cycle?</i> , Electronics World Magazine, Dec. 2008, <i>available at</i> http://www.radiometrix.com/files/additional/Low-Duty-Cycle.pdf
DSS 2004	U.S. Pat. No. 7,558,232
DSS 2005	U.S. Pat. No. 7,092,762
DSS 2006	U.S. Pat. No. 7,049,620
DSS 2007	U.S. Pat. No. 8,837,653
DSS 2008	U.S. Pat. No. 8,727,561
DSS 2009	Definition of "burst," Chambers Dictionary of Science and Technology (1st ed. 1999)
DSS 2010	Tom Sheldon, <i>Encyclopedia of Networking & telecommunications</i> , 549, (Lisa Wolters-Broder ed., McGraw Hill 2001)
DSS 2011	U.S. Pat. No. 3,598,914
DSS 2012	U.S. Pat. No. 6,983,031
DSS 2013	Yurcik, William J., <i>Serial and Parallel Transmission</i> . Computer Sciences. 2002. Encyclopedia.com, <i>available at</i> http://www.encyclopedia.com
DSS 2014	<i>Asynchronous HDLC MC68360 ASYNC HDLC Protocol Microcode User's Manual</i> , 8, (Freescale Semiconductor, Inc. 1996)

Exhibit / Paper #	Description
DSS 2016	Declaration of Mr. Robert Dezmelyk (“Demelyk Dec.”)
DSS 2017	Wmat Auppu, <i>AIF Inter DSP Communication</i> , 1, available at http://processors.wiki.ti.com/index.php/AIF_Inter_DSP_Communication

IV. Legal Principles

14. I understand that, during an *inter partes* review, claims are to be given their broadest reasonable construction in light of the specification as would be understood by a person of ordinary skill in the relevant art.

15. I understand that to determine how a person of ordinary skill would understand a claim term, one should look to those sources available that show what a person of skill in the art would have understood disputed claim language to mean. Such sources include the words of the claims themselves, the remainder of the patent’s specification, the prosecution history of the patent (all considered “intrinsic” evidence), and “extrinsic” evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.

16. I understand that words or terms should be given their ordinary and accepted meaning unless it appears that the inventors were using them to mean something else. I understand that a person of ordinary skill in the art is deemed to read a claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the

specification. For this reason, the words of the claim must be interpreted in view of the entire specification. Put another way, claim terms are given their broadest reasonable interpretation that is consistent with the specification and the prosecution history.

17. In addition to consulting the specification, one should also consider the patent's prosecution history. The prosecution history provides evidence of how both the Patent Office and the inventor(s) understood the terms of the patent, particularly in light of what was known in the prior art. Furthermore, where the specification describes a claim term broadly, arguments and amendments made during prosecution may require a more narrow interpretation.

18. I understand that while intrinsic evidence is of primary importance, extrinsic evidence, e.g., all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises, can also be considered. For example, technical dictionaries may help one better understand the underlying technology and the way in which one of skill in the art might use the claim terms. Extrinsic evidence should not be considered, however, divorced from the context of the intrinsic evidence.

19. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art in view of the prior art, and in light

of the general knowledge in the art. I also understand when a person of ordinary skill in the art would have reached the claimed invention through routine experimentation, the invention may be deemed obvious.

20. I also understand that obviousness can be established by combining or modifying the teachings of the prior art to achieve the claimed invention. It is also my understanding that where there is a reason to modify or combine the prior art to arrive at the claimed invention, there must also be a reasonable expectation of success in so doing. I understand that the reason to combine prior art references can come from a variety of sources, not just the prior art itself or the specific problem the patentee was trying to solve. And I understand that the references themselves need not provide a specific hint or suggestion of the alteration needed to arrive at the claimed invention; the analysis may include recourse to logic, judgment, and common sense available to a person of ordinary skill that does not necessarily require explanation in any reference.

21. I understand that when considering the obviousness of an invention, one should also consider whether there are any secondary considerations that support the nonobviousness of the invention. I understand that secondary considerations of nonobviousness include failure of others, copying, unexpectedly superior results, perception in the industry, commercial success, and a long-felt but unmet need.

V. Person of Ordinary Skill in the Art

22. I understand that a person of ordinary skill in the art (“POSA”) is one who is presumed to be aware of pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. In my opinion, a person of ordinary skill in the art at the time of the priority date of the ’290 patent would be a person with an undergraduate degree in Electrical Engineering and 1-2 years of experience working with wireless network technology, or equivalent education and/or work experience. I am familiar with what a POSA would have known at the time of the priority date of the ’290 patent.

VI. State of the Art and Summary of References

23. In my opinion, the references asserted against the ’290 patent claims and discussed herein clearly show that the features recited in the ’290 patent claims were well known in the prior art. To the extent that a particular feature is not explicitly described in one of the asserted references, it is my opinion that these features would have been obvious to a POSA.

24. Many of the claimed limitations are simply well known components of wireless communication systems performing their standard functions. For example, the claims recite basic features such as a “server microcomputer unit” communicating with multiple “peripheral units,” where these components each have a transmitter and receiver. Energizing the transmitters and receivers only

during designated transmission slots was also well known. So too was synchronizing devices so that they could rely on timed communication plans.

25. It is my opinion that the '290 patent claims merely recite a collection of well known components performing their standard function according to well known techniques. In my opinion, the '290 patent claims do not recite any features that were not previously known in the art or would not have been obvious to a POSA.

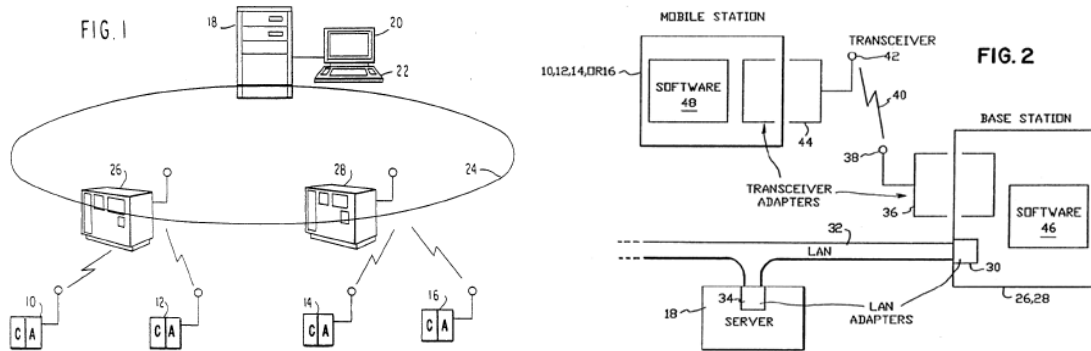
26. It is my understanding from reviewing DSS's Patent Owner Response to Petition that DSS only contends that one feature—the server transmitter being 'energized in low duty cycle RF bursts' is not taught or suggested by the combination of prior art references. Therefore, my opinions and analysis herein focus on this claim element.

