

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the ’754 Patent. The ’754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga’s ONT functionality is placed on Togami’s small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

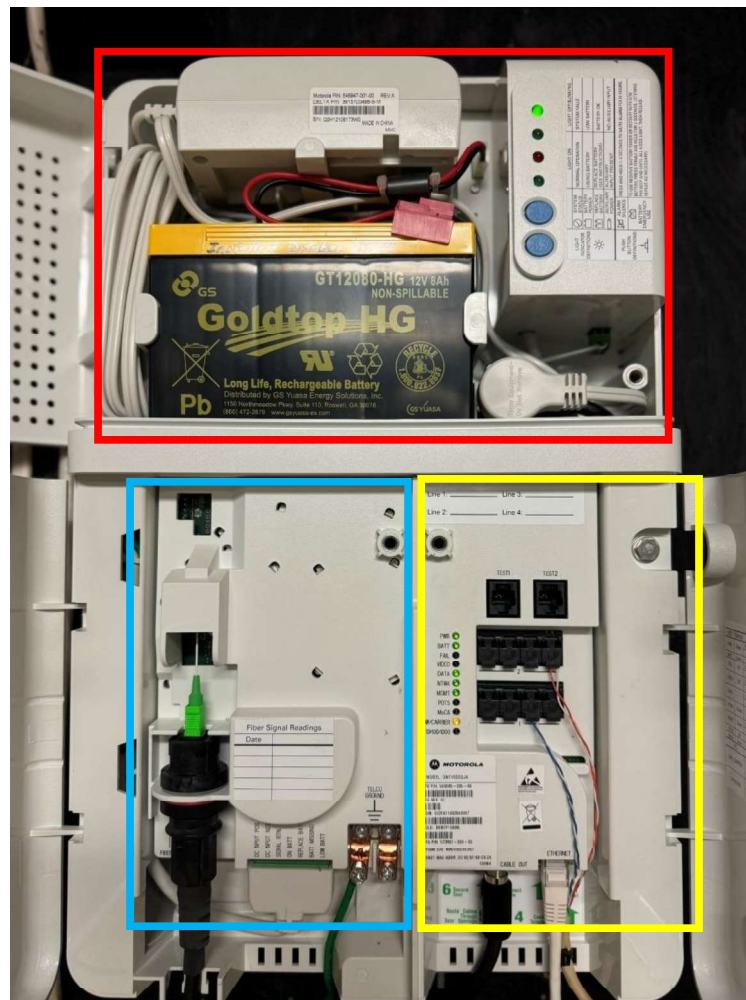
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies’ New Fiber Optic Transceivers Offer Industry’s Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC’s Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia’s Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation’s Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC’s Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

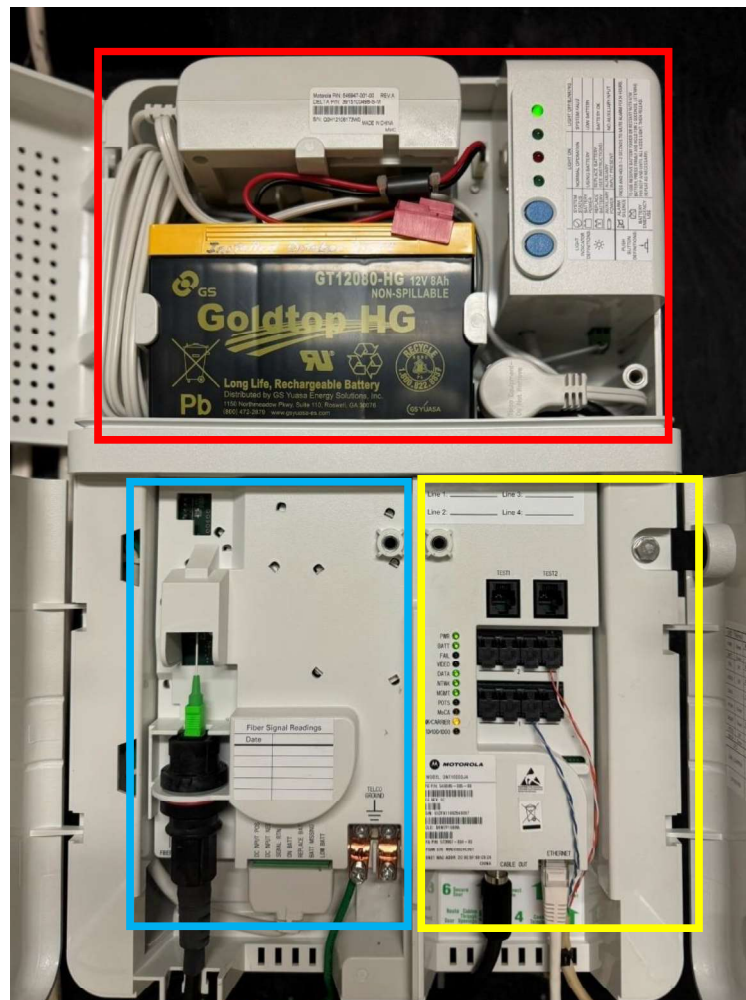
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

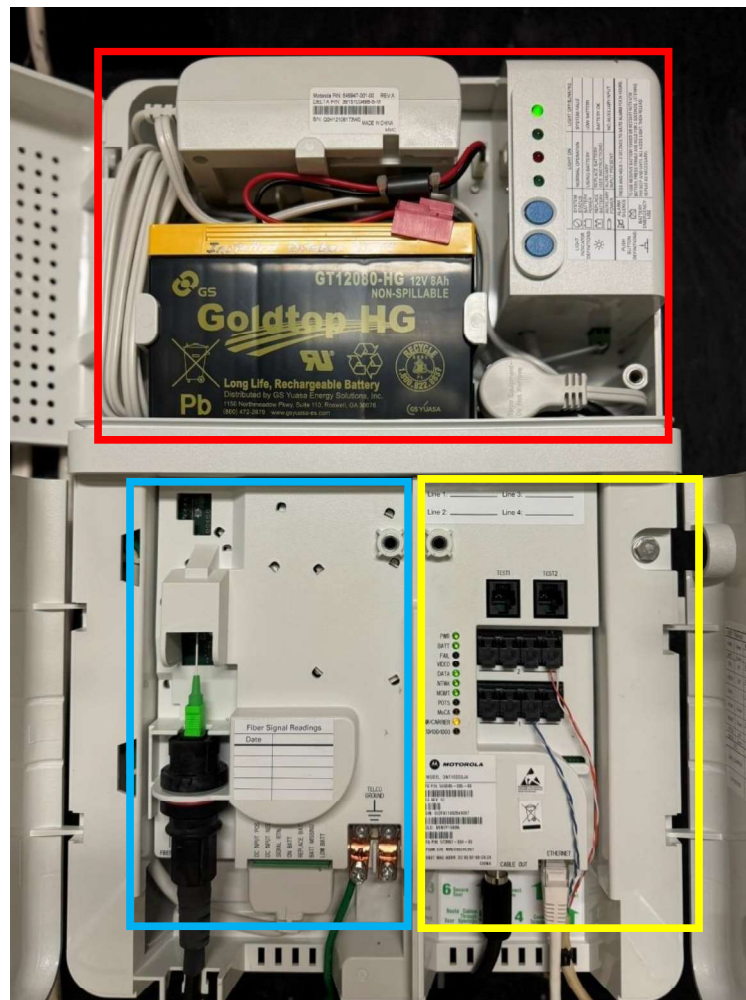
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the ’754 Patent. The ’754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga’s ONT functionality is placed on Togami’s small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

