

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION**

Washington, D.C. 20549

FORM 10-K

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2019

OR

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from _____ to _____
Commission File Number: 000-32743

DASAN ZHONE SOLUTIONS, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction of
incorporation or organization)

22-3509099
(I.R.S. Employer
Identification No.)

1350 South Loop Road, Suite 130
Alameda, California 94502

(Address of principal executive office)

Registrant's telephone number, including area code: (510) 777-7000

Securities registered pursuant to Section 12(b) of the Exchange Act:

Title of each class	Trading Symbol	Name of each exchange on which registered
Common Stock, \$0.001 Par Value	DZSI	The Nasdaq Capital Market

Securities registered pursuant to Section 12(g) of the Exchange Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Exchange Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act:

Large accelerated filer	<input type="checkbox"/>		Accelerated filer	<input checked="" type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>		Smaller reporting company	<input checked="" type="checkbox"/>
			Emerging growth company	<input type="checkbox"/>

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

As of March 20, 2020, there were 21,513,373 shares outstanding of the registrant's common stock, \$0.001 par value. As of June 30, 2019 (the last business day of the registrant's most recently completed second fiscal quarter), the aggregate market value of the common stock held by non-affiliates of the registrant was approximately \$140,613,277.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive Proxy Statement for its 2020 Annual Meeting of Stockholders are incorporated by reference into Part III where indicated.

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Forward-looking Statements

This Annual Report on Form 10-K, including “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” contains forward-looking statements regarding future events and our future results that are subject to the safe harbors created under the Securities Act of 1933 (the “Securities Act”) and the Securities Exchange Act of 1934 (the “Exchange Act”). These statements are based on current expectations, estimates, forecasts, and projections about the industries in which we operate, and reflect the beliefs and assumptions of our management as of the date hereof.

We use words such as “anticipate,” “believe,” “continue,” “could,” “estimate,” “expect,” “forecast,” “goal,” “intend,” “may,” “plan,” “project,” “seek,” “should,” “target,” “will,” “would,” variations of such words, and similar expressions to identify forward-looking statements. In addition, statements that refer to projections of earnings, revenue, costs or other financial items in future periods; anticipated growth and trends in our business, industry or key markets; cost synergies, growth opportunities and other potential financial and operating benefits of the merger with Dasan Network Solutions, Inc. and the acquisition of Keymile GmbH; future growth and revenues from our products; our plans and our ability to refinance or repay our existing indebtedness prior to the applicable maturity dates; our ability to access other capital to fund our future operations; future economic conditions and performance; the impact of the global outbreak of COVID-19, also known as the coronavirus; the impact of interest rate and foreign currency fluctuations; the anticipated relocation of our corporate headquarters to Texas; anticipated performance of products or services; competition; plans, objectives and strategies for future operations, including our pursuit or strategic acquisitions and our continued investment in research and development; other characterizations of future events or circumstances; and all other statements that are not statements of historical fact, are forward-looking statements within the meaning of the Securities Act and the Exchange Act. Although we believe that the assumptions underlying the forward-looking statements are reasonable, we can give no assurance that our expectations will be attained. Factors which could have a material adverse effect on our operations and future prospects or which could cause actual results to differ materially from our expectations include, but are not limited to:

- the impact of the global outbreak of the coronavirus on the Company’s business and operations, including as a result of travel bans related thereto, the health and wellbeing of our employees in affected areas, disruption of our supply chain and softening of demands for our products;
 - our ability to realize the anticipated cost savings, synergies and other benefits of the merger with Dasan Network Solutions, Inc. and the acquisition of Keymile GmbH (“Keymile”) and any integration risks relating to the acquisition of Keymile;
 - our ability to generate sufficient revenue to achieve or sustain profitability;
 - our ability to raise additional capital to fund existing and future operations or to refinance or repay our existing indebtedness;
 - our ability to retain our key management personnel;
 - defects or other performance problems in our products;
 - any economic slowdown in the telecommunications industry that restricts or delays the purchase of our products by our customers;
 - commercial acceptance of our products;
 - intense competition in the communications equipment market from large equipment companies as well as private companies with products that address the same network needs as our products;
 - higher than anticipated expenses that we may incur;
 - any failure to comply with the periodic report filing and other requirements of The Nasdaq Stock Market for continued listing;
 - material weaknesses or other deficiencies in our internal control over financial reporting; and
 - additional factors discussed in Part I, Item 1A “Risk Factors” and Part II, Item 7 “Management’s Discussion and Analysis of Financial Condition and Results of Operations” of this Annual Report on Form 10-K, as well as those described from time to time in our future reports filed with the U.S. Securities and Exchange Commission (the “SEC”).
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PART I