27. Exemplary relevant art that was published before October 14, 1997 includes the references described below.

A. Natarajan

28. Natarajan is directed to battery power conservation in wireless communications of mobile computers controlled by multi-access protocols. (Natarajan, 1:6-12.) Figure 1 shows that multiple mobile units (10, 12, 14, 16) communicate with base stations (26, 28) via wireless radio links. (Natarajan, 2:28-39, Figure 1.) Natarajan describes that the base stations can be a "conventional

microcomputer” and that the mobile units can be a “hand held or laptop computer.” (Natarajan, 2:40-41, 2:58-59.) Both the base stations and mobile units have an RF transceiver for establishing a radio link. (Natarajan, 2:51-56, 2:65-67.) A system



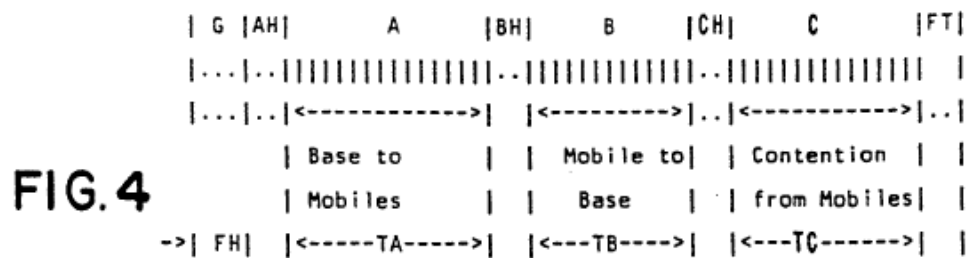
schematic common to both the base station and mobile stations is illustrated in FIG. 3. (Natarajan, 3:7-8.) Each device includes, for example, a microprocessor system (56) that controls the transceiver via an interface (58). (Natarajan, 3:14-15.) The microprocessor system also includes a dedicated microprocessor (62) with high-resolution time interval determination hardware or “timers.” (Natarajan, 3:18-21.)

29. Natarajan describes that its system is intended “for minimizing battery power consumed by wireless link adapters at the mobile units.” To do so, Natarajan describes turning off the transmitter and receivers when not in use. (Natarajan, 4:2-5.) More specifically, Natarajan describes that:

[s]cheduled access multiaccess protocols can be implemented to effectively conserve battery power by suitable control of the state of transmitter and receiver units at the portable units (i.e., by scheduling

when they should be turned ON or OFF). A desirable solution is one in which the transmitter (or receiver) consumes power only when it is actively transmitting a message (or actively receiving a message). (Natarajan, 3:59-4:6.)

30. Natarajan further describes that the scheduled multiaccess protocol divides time into ‘fixed-length frames, and frames are divided into slots,’ as shown, for example, in FIG. 4. (Natarajan, 4:20-23, FIG. 4.) The frames are divided into subframes where, for example with respect to FIG. 4, one subframe is for transmitting data packets from the base station to mobile units (Period A), a second subframe is for contention-free transmission from mobile units to the base station (Period B), and a third subframe is for ‘bursty data traffic’ in a contention mode from mobile units to the base station (Period C). (Natarajan, 4:27-38.)



31. Natarajan describes that in Period A, the base station controls the outbound transmissions to the mobile units. (Natarajan, 4:40-41.) Prior to Period A, the base station broadcasts a header (AH) to the mobile units that includes: a list of mobile units that will be receiving data packets from the base station, the order in which the mobile units will receive the data packets, and the number of data

packets that will be transmitted to each mobile unit. (Natarajan, 4:45-53.) If a mobile unit is not included in header (AH), it will not be receiving data from the base station, and can turn off its receiver for Period A. (Natarajan, 4:63-67.) Because the mobile units know the order and number of data packets to be transmitted, each mobile unit that will be receiving data can compute when its designated transmission slot will be, go to sleep until that time, and wake itself up in its designated time slot to receive data. (Natarajan, 4:67-5:4.) After receiving its data, the receiver can go back to sleep for the remainder of Period A. (Natarajan, 5:4-6.)

32. Natarajan similarly discloses broadcasting another header (BH) for scheduling which mobile units will be allowed to transmit to the base station and the order they will transmit. (Natarajan, 5:9-29.) Flow charts of these processes are shown, for example, in FIGS. 8A-8D and described in Natarajan at 8:14-9:54. Using this scheme, the mobile units save power by powering up only during their designated reception or transmission time slot.

33. Natarajan also describes that header (AH) includes “a coded description of mobile users that will receive data in the current frame. That is, it is a designation of which mobile users are to communicate with the base station during this frame.” (Natarajan, 6:19-22.) Header (BH) similarly includes “a coded designation or description of mobile users that can transmit data in the current

frame.” (Natarajan, 6:31-33.) Natarajan describes assigning each mobile unit an index number during a “registration period” which is “needed to associate each mobile unit in the network with the intended base station.” (Natarajan, 6:48-54.)

34. The header (AH) transmitted from the base station includes a “Receiving Users designation or Index message portion” that is a bit-vector sequence with a bit for each of the registered mobile units. (Natarajan, 6:55-58.)

FIG. 5 illustrates an example of this sequence.