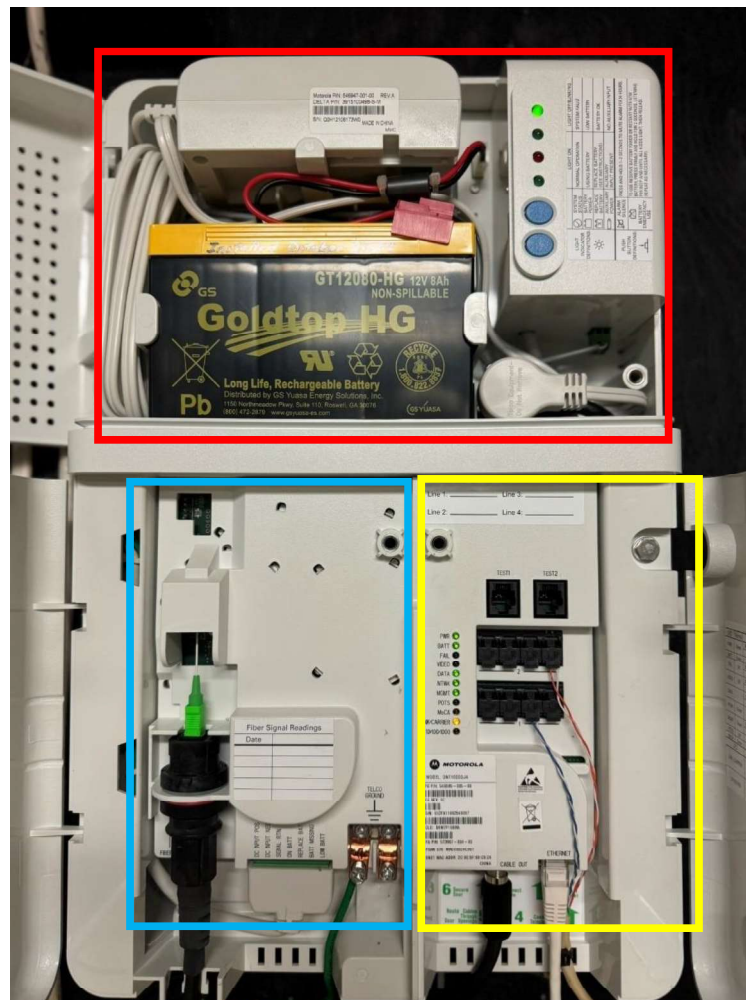
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

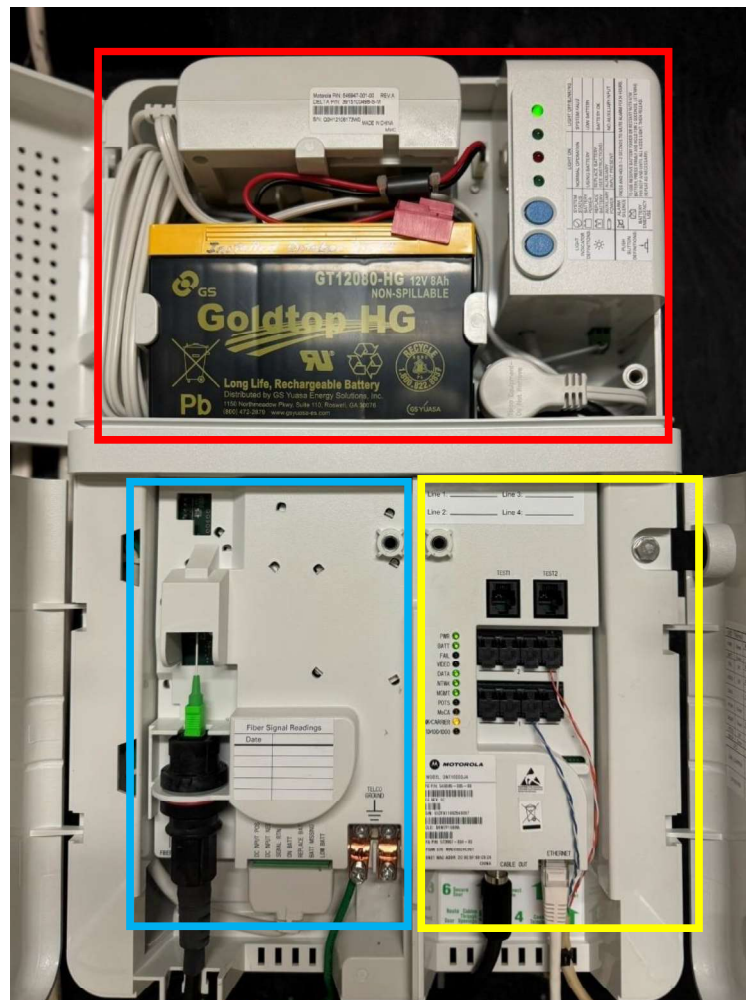
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