ITEM 1. BUSINESS

DASAN Zhone Solutions, Inc. (“DZS” or the “Company,” formerly known as Zhone Technologies, Inc.) was incorporated under the laws of the state of Delaware in June 1999. On September 9, 2016, DZS acquired Dasan Network Solutions, Inc. a California corporation (“DNS”), through the merger of a wholly owned subsidiary of Zhone Technologies, Inc. with and into DNS, with DNS surviving as our wholly owned subsidiary. We refer to this transaction as the “Merger.” At the effective date of the Merger, all issued and outstanding shares of capital stock of DNS held by its sole shareholder, DASAN Networks, Inc. (“DNI”), a company incorporated under the laws of the Republic of Korea (“Korea”), were canceled and converted into the right to receive shares of our common stock equal to 57.3% of our issued and outstanding common stock immediately following the Merger. In connection with the Merger, Zhone Technologies, Inc. changed its name to DASAN Zhone Solutions, Inc.

The mailing address of our worldwide headquarters is 1350 South Loop Road, Suite 130, Alameda, California 94502, and our telephone number at that location is (510) 777-7000.

Company Overview

We are a global provider of ultra-broadband network access solutions and communications platforms deployed by advanced Tier 1, 2 and 3 service providers and enterprise customers. Our solutions are deployed by over 1200 customers in more than 120 countries worldwide. Our ultra-broadband solutions are focused on creating significant value for our customers by delivering innovative solutions that empower global communication advancement by shaping the internet connection experience. Our principal focus is centered on enabling our customers to “connect everything and everyone” to the internet-cloud economy via ultra-broadband connectivity solutions.

We research, develop, test, sell, manufacture and support platforms in five major areas: broadband access, mobile fronthaul/backhaul, Ethernet switching with Software Defined Networking (“SDN”) capabilities, new enterprise solutions based on Passive Optical LAN (“POL”), and new generation of SDN/ Network Function Virtualization (“NFV”) solutions for unified wired and wireless networks. We have extensive regional development and support centers around the world to support our customer needs.

Broadband Access

Our broadband access products are at the core of our product strategy and offer a variety of options for carriers and service providers to connect residential and business customers. Our solutions allow carriers and service providers to either use high-speed fiber or leverage their existing deployed copper networks to offer broadband services to customer premises. Once our broadband access products are deployed, the service provider can offer voice, high-definition and ultra-high-definition video, high-speed internet access and business class services to their customers. We develop our broadband access products for all aspects of carrier and service provider access networks, including customer premise equipment. Products include digital subscriber line (“DSL”) modems, Ethernet access demarcation devices, Gigabit passive optical network (“GPON”) terminals, 10 Gigabit (“10G”) passive optical network (“GPON/GEAPON/XGPON1/XGSPON/NGPON2/10GEAPON”) units and, Gigabit and 10G point-to-point Active Ethernet optical network terminals (“ONTs”). We also develop central office products, such as broadband loop carriers for DSL and voice-grade telephone service (“POTS”), high-speed digital subscriber line access multiplexers (“DSLAMs”) with G. Fast and VDSL capabilities, optical line terminals (“OLTs”) for passive optical distribution networks like GPONs, 10G passive optical networks and 10G point-to-point Active Ethernet.

Ethernet Switching

Our Ethernet switching products provide a high switching performance and manageable solution that bridges the gap from carrier access technologies to the core network. Over the past ten (10) years carriers have migrated access infrastructure to Ethernet from time-division multiplexing and asynchronous transfer mode systems. Our products can also be deployed in data centers, blurring the line between central office and data center. Our products support pure Ethernet switching as well as layer 3 IP and multiprotocol label switching (“MPLS”) and are currently being developed as part of the new programmable SDNs networks.