FIG. 5

```
| 00010001100000 ***** 1000000 |
| <----- 64 bits -----> |
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35. Natarajan specifically describes that the “coded description” designates whether or not each mobile unit will communicate with the base station during a particular time frame:

The content of each bit location signals the receiver activity of the user designated or indexed by the bit location. For example, reading left to right, a “1” in the 4th, 8th, 9th, etc. bit location can be used to signal that the 4th, 8th, 9th, etc. mobile unit is designated to receive one message in the current frame period. “0” in the 1st, 2nd, 3rd, etc. bit location signals that the 1st, 2nd, 3rd, etc. mobile unit is inactive (is not designated to receive any data) and can turn its receiver power OFF until the beginning of Header BH.

(Natarajan, 6:59-68.)

An analogous scheme is used in the header (BH) for transmission from the mobile units to the base station. (Natarajan, 7:1-6.) This scheduled communication scheme reduces power consumption by requiring that the mobile units only be powered on during time slots where they will be receiving or transmitting data. (Natarajan, 7:6-15.)

B. Neve

36. Neve is directed to “[a] communication system able to provide multiple path communication between a plurality of stations operating on a single channel. The stations are synchronized and a cyclically repeating series of time slots is defined.” (Neve, Abstract.) In order to provide radio data communication, Neve discloses that each device includes “a transmitter and receiver device (transceiver) 2 which includes an antenna 3, a transmitter circuit 4 and a receiver circuit 5.” (Neve, 3:59-63.) The transceiver is connected to a digital control processor, which controls data transfer to and from the transmitter and receiver. (Neve, 3:64-68.)

37. Neve describes that it is “desirable to provide a communications system in which the transmitting and receiving apparatus is small, may be easily installed in any location, and is of very low power consumption.” (Neve, 1:31-34.) Thus, Neve’s system “enables a very low power consumption to be achieved in the

cases where the device requires to transmit data only rarely or the receiver receives the predetermined code signal only rarely...a device may need to transmit data for only a fraction of a second in many hours.” (Neve, 2:25-31.)

38. Neve describes that when data transfer is not taking place, the device can enter a lower power consumption state. (Neve, 2:13-16.) The system is designed “automatically to re-enter the data transfer condition when either a signal is received from the device indicative of the need to transmit data or a predetermined code signal is received by the receiver circuit indicative of the need to receive data.” (Neve, 2:19-24.) So, the receiver has very low power consumption because only the internal timing circuitry is energized continuously, whereas the rest of the receiving circuit is energized only when its assigned time slot occurs. (Neve, 2:39-41.) Similarly, the transmitter only needs to be energized when transmission is required. (Neve, 2:45-47.)

39. The time slots include “at least one synchronisation time slot, at least one interrupt time slot, and a plurality of address or data time slots, wherein any other station can transmit a message to the master station during an interrupt time slot to indicate a request to communicate.” (Neve, 3:12-17.) Neve describes that the receiver circuit “includes a low power timing circuit which operates to energise the rest of the receiver circuit only for the time slot in which its address may occur

and for the synchronisation time slot thereby enabling it to maintain synchronisation with low power consumption.” (Neve, 4:43-48.)

40. Neve further describes that controlling the transceiver includes power up, cadence capture, bit synchronization, and a bit synchronization clock. (Neve, 6:7-11.) The clock is always active and the fundamental frequency of the oscillator is used as the system clock for the CPU. (Neve, 6:11-14.)

VII. Claims 1-4 would have been obvious to a POSA over Natarajan in view of Neve.

41. Having reviewed claims 1-4 of the '290 patent and the prior art of record, it is my opinion that each and every limitation of claims 1-4 is disclosed by Natarajan and/or Neve or would have been obvious to a POSA in view of the combination of Natarajan and Neve. Therefore, it is my opinion that claims 1-4 of the '290 patent would have been obvious in view of Natarajan and Neve.

42. Having reviewed Patent Owner DSS Technology Inc.'s Response to Petition, it appears that DSS's only contention is that the combination of Natarajan and Neve does not teach or suggest a server transmitter “energized in low duty cycle RF bursts,” as recited in independent claim 1. It is my opinion that this feature *is*, in fact, taught by the combination of Natarajan and Neve. At the very least, should the Board find, wrongly in my opinion, that this feature is not expressly taught by the prior art, this feature would have been obvious to a POSA in view of Natarajan and Neve.

43. The general term “low duty cycle RF bursts” is not expressly defined in the ’290 patent. I agree with the Board’s position in the Institution Decision that, under the broadest reasonable interpretation of this term, Natarajan’s “scheduled multi-access protocol in which time is divided into fixed-length frames, along with Natarajan’s description of frames being divided into slots and multiple subframes” demonstrates that Natarajan discloses “said server and peripheral transmitters being energized in low duty cycle RF bursts.” (Institution Decision, p. 18.) This is because, like the 290 patent, Natarajan discloses that [s]cheduled access multiaccess protocols can be implemented to effectively conserve battery power by suitable control of the state of transmitter and receiver units at the portable units (i.e., by scheduling when they should be turned ON or OFF)...the transmitter (or receiver) consumes power only when it is actively transmitting a message (or actively receiving a message).” (Natarajan, 3:59-4:6.) Under the broadest reasonable interpretation of this term, a POSA would consider a system operating in this manner to operate in “low duty cycle RF bursts.”

44. DSS asserts that Natarajan only describes that the mobile units operate in the manner described above. (POR, p. 16.) However, it is my opinion that a POSA would have understood that the base station would have operated similarly, that is, when the base station is not transmitting, its transmitter is powered off. As described in Natarajan, “[m]ost users are very likely to be inactive (both Transmit-