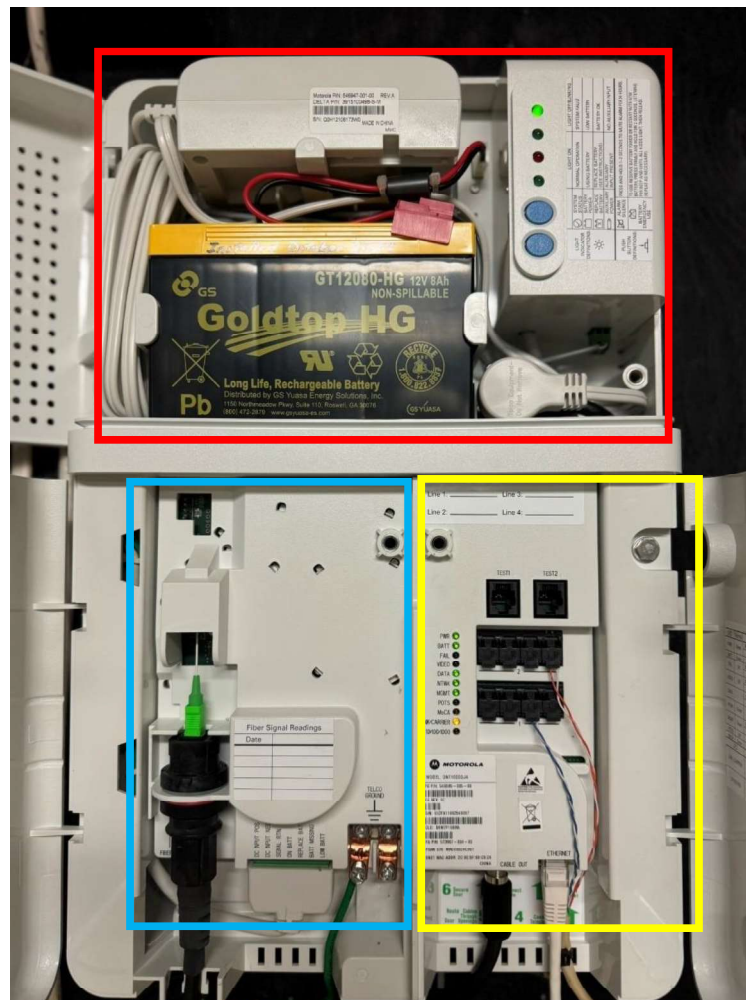
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shruga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the ’754 Patent. The ’754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga’s ONT functionality is placed on Togami’s small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

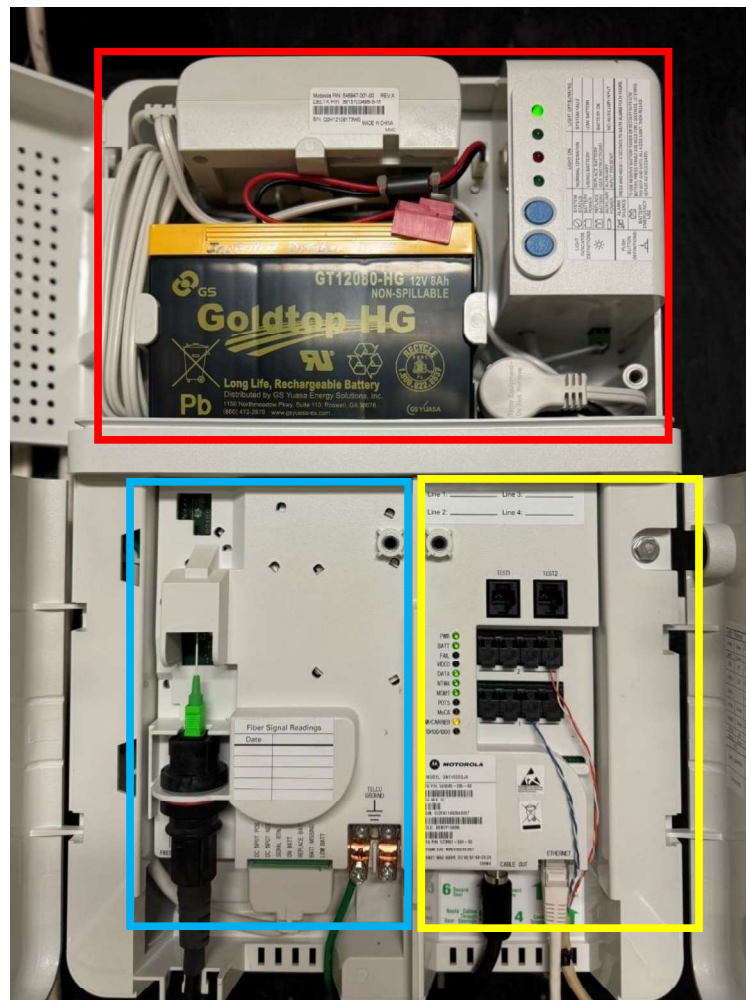
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shrags's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the ’754 Patent. The ’754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga’s ONT functionality is placed on Togami’s small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

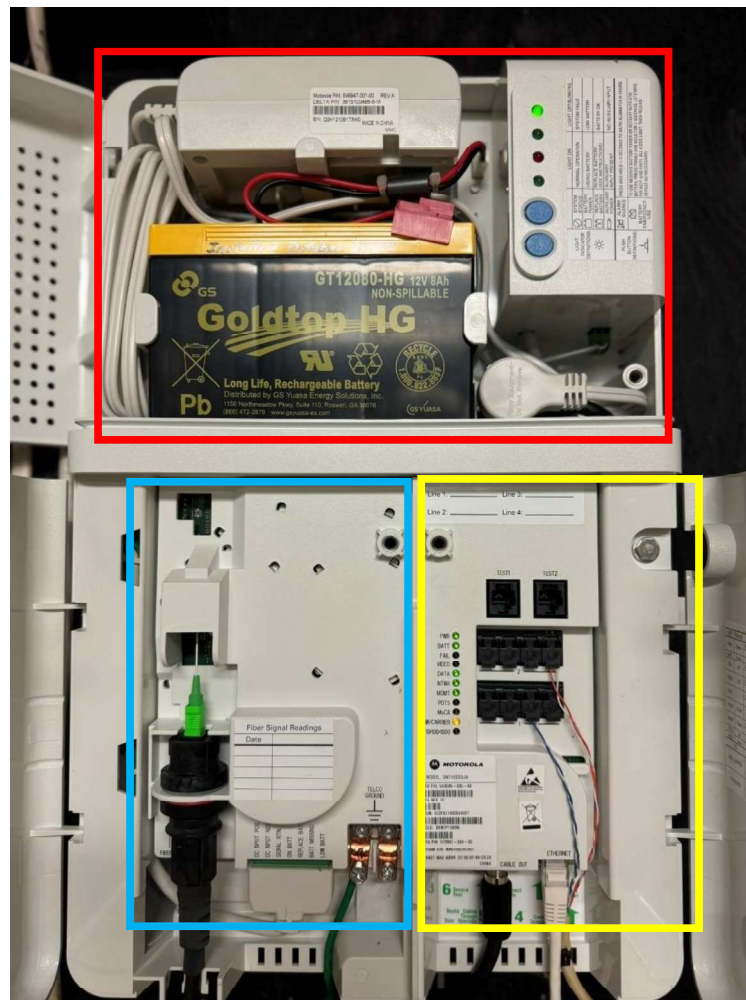
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shruga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shraga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shraga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shraga's switch from Shraga's PON/ONT functionality would have had no effect on the operation of the switch or Shraga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shraga's inventors' decision to represent the switch 64 within the boundaries of Shraga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shraga's switch 64 could be its own distinct device, separate from Shraga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