Mobile Fronthaul/Backhaul

Our mobile fronthaul/backhaul products provide a robust, manageable and scalable solution for mobile operators that enable them to upgrade their mobile fronthaul/backhaul systems and migrate to 5G networks and beyond. We provide our mobile fronthaul/backhaul products to mobile operators or carriers who provide the transport for mobile operators. Our mobile fronthaul/backhaul products may be collocated at the radio access node base station and can aggregate multiple radio access node base stations into a single fronthaul/backhaul for delivery of mobile traffic to the radio access node network controller. We provide standard Ethernet/IP or MPLS interfaces and interoperate with other vendors in these networks. In recent years, mobile fronthaul/backhaul networks have been providing carriers with significant revenue growth, which has led to mobile fronthaul/backhaul becoming one of the most important parts of their networks.

Enterprise Passive Optical LAN

Our FiberLAN™ portfolio of POL products are designed for enterprise, campus, hospitality and entertainment arena usage. Our portfolio includes high-performance, high-bandwidth switches connected to port extenders, which include units with integrated Power over Ethernet (“PoE”) to power a wide range of PoE-enabled access devices.

Our environmentally friendly FiberLAN POL solutions are one of the most cost-effective LAN technologies that can be deployed, allowing IT network managers to deploy a future-proof, low-maintenance, manageable solution that requires less space, air conditioning, copper and electricity than other alternatives.

The FiberLAN™ 2.0 portfolio is focused on a “plug and play” architecture for a new generation of distributed enterprise IT infrastructure that is both highly secure and bandwidth scalable with unified management of wireless and wireline end points/devices from a central network operations center with full visibility and management control of remote sites. Additionally, with SDN upgrades enterprise networks can be software programmed to autonomously monitor, reconfigure, diagnose and authenticate without the need for human intervention.

Software Defined Networks

Our SDN/NFV strategy is to develop tools and building blocks that will allow customers to migrate their networks’ full complement of legacy control plane and data plane devices to a centralized intelligent controller that can reconfigure the services of hundreds of network elements in real time for more controlled and efficient provision of services and bandwidth on a web scale basis. The latest evolution of our hardware-based solution are designed to support SDN/NFV architectures.

The adoption of SDN/NFV is a slow process in the service provider space, but is viewed as providing a better service for subscribers and a more efficient and cost-effective use of hardware resources for service providers. We will leverage our broadband access, mobile fronthaul/backhaul and Ethernet switching expertise to extract and virtualize many of the traditional legacy control and data plane functions to allow them to be run from the Cloud.

Industry Background

We believe that expansion in our worldwide business is driven by the increased demand of subscribers and cloud service providers for mobile and fixed network access solutions and communications equipment that enable or support access to higher speed bandwidth access to the internet. Furthermore, increased competition between service providers for the subscriber business has resulted in significant investment pressure to upgrade network infrastructure to meet the growing bandwidth needs. Broadband access networks must be multiservice in nature and must have an extensive quality of service guarantees in order to support 5G mobile fronthaul/backhaul, symmetric business services and residential services as well as virtual overlay networks for alternative operators and wholesale access.

In recent years, the growth of social communications and networking has placed significant demands on legacy access infrastructure, which has been challenging for the industry, even for the newest and most advanced subscribers. Increased subscriber usage of smartphone, video streaming services, PC gaming services and high definition and ultra-high definition televisions has increased the demand for music, pictures, user-generated content (as found on many video-sharing sites) and high definition video, which have all become a growing part of subscribers’ regular exchange of information. Trends such as SaaS, Cloud, IoT, and 5G have also increased the demand for broadband network access. All of these new technologies share a common dependency on high-bandwidth communication networks and sophisticated traffic management tools. As bandwidth demands continue to increase, carriers need to continue to upgrade their network infrastructure to support such demand. The infrastructure upgrade cycle typically has the effect of moving bandwidth bottlenecks from one part of the network to another (such as a carrier’s access network, core network or data centers), depending on the selection of technology and costs.