Inactive and Receive-Inactive) ***most of the time*** for most applications. This is primarily due to the bursty nature of data communication traffic.” (Natarajan, 6:41-44 (emphasis added).) Because most of the users are inactive most of the time, the base station will not have information to transmit most of the time. Therefore, when it is not transmitting, it will be powered off. Based on this description, a POSA would have understood Natarajan’s base station and mobile units operate in “low duty cycle RF bursts.”

45. Furthermore, as described above, Natarajan explicitly discloses that the mobile unit transmitters operate in “low duty cycle RF bursts.” (Natarajan, 3:59-4:6.) Therefore, it would have been obvious to a POSA to have the base station operate in an analogous manner. The RF systems of the base station and mobile stations in Natarajan have the same physical structure. (Natarajan, 3:7-8, FIG. 3.) A POSA applying the exact design disclosed in Natarajan to an application exactly as described in Natarajan where “***[m]ost users are very likely to be inactive*** (both Transmit-Inactive and Receive-Inactive) ***most of the time***,” (Natarajan, 6:41-44 (emphasis added)) would have conceived a system in which both the transmitter and the receiver of both the base station and the mobile stations operate in “low duty cycle RF bursts.” Therefore, it is my opinion that a POSA would not have found the “low duty cycle RF bursts” recited in claim 1 of the ’290 patent to be novel.

VIII. HDLC is consistent with low duty cycle RF burst communications.

46. DSS asserts that the High-Level Data Link Control (HDLC) packet structure disclosed in Natarajan is inconsistent with a server transmitter being energized in low duty cycle RF bursts. (POR, pp. 20-22.) For the reasons below, it is my opinion that DSS's position is wrong. To the contrary, HDLC is consistent with low duty cycle RF burst communications.

A. The preferred embodiment disclosed in the '290 patent uses HDLC.

47. The preferred embodiment of the '290 patent discloses using HDLC for communication between the PDA and PEAs. Therefore, if HDLC is not compatible with low duty cycle RF burst communications, then the preferred embodiment in the '290 patent would not work.

48. The basic scheme of the '290 patent's frame structure is "a form of time division multiple access (TDMA)." ('290 patent, 5:45-50.) The '290 patent states that "[a]s will be understood by those skilled in the art, the TDMA system is greatly facilitated by the establishment of a common frame time base between PEA and PDA." ('290 patent, 7:63-65.) I agree this was well-known in the art. The '290 patent describes that establishment of a common frame time base is accomplished using synchronization beacons (SBs). ('290 patent, 7:65-67.) Before receiving the SBs, a PEA is associated with the PDA using a succession of Attachment Beacons (ABs), which are "***composed of RF bursts*** having the same interval spacings as

Synchronization Beacons,” broadcast from the PDA to the PEAs. (’290 patent, 9:13-16 (emphasis added), 9:66-10:2.) The 290 patent states that [t]his succession of ABs ***forms an HDLC channel*** using bit-stuffing to delineate the beginning and end of a packet.” (’290 patent, 10:2-4 (emphasis added).)

49. In view of this disclosure in the ’290 patent, a POSA would have understood that the preferred embodiment of the ’290 patent discloses using HDLC to transmit and receive RF bursts of relatively small number of bits in a non-continuous fashion, due to the small size of the Attachment Beacons (ABs) and the interval spacings between the ABs. Furthermore, in view of my own understanding of HDLC, it is my opinion that HDLC is compatible with low duty cycle RF burst communications and a POSA would have understood the same.

B. Mr. Dezmelyk’s understanding of HDLC is incorrect.

50. Mr. Dezmelyk admits he is not an expert in HDLC. (Dezmelyk Depo., 26:15-16.) This is clear, in my opinion, because his explanations of the HDLC protocol are factually inaccurate.

51. Based on my knowledge and experience, an accurate description of the HDLC protocol is found in *Telecommunication Networks: Protocols, Modeling and Analysis*, Addison-Wesley (1988) by Mischa Schwartz (APL 1012), which is specifically referred to in Natarajan. (Natarajan, 3:28-40.) Because the Schwartz book is specifically referenced in Natarajan, this would have been the most logical

resource for a POSA to consult for information on Natarajan's HDLC packet structure. I found it surprising that neither DSS nor Mr. Dezmelyk looked to the Schwartz book for information on HDLC.

52. Pages 135-136 of Schwartz and Figure 4-9, reproduced below, provide a concise summary of the HDLC frame format as it would have been understood by a POSA:

The standard frame format for HDLC (ADCCP and SDLC have the same format) appears in Fig. 4-9. Note that the number of overhead (control) bits is $\ell' = 48$, just the number used earlier for calculations. The eight-bit flag sequence 01111110 that appears at the beginning and end of a frame is used to establish and maintain synchronization. Because the flag appears at the beginning and end of the frame there is no need to prescribe an information field structure. The information field (packet) delivered from the network layer above can be any desired number of bits. Extended versions of the frame structure of Fig. 4-9 are available as well: The address, control, and block-check fields can all be increased to allow additional addressing, improved error detection, and increased sequence numbers. Since the flags appearing at the beginning and end of a frame contain six consecutive ones, that sequence may not appear anywhere else in the frame. Bit stuffing is used to eliminate this possibility: a zero is inserted at the transmitter any time that five ones appear outside the F fields. The zeros are removed at the receiver. If seven ones appear anywhere in the frame (six ones followed by an additional one), the frame is declared in error.

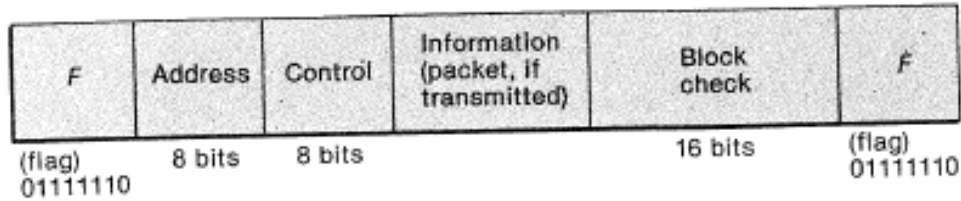


Figure 4-9 HDLC standard frame format

53. Schwartz also describes that [w]hen the transmitter reaches its maximum sequence number ***it is forced to stop transmitting*** until a frame in the reverse direction is received, acknowledging an outstanding packet.” (Schwartz, p. 136 (emphasis added).) Thus, the transmitter does not continuously transmit under HDLC protocol. This is also shown in the throughput calculation analysis illustrated in Figure 4-13, reproduced below, which indicates periods (e.g., between I10 and I30) where the transmitter is idle (i.e., not transmitting). As described in Schwartz, Figure 4-13 illustrates the maximum throughput, so the amount of time the transmitter is not transmitting is at a minimum. (See Schwartz, p. 142 (“This station is assumed in addition to be in a saturated state: It *always* has frames to send. As noted earlier, this provides the maximum possible throughput.” (emphasis original).) A POSA would understand that, in cases where the primary station is not saturated, there will be additional periods where the transmitter is not transmitting.