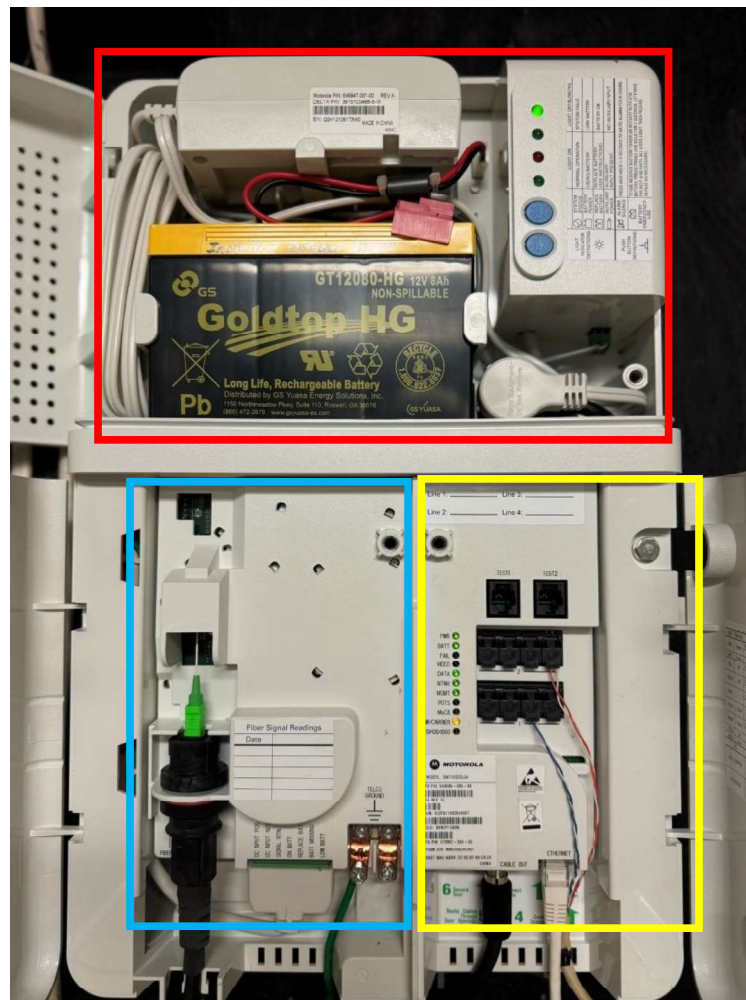
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shraga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NOKIA OF AMERICA CORPORATION

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owners

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Case No. IPR2023-00960

U.S. Patent No. 8,238,754

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**SUPPLEMENTAL DECLARATION OF PAUL R. PRUCNAL, Ph.D.**

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## **TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Short Name</b>            | <b>Description</b>                                                                                                                                 |
|----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1001       | '754 Patent                  | U.S. Patent No. 8,238,754                                                                                                                          |
| Ex. 1002-1     | '754 File History            | File History of U.S. Patent No. 8,238,754                                                                                                          |
| Ex. 1002-2     | '514 File History            | File History of U.S. Patent Application No. 60/886,514                                                                                             |
| Ex. 1003       | Prucnal Declaration          | Declaration of Dr. Paul Prucnal                                                                                                                    |
| Ex. 1004       | Prucnal CV                   | <i>Curriculum Vitae</i> of Dr. Paul Prucnal                                                                                                        |
| Ex. 1005       | Shraga                       | U.S. Patent No. 6,697,374                                                                                                                          |
| Ex. 1006       | Wood                         | U.S. Patent No. 7,088,921                                                                                                                          |
| Ex. 1007       | Togami                       | U.S. Patent No. 6,439,918                                                                                                                          |
| Ex. 1008       | Fujimori                     | U.S. Patent No. 7,206,366                                                                                                                          |
| Ex. 1009       | Liu                          | U.S. Patent No. 6,005,694                                                                                                                          |
| Ex. 1010       | Starr Declaration            | Declaration of Thomas J. J. Starr                                                                                                                  |
| Ex. 1011-1     | G.984.3 Draft Recommendation | ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks |
| Ex. 1011-2     | Contribution 104             | ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks     |
| Ex. 1012       | OKI Article                  | <i>SFF &amp; SFP Optical Transceivers</i> , OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002)                                            |

| Exhibit  | Short Name           | Description                                                                                                                                                                                 |
|----------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1013 | Ramaswami            | Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)                                                                                           |
| Ex. 1014 | Kramer IEEE          | Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)             |
| Ex. 1015 | Kazi                 | Khurram Kazi, <i>Optical Networking Standards, A Comprehensive Guide for Professionals</i> (2006)                                                                                           |
| Ex. 1016 | SFP MSA              | SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).                                                                           |
| Ex. 1017 | XFP MSA              | 10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002)                                                                                                          |
| Ex. 1018 | XENPAK MSA           | INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001)                                                        |
| Ex. 1019 | Kramer OSA           | Glen Kramer, et al., <i>Supporting differentiated classes of service in Ethernet passive optical networks</i> , Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002) |
| Ex. 1020 | EC&M Article         | Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001).                                                                                                             |
| Ex. 1021 | Going Serial Article | Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002).                                                                                                           |