It is widely acknowledged in the industry that a fiber-optic broadband access network is the preferred network architecture for a broadband fixed network. This network architecture is commonly called Fiber to the Premises (“FTTP”) for business subscribers or Fiber to the Home (“FTTH”) for residential subscribers. With FTTH all services are generally delivered at the premise through smart optical networking units (ONT). The Fiber to the Node (“FTTN”) architecture is also deployed where the fiber-optic cable terminates at a street cabinet which contains a DSLAMs or Multiple Service Access Node (“MSAN”) that then provides higher speed services to their customers over the last mile legacy copper wireline infrastructure. With the shift away from the legacy copper telephone Time-division Multiplexing (“TDM”) switches (used in carrier networks from the 1980’s to the early 2000’s): many carriers that continue to provide services over copper wireline networks are decommissioning their legacy telephone switches and moving services over to Voice over Internet Protocol (“VoIP”) platforms via an MSAN/Softswitch solution. Our broadband access products and solutions are designed to address all these fiber configurations commonly referred to as (FTTX) by allowing carriers and service providers to either use fiber-optic networks or leverage their existing deployed copper networks to offer broadband services to customer premises.

With respect to mobile wireless networks, the popularity of mobile smartphones and increasing demand for mobile data has forced mobile network operators to upgrade their mobile access technologies from 3rd generation wireless (“3G”) to 4th generation wireless (“4G” or “LTE”) and to plan for 5th generation wireless technologies (“5G”). These technology upgrades are typically accompanied by network infrastructure upgrades, including upgrades to the carriers’ access networks (referred to as “mobile fronthaul/backhaul”), core networks and data centers. Our mobile fronthaul/backhaul products, which have features for time sensitive networks, provide a robust, manageable and scalable solution for mobile network operators that enable them to upgrade their mobile fronthaul/backhaul systems and migrate to 4G and 5G.

Another growing industry trend is the desire of carriers and service providers to simplify network operation and reduce costs. Increasingly, we see network operators seeking to reduce the number of active components in their networks and to centralize network data and control in data centers, both of which require network redesigns and upgrades. Our FiberLAN portfolio of POL products, as well as our Ethernet switching products and SDN and NFV tools and building blocks, are designed to address these market trends, with POL emerging as a popular customer choice for network upgrades.

Our Strategy

We are a global provider of ultra-broadband network access solutions and communications platforms deployed by advanced Tier 1, 2 and 3 service providers and enterprise customers. We provide a wide array of reliable, cost-effective networking technologies that include broadband access, Ethernet switching, mobile fronthaul/backhaul, passive optical LAN and software-defined networks.

The principal elements of our strategy include:

- **Global Presence.** We have a diversified customer base that includes more than 1200 customers in more than 120 countries worldwide. We provide our network access solutions to Tier 1 carriers in the Asia-Pacific region, the Middle East region and Europe, as well as Tier 2 and Tier 3 carriers in North America and Latin America. We leverage our global infrastructure, including sales offices all over the world, leading research and development centers in the United States, Germany, Korea, and Vietnam, and manufacturing capabilities in the United States, Germany, Korea, and China, to support our customer base.
- **Leading FTTx Market Position.** We enjoy a strong leadership position in the FTTx network access space. As an industry global leader in FTTx ONT and OLT portfolio options, we shipped more than 2.0 million ONTs in 2019, which we believe positions us as a top two leader, by volume, in the broadband fiber access market, excluding Chinese equipment manufacturers. We offer customers an extensive choice of indoor and outdoor fiber demarcation and fully integrated smart gateway’s with telephone data, POE, Wi-Fi 5 and OTT STB capabilities and other service interfaces. In the FTTx Optical Line Termination (OLT) category, we offer the industry’s largest portfolio of modular chassis and single platform for deployment in datacenter, central office, extended temperature environments and multi dwelling unit (MDU) scenarios.
- **Strategic Mergers and Acquisitions.** In addition to organic growth, we may from time to time seek to expand our operations and capabilities through strategic acquisitions. On January 3, 2019, we acquired Keymile to expand our business efforts in the Europe, Middle East and Africa (“EMEA”) region by acquiring experienced employees in sales and marketing, support and services, manufacturing, and research and development groups. This also expanded our in-house manufacturing and logistics and procurement capacity. The Keymile Multi-service Access Nodes (MSAN) portfolio complement the DZS existing portfolio by offering leading class point-to-point active FTTx Ethernet and copper-based access technology based on VDSL/Vectoring and G. Fast technology as well as VoIP gateway features. In addition, Keymile has a broad base of customers, comprised primarily of Tier 1 and Tier 2 service providers, across 35 countries, which further offers DZS customer and geographic diversification, particularly in Europe. The DZS regional EMEA headquarters is located in the Keymile facilities in Hannover, Germany.