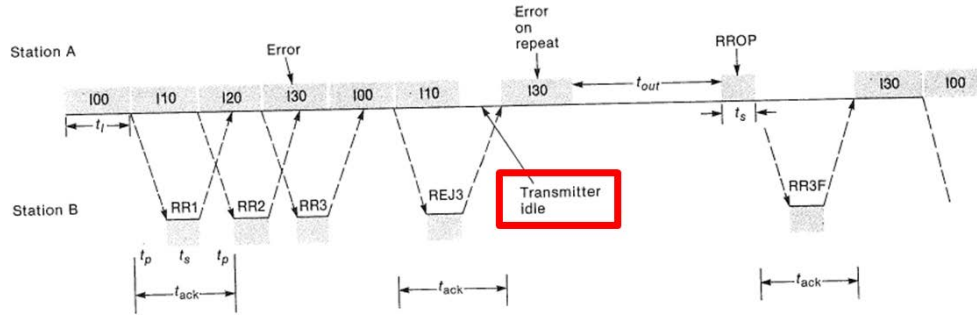


Figure 4-13 Example of error-recovery procedures, version of HDLC, $M = 4$

Annotated Figure 4-13 of Schwartz

54. Thus, as would have been understood by a POSA, the HDLC protocol, for example as described in Schwartz, does not require continuous transmission as asserted by DSS, and can be deployed in a low duty cycle communication. And, as illustrated, for example, in Figure 4-13, the transmissions occur in “bursts.”

55. Schwartz also describes the three modes of operation for the HDLC protocol. (Schwartz, pp. 137-138.) The third mode listed, the asynchronous balanced mode (ABM), is for point-to-point transmission only. Therefore, ABM is inapplicable to Natarajan, which discloses point-to-multipoint communication. The normal response mode (NRM) and asynchronous response mode (ARM) are used for point-to-multipoint operation. (Schwartz, p. 137.) A POSA would have understood that Natarajan operates using the ARM because it provides that “the secondary station does not need permission from the primary station to initiate transmission.” (Schwartz, p. 137.) This type of communication occurs in Period C

in Natarajan, which allows for “bursty data traffic in a contention mode from mobile units to base station.” (Natarajan, 4:36-37.) In Period C, the mobile units initiate transmission without permission from the base station.

56. In my opinion, DSS’s arguments are flawed that Natarajan does not teach low duty cycle RF bursts because it employs HDLC protocol. To begin with, DSS’s reliance on the excerpt from DSS 2010 is misguided. DSS asserts that the cited definition for “bit-oriented framing” shows that HDLC “involves continuous outbound transmission.” (POR, pp. 20-22.) However, as indicated in the first sentence of the section cited by DSS, it states that it pertains to “[a] **point-to-point connection** between two computers or devices consists of **a wire** in which data is transmitted as a stream of bits.” (DSS 2010, p. 549 (emphasis added).) Thus, the description cited by DSS only applies to a point-to-point wired communication, not a point-to-multipoint wireless system, as taught in Natarajan.

57. A point-to-point connection between two computers or devices that consists of a wire is the simplest form of data communication. Firstly, the connection is dedicated to the two computers or devices communicating exclusively to each other, and hence no scheduling mechanism is required beyond specifying the direction of data transmission over the dedicated connection, i.e., which of the two peer computers or devices is transmitting (and the other peer computer or device would be receiving) at any given time. Secondly, the

connection consists of a wire, in which data travels at a high speed within the isolation provided by the wire, and hence the transmission bit rate, transmission delay, and interference with nearby devices and systems—the three major issues faced when designing a wireless connection—are of little relevance to the design of a point-to-point wired connection.

58. A wireless point-to-multipoint system, on the contrary, allows data communication over an open channel among more than two devices. When a base station transmits, there are multiple peripheral devices capable of receiving at the same time; similarly, when a base station receives, multiple peripheral devices can compete to transmit to the base station. Therefore, a sophisticated scheduling mechanism needs to be established to achieve the point-to-multipoint communication. Unlike a point-to-point wired connection in which simplicity and reliability are usually the only design goals, a point-to-multipoint wireless connection often needs to prioritize the system data rate, interference avoidance, delay management, and power management.

59. Recognizing these fundamental differences between a point-to-point wired connection and a point-to-multipoint wireless connection is important because ignoring them and applying a design suited for one type of connection to the other type of connection will result in underutilization of system resources at best and system failure at worst. For example, applying the frame structure

disclosed in Natarajan to a point-to-point wired connection will result in almost all time slots in subframe C (the designated contention subframe) being wasted as there is only one peripheral device in the point-to-point connection. Similarly, enforcing a continuous transmission of so called ‘idle words’ to maintain synchronization whenever there is no data being transmitted—a scheme suitable for an isolated point-to-point wired connection to achieve design simplicity and reliability—is detrimental to a point-to-multipoint wireless connection because it interferes with the carefully designed scheduling and synchronization mechanism, wastes power, decreases the system data rate, and pollutes the wireless channel potentially shared by many devices and systems.

60. For these reasons I disagree with Mr. Dezmelyk’s assertion that a point-to-point connection and a point-to-multipoint connection are the same “in particular [when] the question is what the channel looks like.” (Dezmelyk Depo., 102:19-103:2.) I also disagree with Mr. Dezmelyk’s assertion that the quoted passage in DSS 2010 is applicable to the wireless communication protocols. (Dezmelyk Depo., 113:15-114:3.) In his deposition, Mr. Dezmelyk references a sentence in the quoted passage in DSS 2010: “[i]t provides a way for a sender to transmit a set of bits that are meaningful to the receiver,” as evidence that this passage also applies to wireless communication. (Dezmelyk Depo., 113:15-114:3 (referencing DSS 2010, p. 549.) This is incorrect. This sentence describes a generic

function of all data communication, and is not proof that the two distinct types of data communication—a point-to-point wired data communication and a point-to-multipoint wireless data communication—are the same. Nor does this sentence show that the quoted passage, specified by the author to refer to a point-to-point wired communication, is also applicable to a point-to-multipoint wireless communication.