| <b>Exhibit</b> | <b>Short Name</b>       | <b>Description</b>                                                                                                                                                             |
|----------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1022       | G.984.2                 | ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification                                                    |
| Ex. 1023       | G.984.1                 | ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics                                                                               |
| Ex. 1024       | ITU-T A.1               | ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)                                                                  |
| Ex. 1025       | SG15 Contributions List | List of contributions from Oct. 2003 Geneva, Switzerland Meeting                                                                                                               |
| Ex. 1026       | SG15 TD-PLEN List       | List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting                                                                                             |
| Ex. 1027       | WP1 TD List             | List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting                                                                                                     |
| Ex. 1028       | WP1 TD5                 | Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA                                                                                                       |
| Ex. 1029       | TD-58GEN                | List of participants at the Oct. 2003 Geneva, Switzerland                                                                                                                      |
| Ex. 1030       | TD-7PLEN HTML           | Webpage printout of The G.984.3 Draft Recommendation page                                                                                                                      |
| Ex. 1031       | Contribution 104 HTML   | Webpage printout of Contribution 104                                                                                                                                           |
| Ex. 1032       | DCO                     | Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases) |

| Exhibit  | Short Name                                         | Description                                                                                                                                                                                                                          |
|----------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ex. 1033 | Caseload                                           | U.S. District Court – Judicial Caseload Profile (Sept. 2022)                                                                                                                                                                         |
| Ex. 1034 | Agilent New Fiber Optic Transceiver                | <i>Agilent Technologies' New Fiber Optic Transceivers Offer Industry's Lowest EMI Emissions</i> , Agilent Technologies Inc. (July 10, 2001)                                                                                          |
| Ex. 1035 | Infringement Contentions                           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to the Nokia Defendants, <i>NextGen Innovations, LLC v. Nokia Corp., et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)              |
| Ex. 1036 | Nokia's Motion to Intervene in the AT&T Litigation | Dkt. No. 27, Nokia of America Corporation's Motion to Intervene, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                          |
| Ex. 1037 | AT&T Litigation DCO                                | Dkt. No. 23, Docket Control Order, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.)                                                                                        |
| Ex. 1038 | AT&T Litigation Infringement Contentions           | Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to AT&T, <i>NextGen Innovations, LLC v. AT&amp;T Services, Inc., et al.</i> , No. 2:23-cv-00263-JRG-RSP (E.D. Tex.) (Sept. 13, 2023) |
| Ex. 1040 | Willner Deposition Transcript                      | Deposition Transcript of Dr. Alan Willner, (Sept. 17, 2024)                                                                                                                                                                          |

| Exhibit  | Short Name                             | Description                                     |
|----------|----------------------------------------|-------------------------------------------------|
| Ex. 1041 | Prucnal<br>Supplemental<br>Declaration | Supplemental Declaration of Dr. Paul<br>Prucnal |

## **I. INTRODUCTION**

1. I have been retained as a technical expert by counsel for Petitioner Nokia of America Corporation (“Nokia”) to address certain issues regarding U.S. Patent No. 8,238,754 (“the ’754 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owners’ expert(s) in this matter.

7. I am being compensated at my current consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. I hereby incorporate my Qualifications sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **III. LEGAL STANDARDS**

9. I hereby incorporate my Legal Standards sections from my Declaration filed with the original Petition for *Inter Partes* Review on June 30, 2023. Ex. 1003.

## **IV. THE PROPOSED COMBINATION OF SHRAGA AND TOGAMI**

10. I understand that Patent Owners posit that I have proposed “two devices” as obvious in light of the combination of Shraga and Togami. This is not accurate. The combination discussed in my original Declaration, and the Petition that it supports, does not propose or suggest that a POSITA would have been motivated to place the switch found in the Shraga reference inside a pluggable optical transceiver module such as the pluggable described in the Togami reference.

11. As my original Declaration confirms, the combination of Shraga and Togami that I believe would have been obvious to a POSITA is the implementation of PON communications functions described in the ONT device of Shraga on a pluggable optical transceiver module, such as that of Togami. *See* Ex. 1003 ¶ 106. I understand that the Board recognized that this was the combination presented in the Petition and supported by my original Declaration. *See* Paper 19 at 48.

12. In support of my opinion that a POSITA could have, and would have been motivated to, combine Shraga and Togami to make the pluggable optical module capable of PON communication functionalities, I use the functional diagram of an ONT shown in Shraga's Figure 1 for two purposes. Shraga's Figure 1 shows that a POSITA would have been aware of and known how to arrange the components performing the functionalities claimed by the '754 Patent in a pluggable optical module. I also use Shraga's Figure 1 in my discussion to show, visually, how easily these components would align with each of the components and ports of Togami's pluggable. For example, as I discuss in my original declaration, the optical interface block of Shraga would align with Togami's circuitry for performing opto-electrical conversion and Shraga's connection point for interfacing with the optical distribution fabric of the network aligns with Togami's optical port for receiving an optical fiber. Ex. 1003 ¶¶ 123-32. Understanding these connections and similarities, and understanding the widely recognized benefits of form-factor pluggable modules, a POSITA would have been motivated to include additional PON communications functionality on a pluggable optical module.

13. During my deposition, I testified that the additional functional components I believe a POSITA would have been motivated to integrate or implement in Togami's pluggable primarily consist of Shraga's ONT's optical interface, framer blocks, PON/OLT functions of the CLU, and ingress and egress

FIFO. *See, e.g.*, Ex. 2021 at 51:58-52:4, 87:8-88:4, 96:23-97:2. When Patent Owners' attorneys asked me repeatedly about my combination, I specifically did not include Shruga's switch with these functionalities. *Id.* Therefore, Patent Owners' attempt to characterize the combination proposed in my original Declaration as anything other than pluggable optical module capable of PON communication functionalities is inaccurate and a misrepresentation of my testimony and Declaration. Patent Owners' attorney went on additionally to ask me about *their* notion of integrating the switch itself, which I dutifully answered.

## **V. MOTIVATION TO COMBINE**

14. I have reviewed Dr. Willner's opinions that a POSITA would not have a motivation to combine Shruga and Togami. As discussed in my original Declaration, I disagree, and I address Dr. Willner's criticism below.