- **Technology Leadership.** We believe that our future success is built upon our investment in the development of advanced communications technologies. This belief is reflected in our employee base, where more than 50% of our workforce is in research and development. We intend to continue to focus on research and development to maintain our leadership position in broadband network access solutions and communications equipment. These development efforts include innovating around 5G mobile fronthaul/backhaul technology with our leading Tier 1 carriers, developing a new generation of SDN/NFV solutions for unified wired and wireless networks, delivering a “plug and play” FiberLAN™ 2.0 solution to enhance usability and drive faster return on investment for our enterprise customers, upgrading our broadband access technology for 10 and 25/100 gigabyte access speeds, introducing our cloud managed Wi-Fi 5 solutions and data analytics offering and exploring distributed ledger and block chain technology for the telecommunications industry.
- **Ecosystem Partners.** We believe there is further opportunity to grow sales through our channel partners, particularly with distributors, value-added resellers, system integrators, as well as with municipalities and government organizations. We have a track record of building a diverse but targeted network of partners to help drive growth in specific segments of our business or in specific geographies. For FiberLAN™, we are working with distributors, value added resellers, and system integrators to broaden our enterprise go to market presence. For example, in India, we are working closely with municipalities to deploy their initial fiber-to-the-home vision and help deliver high speed broadband access to residents.

Customers

For our core business, we generally sell our products and services directly to carriers and service providers that offer voice, data and video services to businesses, governments, utilities and residential subscribers. Our global customer base includes regional, national and international carriers and service providers. To date, our products have been deployed by over 1200 carriers and service providers worldwide.

For our Enterprise FiberLAN™ business, we sell solutions indirectly to end customers through system integrators and distributors to the hospitality, education, stadiums, manufacturing and business enterprises as well as to the government and military. Our global FiberLAN™ customer base includes hotels, universities, sports arenas, military bases, government institutions, manufacturing facilities and Fortune 500 businesses.

For the year ended December 31, 2019, we had no customers that represented 10% or more of net revenue. For the year ended December 31, 2018, one customer, SK Broadband, Inc. represented 11% of net revenue.

Research and Development

The industry in which we compete is subject to rapid technological developments, evolving industry standards, changes in customer requirements, and continuing developments in communications service offerings. Our continuing ability to adapt to these changes, and to develop new and enhanced products, is a significant factor in maintaining or improving our competitive position and our prospects for growth. Therefore, we continue to make significant investments in product development.

We have core research and development teams located in the United States (Oakland, California; Seminole, Florida; Alpharetta, Georgia), Korea, Vietnam, India and Hannover, Germany through the acquisition of Keymile. In all of these centers, we develop and test both our hardware and software solutions. We continue to invest heavily in automated and scale testing capabilities for our products to better emulate our customers’ networks.

Our product development activities focus on products to support both existing and emerging technologies in the segments of the communications industry that we consider represent viable revenue opportunities. We are actively engaged in continuing to refine our solution architecture, introducing new products using the various solutions we support, and in creating additional interfaces and protocols for both domestic and international markets.

We continue our commitment to invest in leading edge technology research and development for new products and innovative solutions that align with our business strategy. Our research and product development expenses were \$38.5 million and \$35.3 million in 2019 and 2018, respectively.