61. DSS also asserts that the quoted passage in DSS 2010 indicates that the “HDLC [*sic*] packet structure is used to transmit ***‘long*** strings of data at one time,” alleging that this is inconsistent with “small” RF bursts. (POR, p. 21 (emphasis original).) I note that the actual quote in DSS 2010 is: “[t]his type of framing allows the sender to transmit ***a long string of bits at one time.***” (DSS 2010, p. 549 (emphasis added).) A POSA would have understood that within the context of framing, bit-oriented protocols such as HDLC add special bit sequences to the beginning and end of a string of bits to be transmitted, and hence the upper layers of the sender that has data bits to transmit “at one time” don’t have to break the string of bits into smaller frames or packets before the string of bits reach the data link layer. This clearly does not mean that HDLC can only handle a long string of bits; nor does it suggest that the transmission of a string of bits of any length is not a “burst.”

62. Furthermore, another portion of DSS 2010 describing Figure H-2, shown below, discloses that the number of bits in the Information Field of an HDLC frame is “variable.” (APL 1013, p. 582, Figure H-2.) This corroborates Schwartz, which discloses that “[t]he information field (packet) delivered from the network layer above can be **any desired number of bits.**” (Schwartz, p. 135 (emphasis added).) An information field that “can be any desired number of bits” supports that the HDLC frame format is compatible with a “burst” transmission.

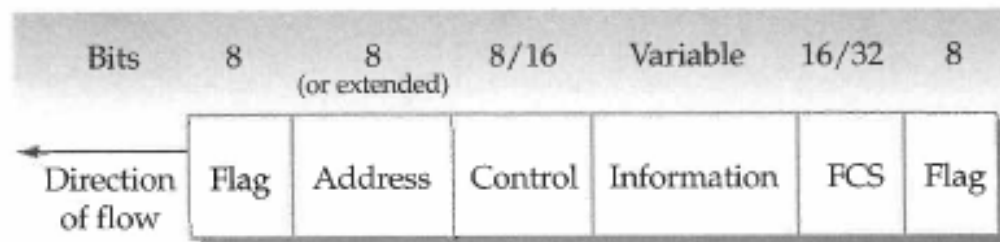


Figure H-2. HDLC frame definition

63. Mr. Dezmelyk combines the excerpt from DSS 2010 with an excerpt from DSS 2013 to suggest that Natarajan teaches continuous transmission by the base station. But Natarajan does not teach continuous transmission by the base station. Mr. Dezmelyk notes that Natarajan’s HDLC packets are provided in “serial form.” (Dezmelyk Dec. ¶ 35 (citing APL 1003 at 3:36-37).) Pointing to DSS 2013, he then alleges that serial communication systems “include a server transmitter transmitting idle words when no useful data is being transmitted.” (Dezmelyk Dec. ¶ 35.) First, I note that DSS 2013 does not use the term “idle words.” And second, idle words are not used in Natarajan.

64. Mr. Dezmelyk provides a quote: “In *synchronous transmission*, groups of bits are combined into frames and frames are sent continuously with or without data to be transmitted.” (Dezmelyk Dec. ¶ 35 (quoting DSS 2013, p. 2 (emphasis added)).) But this quote does not describe the HDLC protocol in Natarajan, which is *asynchronous*. Mr. Dezmelyk is wrong that a POSA would not have known whether Natarajan operates under a synchronous or asynchronous protocol. (See Dezmelyk Depo., 99:12-20.) In my opinion, this illustrates his lack of understanding of HDLC. As discussed above, a POSA would have understood that Natarajan specifically operates under the asynchronous response mode (ARM) of HDLC.

65. In fact, the very next sentences in DSS 2013 after the sentence quoted by Mr. Dezmelyk describe that “[i]n asynchronous transmission, groups of bits are sent as independent units with start/stop flags and no data link synchronization, to allow for arbitrary size gaps between frames. However, start/stop bits maintain physical bit level synchronization once detected.”(DSS 2013, p. 2.) These “start/stop flags” that are used to maintain synchronization corroborate Schwartz’s disclosure of HDLC that an “eight-bit flag sequence 01111110 that appears at the beginning and end of a frame is used to establish and maintain synchronization.” (Schwartz, p. 135.) A POSA would have understood that, in HDLC, transmission is not continuous, but rather there are gaps between frames.

66. Mr. Dezmelyk adds an excerpt from DSS 2014 together with the excerpts from DSS 2010 and DSS 2013. (Dezmelyk Dec. ¶ 35 (quoting DSS 2014 at Section 2.5.6. (“When transmitting, the Asynchronous HDLC controller will transmit IDLE characters (characters consisting of only “1’s) when no data is available for transmission.”)).) In my opinion, this association is inappropriate for two reasons. First, DSS 2014 is related to point-to-point communications, not point-to-multipoint communications as described in Natarajan. DSS 2014 states that “[t]his protocol is typically used as the physical layer for the Point-to-Point (PPP) protocol.” (DSS 2014, p. 4.) As discussed above, a point-to-point wired connection and a point-to-multipoint wireless connection are two fundamentally different types of data communication with distinct design challenges and principles. (See ¶¶ 57-60.) Second, DSS 2014 is a technical manual for a proprietary Motorola product, which uses a modified “HDLC-like” protocol. This is evident from its description of repeatedly transmitting “characters consisting of only 1’s” when no data is available for transmission. Therefore, during an extended period when no data is available for transmission, there would be many 1’s transmitted. A POSA would have understood that these repeated 1’s would violate the standard HDLC protocol, where “[i]f seven ones appear anywhere in the frame (six ones followed by an additional one), the frame is declared in error.” (Schwartz, p. 136.) This point is reaffirmed on page 582 of APL 1013 (DSS 2010),

which states that “[i]f any portion of the data in the frame contains more than five 1 bits, a zero-bit insertion technique inserts a 0 bit to ensure that data is not mistaken for a flag.”

67. The incompatibility of a continuous transmission of the idle words, as described on page 549 of DSS 2010 and in DSS 2014, with the standard HDLC protocol, as described by pages 581-583 of APL 1013 (DSS 2010) and by Schwartz, can also be explained on page 1006 of APL 1013 (DSS 2010). In the section describing “PPP (Point-to-Point Protocol),” it states that “[m]ost PPP implementations use framing **derived from** HDLC (High-level Data Link Protocol) as described in RFC 1662 (PPP in HDLC-like Framing, July 1994).” (APL 1013 (DSS 2010), p. 1006 (emphasis added).) In other words, the HDLC protocols referred to in both page 549 of DSS 2010 and in DSS 2014 are “HDLC-like” protocols, **modified** to suit the specific design need of a point-to-point protocol.

68. Because DSS 2014 does not disclose the standard HDLC protocol, it cannot be used to support DSS’s position. Mr. Dezmelyk asserts that he relies on DSS 2014 as being analogous to “the HDLC spec,” but it is not. (See Dezmelyk Depo., 69:17-71:1.) Because Mr. Dezmelyk bases his opinions on DSS 2014, which does not disclose the standard HDLC protocol, it is my position that his opinions on HDLC are irrelevant.

C. Natarajan and the HDLC protocol do not use “idle words.”