### **A. Separating Shruga's switch from Shruga's PON/ONT functionality would have had no effect on the operation of the switch or Shruga's PON communication system.**

15. As I discussed in my original Declaration and reiterated in my deposition testimony, Shruga's inventors' decision to represent the switch 64 within the boundaries of Shruga's ONT box, rather than outside, was a mere design choice that would not have impacted the operation of either device. *See* Ex. 1003 ¶ 141; *see also* Ex. 2021 at 66:12-17, 68:17-22, 69:13-25. A POSITA would have understood that Shruga's switch 64 could be its own distinct device, separate from Shruga's

ONT, as it is merely connected to Shraga at the ingress and egress FIFO blocks and communicates with Shraga's other components, like the CLU, through this connection. *See* Ex. 1005 at Fig. 1. Moreover, switch 64's operation and functions would not be affected if it was not within the same physical "device" or "boundary" as the other functional components located within Shraga's ONT—switch 64 would still be capable of electrically communicating with the other components via the connection at the ingress/egress FIFO blocks. *Id.*

16. Supporting my opinion is the fact that such separate and discrete switches existed and were well known in the art at the time of the '754 Patent's filing. I myself was purposefully aware of such switches, worked with them, and used them in the network in my own home and laboratory. These switches could have come in the form of Ethernet switches for packet switching or service switches for switching between multiple coupled services, as shown in Shraga. Ex. 1005 at 7:67-8:2, 8:36-42. I recall that some of the first multiport Ethernet switches were introduced as early as 1990. For example, I recall that Cisco and 3Com both offered Ethernet switch products in the 1990s. Therefore, it is my opinion that Shraga's design choice to include the switch 64 as part of its ONT functional diagram would not have persuaded a POSITA from separating the switch and combining the ONT functional components of Shraga with the pluggable optical module of Togami.

17. I understand that Dr. Willner further argues that a POSITA would not have “separated” Shraga’s switch 64 from its other functional components because Shraga states that its CLU sends controlling signals to switch 64. I do not agree. First, as mentioned briefly above, Shraga portrays switch 64 as connected to Shraga’s additional functional components through its coupling to the ingress and egress FIFO blocks. *See* Ex. 1005 at Fig. 1. Even if the switch controlling functionality was *not* on the same device as the switch, a POSITA would understand that controlling signals from Shraga’s CLU to switch 64 could have been communicated through the ingress/egress FIFO components, which are also operated according to controlling signals from the CLU. *See id.* at 7:67-8:7, 8:36-42. Accordingly, I believe it would have been obvious to a POSITA that, regardless of whether switch 64 is located within the box of Shraga’s ONT or is packaged as its own distinct device, switch 64 could nonetheless remain capable of receiving controlling signals from the CLU in substantially the same manner. Second, the combination of Shraga and Togami proposed does not suggest moving the switch-specific control functions from the Shraga device; the controlling functionalities associated with Shraga’s switch would stay with the switch. Ex. 2021 at 87:8-88:4. For the reasons I discussed above in ¶16, switch 64 could be controlled by a controller or a CLU within its own, discrete box, as was common for switches. A POSITA would have understood that a switch did not need to be controlled by a

separate, external CLU. More commonly, in fact, switches maintained their own controllers or CLUs.

18. I further understand that Dr. Willner argues that a POSITA would not have been motivated to make the proposed combination of Shraga and Togami because, if the pluggable optical module were not plugged into the switch, there would be no electrical connection from the CLU to the switch, rendering the switch inoperable. Dr. Willner states this is because the CLU would no longer be able to send controlling signals to the switch if the pluggable optical module were not plugged into the switch. While I don't disagree with Dr. Willner's observation that signals from the pluggable optical module would not occur if the pluggable optical module were not plugged into the switch, I find this scenario to be wrong and inconsequential to a POSITA's motivation to combine the references of Shraga and Togami to make the proposed combination.

19. My reasoning for this opinion is based in simple logic. As mentioned above, a POSITA would have found it obvious, based on knowledge of common switches in the art, that a switch could maintain its own controller and controlling functions—"separating" the PON functionality components from the switch would have no adverse effect. Moreover, if the proposed pluggable optical module were not plugged into the host device, such as a switch, the communications system as contemplated in Shraga would fail to operate as intended, not just the hosting switch.

Because the host switch is connected to the network through the pluggable optical module that contains the PON communications functionality, the pluggable optical module acts as a conduit to transmit and receive data communications onto the PON network. In order for the system to function and for the pluggable optical module to, for example, receive communications from the PON and convey it to the switch for further downstream transmission, the pluggable optical module must be plugged into the host switch. If the pluggable optical module were unplugged, the system would effectively be “off” and data communications across the PON and through the switch host would not occur. Thus, I consider the pluggable optical module and its host device to be symbiotic—neither functions for its purpose without the other. I also note that such a scenario, where the pluggable network client optical transceiver module is not coupled to its host device, such as a switch or router, is not contemplated in the '754 Patent. The '754 Patent requires that the pluggable module be coupled to the switch. Ex. 1001 at Claim 1.

20. Dr. Willner also argues that a POSITA would have not been motivated to combine Shraga and Togami because, if Shraga's ONT functionality is placed on Togami's small form-factor pluggable module, the CLU would not be able to transmit controlling signals across the electrical interface to the switch. Dr. Willner states that the electrical interface of an SFP, such as the pluggable described in Togami, does not allow for the passage or communication of “control signals” across

its interface because there are no “pins” for such communications. I disagree. First, as explained previously, a POSITA would have understood that a switch could, and more commonly would, contain its own internal controller. This would not have dissuaded a POSITA. Second, even if the switch controlling functionality was located on the pluggable optical module of the Petition’s combination, it is clear to me, as it would have been to a POSITA, that the technical specification of pluggable SFP devices explicitly discusses input and output lines for the transmission and/or reception of control and status information at the electrical interface. *See* Ex. 1016.

21. In particular, Appendix B of the SFP MSA describes the device’s “Electrical Interface”—this is the side of the pluggable that interfaces with the host switch device, for example. *Id.* at 1016.021-39. Appendix B contains Section B4 titled “Timing Requirements of Control and Status I/O.” *Id.* at 1016.025. A POSITA would have known that I/O stands for “input/output.” This section discusses the “control and status lines” located at the electrical interface of the SFP. *Id.* Other pluggable form factors, such as XFP, also describe similar control inputs and outputs at the electrical interface of the device. For example, the XFP MSA, the technical specification for 10-gigabit small form-factor pluggables, describes that the electrical interface of an XFP pluggable similarly contains “low speed pins for control and status.” Ex. 1017 at 1017.30.