69. It is my understanding from reviewing Apple’s Petition that Neve is included in combination with Natarajan because “Natarajan does not explicitly describe synchronizing the mobile units with the base station.” (Petition, p. 40.) I agree, as explained in the Petition, that Natarajan does teach that “coordinated timing of transmissions is important” for the numerous reasons discussed in the Petition. (Petition, pp. 40-41.) I also agree that a POSA would have been motivated to precisely synchronize the mobile units with the base unit, which would have led a POSA to a reference such as Neve, which is an example of a conventional synchronization technique.

70. Although Natarajan does not explicitly disclose synchronizing the mobile units with the base station, the HDLC protocol, for example, as described in Schwartz, explains that the “standard frame format for HDLC” has an “eight-bit flag sequence 01111110 that appears at the beginning and end of a frame [that] is used ***to establish and maintain synchronization.***” (Schwartz, p. 135.) A POSA would have understood that the HDLC protocol used by Natarajan contemplates a mechanism for synchronization. Such synchronization was within the skill of a POSA.

71. DSS’s suggestion that the HDLC protocol of Natarajan uses idle words (as described in Neve) is inaccurate. I would first point out that Neve does

not disclose that idle words are continuously transmitted by the master station. I agree with the Board, which found that Neve “*do[es] not suggest continuous transmission*” from the master station, but instead transmission of idle words in the event that there is no data required to be transmitted in the time slots specifically allocated for transmission by the server” and that “the master station performs different functions during different time slots, only certain of which involve transmission.” (Institution Decision, p. 20 (emphasis added).)

72. DSS suggests that the base station in Natarajan transmits idle words like in Neve, but it does not. And a POSA would have understood that HDLC does not use idle words.

73. To be clear, neither Natarajan nor Schwartz’s discussion of HDLC mention idle words. In my opinion, this is likely because the use of continuous idle words in Natarajan, which DSS asserts would assist with synchronization, would be pointless in HDLC. (See POR, pp. 26-27, 32; Dezmelyk Depo., 119:13-20.) First, HDLC has its own mechanism—start/stop flags—for synchronization. Second, as Mr. Dezmelyk acknowledges, if Natarajan used idle words, they would be transmitted “out into the air and there is nobody really paying attention to it.” (Dezmelyk Depo., 84:22-85:1.) A POSA would have found it illogical to transmit idle words that were not received by any of the mobile devices. Mr. Dezmelyk asserts that when the receivers turned back on, they would be able to synchronize

onto the stream of idle words. (Dezmelyk Depo., 85:2-14.) However, Natarajan discloses that “each receiving mobile unit can compute *exactly when* it should be ready to receive packets from the base station...to wake itself up at its designated time for receiving data.” (Natarajan, 4:67-5:3 (emphasis added).) Thus, a POSA would have understood that Natarajan is designed to have the mobile units turn back on precisely when needed to receive data. They would not wake up “early” to try to synchronize to a string of idle words, in the manner suggested by Mr. Dezmelyk. This would defeat the precise timing disclosed in Natarajan and is unnecessary because of the start/stop flags used in HDLC for synchronization.

74. Mr. Dezmelyk’s lack of understanding of HDLC is further highlighted by his assertion that systems using idle words can have, for example, ten consecutive 1’s. (Dezmelyk Depo at 98:1-13.) HDLC cannot have more than six consecutive 1’s, otherwise an error is declared. (Schwartz, p. 135-136.) That is why, “[i]f any portion of the data in the frame contains more than five 1 bits, a zero-bit insertion technique inserts a 0 to ensure that data is not mistaken for a flag,” (i.e., 01111110). (APL 1013 (DSS 2010), p. 582.)

75. In sum, nothing in Natarajan or the HDLC protocol suggests the use of idle words and a POSA would understand that HDLC does not use idle words.

IX. DSS's interpretation of "low duty cycle" is incorrect.

76. DSS proposes that the broadest reasonable interpretation for a server transmitter energized in a "low duty cycle" is that "the server transmitter is energized for less than ten percent (10%) of the total duration designated for outbound transmissions." (POR, p. 11 (emphasis added).) In my opinion, DSS's interpretation is not supported by the '290 patent or the evidence presented.

77. One of DSS's own examples in Table 1 contradicts the proposed construction of "less than ten percent," because it provides for a "low duty cycle, e.g., *at an about* 10 percent (10%) duty cycle." (POR, p. 13 (quoting DSS 2008 at 10:5-6) (emphasis added).) This example would include a "low duty cycle" that is at or even slightly above 10%, which is not "less than ten percent." Furthermore, Mr. Dezmelyk acknowledges that the term "low duty cycle" does not require an upper bound at 10%. (Dezmelyk Depo., 78:2-6.) Indeed, a POSA would not have placed a strict upper limit of 10% on "low duty cycle."

78. Mr. Dezmelyk also asserts that the 10% limit is based on claim 8 of U.S. Patent No. 5,699,357. (See Dezmelyk Depo., 79:12-81:3.) Claim 8 of the '357 patent recites "[a] data network system as set forth in claim 7 wherein said psuedo random codes are sparse uncorrelated codes and said low duty cycle pulses comprise chips within the respective code sequences such that a transmitter is ennergized [*sic*] less than 10% of the time during an allocated time slot." It is my

understanding that because claim 8 depends ultimately from independent claim 6, it is narrower than the independent claim, meaning that the 357 patent contemplates a “low duty cycle” that is greater than 10%.

79. Accordingly, it is my opinion that the term “low duty cycle” does not impose an upper limit of 10% for the duty cycle. Under the broadest reasonable interpretation standard, a “low duty cycle” of a transmitter should simply be interpreted as the transmitter being carefully designed to be on only to satisfy the data communication needs over the communication cycle of the system. Moreover, a transmitter that is off for more time than it is on over the communication cycle of the system would be an example of a low duty cycle.

80. It is also my opinion that Mr. Dezmelyk’s interpretation of “duty cycle” is not only inaccurate, it does not make sense. Mr. Dezmelyk asserts in his declaration that “duty cycle” should be construed to mean “the ratio of the duration during which the server transmitter is energized to the total duration designated for outbound transmissions—from the server unit to the peripheral units.” (Dezmelyk Dec. ¶ 23.) In his deposition, Mr. Dezmelyk further explains his proposed construction. First, Mr. Dezmelyk asserts that “duty cycle is measured based on when you are transmitting.” (Dezmelyk Depo., 116:8-9.) He asserts that Natarajan has a 100% duty cycle because “if you measure during what periods of time it is transmitting it is transmitting at 100 percent duty cycle.” (Dezmelyk Depo., 69:7-

9.) In my opinion, this interpretation is illogical because if the only time frame used to calculate duty cycle is when the transmitter is actually transmitting, the duty cycle will always be 100%. Using Mr. Dezmelyk's example from the '290 patent, if transmissions occur in 3 out of 64 slots and "if you measure during what periods of time it is transmitting" (i.e., the 3 transmissions slots) then the '290 patent is transmitting at a 100%, not at 4.688%. (See Dezmelyk Dec. ¶¶ 24, 26; see also Dezmelyk Depo., 116:10-14 ("So if there was enough data to occupy two slots then the question is: What is the duty cycle of the RF transmitter during that period of time of those two slots. Or the aggregate time of those two slots if they weren't adjacent to one another.").) Under Mr. Dezmelyk's interpretation, if a particular time slot is filled by a transmission, the duty cycle is 100%.

81. Mr. Dezmelyk provides additional context to his interpretation, asserting that duty cycle is calculated based on a sub-portion of a time slot is taken up by a transmission. Mr. Dezmelyk asserts that:

if you had -- you are using in essence two slots out of the 10 that are available, and particular slots have a fixed width, then that ***period of time of the two slots that you actually have something to transmit in gives you the kind of what you are dividing by, the time you are dividing by to calculate the duty cycle.*** You are looking at the percentage of time that the transmitter is active during the period in time when, in essence when a transmission is called for. (Dezmelyk Depo., 116:20-117:6 (emphasis added).)

82. Put another way by Mr. Dezmelyk, “the question is, what **percentage of that slot time** is taken up by the transmission.” (Dezmelyk Depo., 106:2-4 (emphasis added).) Mr. Dezmelyk’s interpretation thus requires determining the percentage of a single transmission slot used for transmission. Under this interpretation, Mr. Dezmelyk’s calculation from the example in the ’290 patent, which accounts for transmission during the entirety of the 3 time slots (out of the 64 total slots), would again be a 100% duty cycle. Thus, neither of Mr. Dezmelyk’s interpretations of duty cycle are consistent with his interpretation of the ’290 patent specification, which he asserts requires a duty cycle of less than 10%.

83. Furthermore, DSS improperly focuses only on the period for “outbound transmissions” for calculating the duty cycle in Natarajan. (POR, p. 11; Dezmelyk Dec. ¶ 23.) A POSA would calculate the duty cycle over the period of time that it takes a system to go through a cycle of communication. DSS’s methodology improperly manipulates the time period over which a POSA would determine the duty cycle.

84. For Natarajan, a POSA would calculate the duty cycle over all of Periods A, B, and C. To limit the calculation only to Period A, as suggested by Mr. Dezmelyk (Dezmelyk Dec. ¶ 32), would read the word “cycle” out of the term “duty cycle.” The communication “cycle” in Natarajan includes all of Periods A-C.

85. Once the transmissions between the base station and mobile stations cycle through Periods A-C, the next transmission cycle begins again with Period A. Accordingly, the calculation of the duty cycle for Natarajan must include Periods A-C. Furthermore, a POSA would have understood that the communication cycle in Natarajan, where “[m]ost users are very likely to be inactive (both Transmit-Inactive and Receive-Inactive) most of the time,” represents a low duty cycle.

86. Using the proper calculation over Periods A-C for duty cycle in Natarajan, even under DSS’s incorrect interpretation of “low duty cycle” being less than 10%, Natarajan can operate in a manner that satisfies the proposed interpretation. By way of example, if the base station transmits to one (1) mobile unit during Period A, thirty (30) mobile units transmit to the base station during Period B, and two (2) mobile units transmit to the base station during Period C (with two (2) ACKs transmitted from the base station to those mobile stations). Assuming all transmissions take one slot each, then the base station will have transmitted in three (3) slots out of the thirty-five (35) slots in Periods A-C. This would represent a duty cycle of 8.57%. Accordingly, even under DSS’s incorrect interpretation, Natarajan is still capable of satisfying the “low duty cycle” claim element.

87. In another example, Natarajan can operate under a low duty cycle that is less than 10% where the base station: transmits to one (1) of thirty (30) mobile units during Period A, two (2) mobile units transmit to the base station during Period B, and two (2) mobile units transmit to the base station during Period C (with two (2) ACKs transmitted from the base station to those mobile stations), where the length of Period C has enough inbound slots (i.e., twenty-eight (28) in this example) for each of the mobile stations that did not transmit in Period B to transmit in the contention mode of Period C. A POSA would have found such an arrangement for Period C to be logical because it provides the opportunity for each mobile station to transmit to the base station, but if they do not, they can still conserve power by not turning on. Assuming all transmissions take one slot each, then the base station will have transmitted in three (3) slots out of the thirty-three (33) slots in Periods A-C. This would represent a duty cycle of 9.09%.

88. Furthermore, should the Board decide, wrongly in my opinion, only to look at Period A in Natarajan for calculating the duty cycle, it is my opinion that a POSA would understand that Period A of Natarajan could operate in a low duty cycle, even at less than 10%. For example, a POSA would have understood that Period A of Natarajan could be of fixed length, for example, having a timeslot reserved for each of thirty (30) mobile units, as was common in TDMA schemes. If the base station transmits to two (2) of the thirty (30) timeslots, this would

represent a 6.67% duty cycle. The transmitter would be off for the remainder of Period A because, as discussed above, Natarajan's HDLC protocol does not use idle words when there is no data to transmit.

X. Conclusion

89. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

90. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Respectfully submitted,



Dr. Jing Hu

Date: 1/22/2016

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