22. Therefore, in light of the technical specifications for each of these pluggable optical module devices, a POSITA would have understood that the electrical interface of these devices, which couple into the corresponding port of a host device, are capable of transmitting control and status information. Thus, it is my opinion that, despite Dr. Willner's argument otherwise, the CLU or control module of the pluggable optical module would be capable of transmitting or receiving control signals across the electrical interface and to/from the host device, such as a switch. A POSITA would, therefore, not be dissuaded from implementing such a combination for this reason, and also because, as discussed, it would have been obvious to a POSITA that the switch controlling functionality would be maintained on the same device as the switch.

23. As I discussed above and in my original Declaration, however, a POSITA would have understood that Shraga's inclusion of switch 64 within the box of its ONT device was a design choice—the switch 64 could just as equally be located outside of Shraga's ONT box. On a similar note, a POSITA would have understood that there existed switches in the art that did not need controlling signals from an ONT to function as a switch, because many well-known switches at the time were controlled by their own integrated controllers or CLUs. Therefore, I would also consider the functionality of the CLU to control the switch's operations, as described in Shraga, to be a design choice. A POSITA would have been familiar with a number

of switches at the time of filing of the '754 Patent that did not require control information to be sent from some external control module or CLU in order to function. Therefore, it is my opinion that the teaching that Shraga's CLU sends controlling information to switch 64 would not have prevented, or even dissuaded, a POSITA from being motivated to combine Shraga and Togami in the way outlined in the Petition.

**B. A POSITA would have been motivated to place Shraga's ONT functionality in a pluggable.**

24. In my original Declaration submitted with the Petition in this proceeding, I outlined a number of motivations to combine the references Shraga and Togami. Ex. 1003 ¶¶ 105-115. I incorporate those motivations as if fully set forth herein.

25. It is my understanding that Dr. Willner argues that the motivations to combine I discussed in my original Declaration would not have motivated a POSITA to combine Shraga's data communication system and functionality with the pluggable optical transceiver module described in Togami and, instead, only motivated a POSITA to "use Togami *as-is*." I very much disagree with this analysis and determination. As discussed in my Declaration, POSITAs were already well aware of pluggable optical transceiver modules, such as the pluggable described in the Togami reference, by the time of filing of the '754 Patent. Therefore, I don't believe that Dr. Willner's arguments, that my presented motivations would have

only encouraged a POSITA to create a device that *already* existed and was widely used in the industry, make sense. With the knowledge of the benefits of a pluggable optical module, as discussed in my Declaration, a POSITA would have instead been motivated to implement even further technology and functionality in these pluggable optical form factors. Doing so would have been in line with a POSITA's goal to achieve the well-known and desired benefits of a small, easily removable device.

26. For example, traditional ONTs in the prior art often consisted of hardware that was physically coupled to the walls of homes of clients or users and, as a result, were not very removable or easy to service or replace. In the mid-2000's time frame, I had such a BPON ONT installed in my own house. Had I wanted to upgrade to a GPON ONT, for example, in order to increase data rates as technology advanced, I would have had to hire a technician to come to my house to disconnect the fiber from the ONT unit, power supply lines, and other downstream lines to my switches in routers. A technician would have also had to unscrew the entire unit from the wall and reinstall a new unit. This entire process would be costly and time consuming, as I mention in my original Declaration. *See* Ex. 1003 ¶ 105-115.

27. With this in mind, I believe a POSITA would have found it advantageous to instead implement the functionality of one of these ONTs on a device with a smaller and removable format, such as an SFP. A removable SFP would allow for seamless and uncomplicated replacement of the device in instances

such as device failure or upgrade as higher data rates were implemented in PON systems, as I mentioned above. Rather than hiring a technician for removal and replacement, a homeowner could simply replace the pluggable themselves, at no added cost, in a process as routine as swapping out an older router or set top box for a new one.

28. The additional benefits of implementing such functionality on a pluggable optical module are numerous, as I highlighted in my Declaration. As additional examples, a POSITA would have been motivated to implement ONT functionality on a smaller, pluggable form-factor footprint because doing so would create a device conforming to MSA and industry standard, cutting down on manufacturing costs, ensuring interoperability with other devices, and increasing marketability to consumers. Therefore, for the reasons I have highlighted above and in my original Declaration, I do not agree with Dr. Willner and believe that a POSITA would have been motivated to combine Shruga and Togami to create a pluggable optical module capable of performing functionalities for the communication of data in a passive optical network.

**C. A POSITA would have had a reasonable expectation of success in combining Shruga and Togami.**

29. I understand that Dr. Willner argues that a POSITA could not have implemented certain functionalities described in Shruga's ONT in a pluggable form factor device because they would have "faced significant challenges in reducing the

size, power consumption, and heat generation of such a device.” I disagree. I also very much disagree with Dr. Willner’s use of the Motorola ONT6000GVT to suggest that a POSITA would not have been able to make the proposed combination.

30. The Motorola ONT6000GVT, a “GPON ONT for Multi-Dwelling Unit” is an ONT device that contains a number of bulky components that would not have been implemented in the pluggable optical module I propose would have been obvious to a POSITA. For example, the data sheet of the Motorola ONT6000GVT states that it “provides 24 lines of Class 5 or soft-switch VoIP quality voice service.” Ex. 2025 at 1. VoIP stands for “voice over IP” and relates to the process of using a packet-switched network to transmit voice calls using broadband internet. A POSITA would understand that, given the description that it provides 24 lines of the switched service, the Motorola ONT device would contain a switch with 24 output ports to service up to 24 downstream devices (i.e., “lines”). A 24-port switch would take up considerable space in the Motorola ONT, contributing significantly to its large size. As I already discussed in detail above, the combination proposed in the Petition and supported by my original Declaration does not propose placing a switch, let alone a 24-port switch, onto a pluggable optical module.

31. As another example, the Motorola ONT6000GVT data sheet states that it “provides 12 lines of Ultra-Broadband data via VDSL2.” Ex. 2025 at 1. As a POSITA would have understood, this description indicates that the Motorola ONT

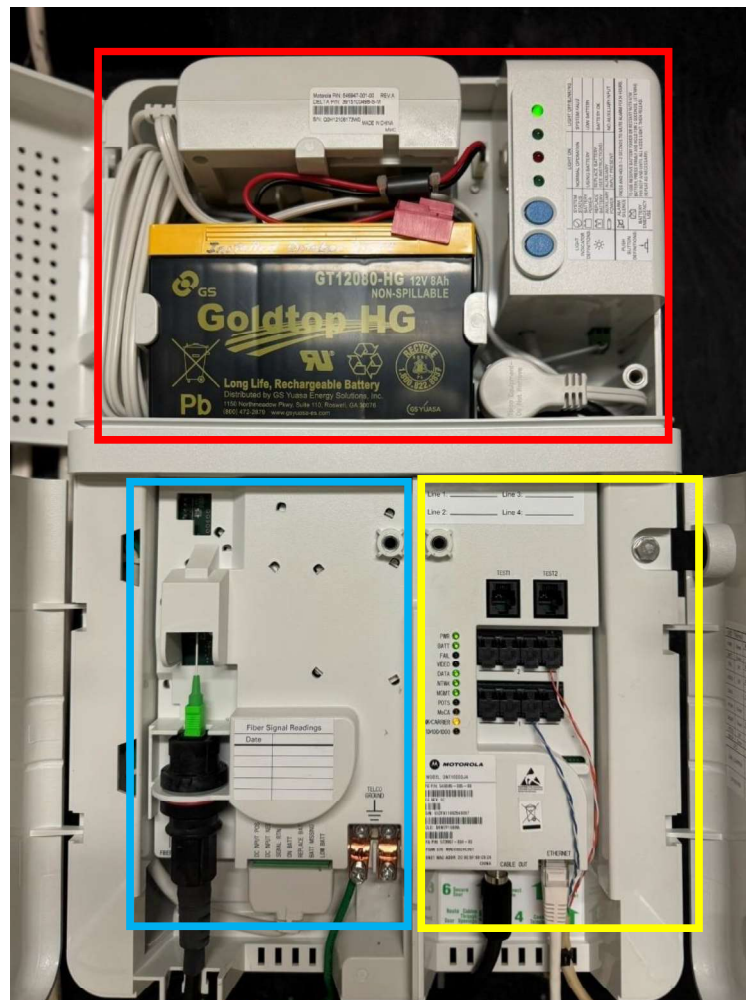
provides DSL capabilities and access to at least 12 downstream users or devices through the inclusion of, for example, a DSL modem. Ex. 2025 at 1. The combination proposed in the Petition and supported by my original Declaration does not propose placing DSL distribution functionalities or ports, such as those found on a modem, on a pluggable optical module. In fact, neither of the prior art references discussed in the Petition and my Declaration even mention or contemplate DSL, let alone a 12-port DSL modem.

32. Moreover, other ONTs available at the same time as the Motorola ONT6000GVT, such as the Motorola ONT1000GJ4, are examples of ONTs with a smaller footprint capable of performing the PON data communications functionality described in Shraga. I had, and currently have today, one such ONT1000GJ4 in my house and am very familiar with this device. The image below is a picture I personally took of the Motorola ONT1000GJ4 mounted on the wall of my house. Though I do not recall the exact date, this ONT was installed in my house in the 2007 time-frame, the same year that is dated on Dr. Willner's ONT6000GVT data sheet.



33. I believe the image of this ONT helps to demonstrate my opinion that a POSITA would have had a reasonable expectation of success in placing the ONT data communications functionalities, such as those described in Shruga's ONT, onto a pluggable optical module, such as that described in Togami. For example, unlike the Motorola ONT6000GVT, the ONT1000GJ4 does not contain a 24-port switch or a 12-port DSL modem, significantly decreasing the size of its footprint. The

ONT1000GJ4's size is approximately, in totality, 290x104mm compared to the ONT6000GVT's size of 425x305mm. Moreover, the ONT1000GJ4 is further subdivided into three compartments that I have highlighted individually below on the image of the inside of the ONT1000GJ4.



34. The top compartment of the ONT1000GJ4 box, highlighted in red, consists entirely of a backup power source for the ONT box that allows the device to continue to function in case it is unable to receive power directly through the

power line plugged into the wall. As one can see, this backup power source alone comprises nearly half of the entire ONT box and consists of a 12v 8ah battery, a battery charger, circuitry to monitor the system's status, power levels, time to replace the batter, and generate an alarm. The bottom right compartment, highlighted in yellow, handles the output of signals from the ONT to various devices on the network, such as a router or switch, via, for example, an Ethernet cable. The bottom left compartment, highlighted in blue, is the part of the ONT box that contains the actual functionality (and circuitry supporting the functionality) of the ONT. For example, the image shows the circuit board containing laser and photodetector, visible through an opening in the casing, used to transmit and receive onto the optical fiber. I also note that, given the additional components located in this ONT box, I believe this circuitry consists of additional functionality capable of interacting with these components, such as the backup battery. Therefore, the circuitry highlighted in blue would contain even more functionality and components than that contemplated by the combination of Shraga and Togami. I estimate that, based on this image and the relative size of the entire ONT box, the compartment of the ONT box that actually contains the PON data communications functionality and components is approximately 120x40mm. With the size of these components in mind, it is my opinion, as a POSITA would have recognized, that the components

highlighted in blue could have been condensed for placement on a pluggable optical transceiver module without much difficulty.

35. I also understand that Patent Owners argue that a POSITA would not have been motivated to combine Shraga and Togami as proposed by Petitioner because the ONT6000GVT receives a 48V or 120V power supply, which is more than a pluggable optical module would have been able to support. As I discuss above in relation to its size, the Motorola ONT6000GVT contains many more functionalities and services than those contemplated in my proposed combination or discussed in the Shraga reference. Thus, the Motorola ONT6000GVT would need to draw much more power than the pluggable optical module I contemplate as the combination of Shraga and Togami.

36. I do not disagree that the Motorola ONT6000GVT discussed by Dr. Willner is *one* example of an ONT device. The ONT6000GVT, however, contains many more functionalities and services than those contemplated in the combination of Shraga and Togami that contribute to its large size. For the reasons discussed extensively above, the combination of Shraga and Togami discussed in my original Declaration and in the Petition does not propose placing the entirety of a 425x305mm device inside a 56x14mm pluggable, as argued by Dr. Willner and Patent Owners. Therefore, as I expressed in my original Declaration, it is my opinion that a POSITA would have had a reasonable expectation of success in combining

the PON data communications functionalities described in Shraga with the pluggable optical transceiver module described in Togami.

**VI. THE COMBINATION OF SHRAGA AND TOGAMI RENDERS OBVIOUS ALL CHALLENGED CLAIMS OF THE '754 PATENT**

37. For the reasons set forth above, and in my initial declaration, the combination of Shraga and Togami renders obvious all Challenged Claims of the '754 Patent.

**VII. CONCLUSION**

I 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 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.

Dated: October 11, 2024

  
Paul R. Prucnal, Ph.D.