Intellectual Property

We seek to establish, maintain and protect our proprietary rights in our technology and products through the use of patents, copyrights, trademarks and trade secrets. We also seek to maintain our trade secrets and confidential information by nondisclosure policies and through the use of appropriate confidentiality agreements. We have obtained a number of patents and trademarks in the United States of America (“United States”) and in other countries. There can be no assurance, however, that these rights can be successfully enforced against competitive products in every jurisdiction or any particular jurisdiction. Although we believe the protection afforded by our patents, copyrights, trademarks and trade secrets has value, the rapidly changing technology in the networking industry and uncertainties in the legal process, both domestically and internationally, make our future success dependent primarily on the innovative skills, technological expertise, and management abilities of our employees rather than on the protection afforded by patent, copyright, trademark, and trade secret laws.

Many of our products include intellectual property licensed from third parties. While it may be necessary in the future to seek or renew licenses relating to various aspects of our products, we believe, based upon past experience and standard industry practice, that such licenses generally could be obtained on commercially reasonable terms. Nonetheless, there can be no assurance that the necessary licenses would be available on acceptable terms, if at all. Our inability to obtain certain licenses or other rights or to obtain such licenses or rights on favorable terms, or the need to engage in litigation regarding these matters, could have a material adverse effect on our business, operating results and financial condition. The communications industry is characterized by rapidly changing technology, a large number of patents, and frequent claims and related litigation regarding patent and other intellectual property rights. We cannot assure you that our patents or other proprietary rights will not be challenged, invalidated or circumvented, that others will not assert intellectual property rights to technologies that are relevant to us, or that our rights will give us a competitive advantage. In addition, the laws of some foreign countries may not protect our proprietary rights to the same extent as the laws of the United States.

Sales and Marketing

We have a global sales presence with customers from over 120 countries, and we sell our products and services both directly and indirectly through channel partners with support from our sales force. Channel partners include distributors, value added resellers, system integrators and service providers. These partners sell directly to and service end customers and often provide additional value-added services such as system installation, technical support, and professional support services in addition to equipment sales. Our sales efforts are generally organized and fitted according to geographical regions for target carriers, service providers, municipalities and enterprise customers.

- **Americas Sales.** Our Americas Sales organization includes coverage of North America and Latin America regions. On the functional side, the Americas Sales organization also manages our inside sales and sales engineer activities. The organization establishes and maintains direct and indirect relationships with customers in the Americas, which includes carriers and service providers, cable operators, utilities and enterprises. In addition, this organization is responsible for managing our distribution channel.
- **EMEA Sales.** Our EMEA Sales organization consists of the combination of the Keymile sales organization with DZS’s EMEA Sales organization. This organization establishes and maintains direct and indirect relationships with customers in the EMEA region, which includes carriers and service providers, cable operators, utilities and enterprises.
- **Asia-Pacific (excluding Korea) Sales.** Our Asia-Pacific Sales organization includes coverage of Asia Pacific countries, exclusive of Korea. The organization establishes and maintains direct and indirect relationships with customers in the Asia Pacific region, which includes carriers and service providers, cable operators, utilities and enterprises.
- **Korea Sales.** Our Korea Sales organization establishes and maintains direct relationships with our Korean customers, consisting primarily of Tier 1 carriers. These carriers have historically been early innovators across various telecommunications industry upgrade cycles, including broadband access technology and mobile fronthaul/backhaul technology. We partner with such carriers from the early phases of technology development to ensure our products are carrier-grade and purpose-built for the most rigorous of environments.
- **Enterprise Sales.** Our Enterprise Sales organization includes global geographic coverage, and is primarily focused on coverage of our FiberLAN solutions. The organization establishes and maintains direct and indirect relationships with enterprise customers for both greenfield (i.e., projects that do not follow a prior work) and brownfield (i.e., projects that modify or upgrade existing infrastructure or products) projects targeting enterprise customers in several industry verticals, including education (i.e., K-12, universities and colleges, etc.), hospitality, healthcare, stadiums, corporate campuses, and others.

Our marketing team works closely with our sales, research and product development organizations, and our customers by providing communications that keep the market current on our products and features. Marketing also identifies and sizes new target markets for our products, creates awareness of our company and products, generates contacts and leads within these targeted markets, performs outbound education and public relations, and participates in industry associations and standard industry bodies to promote the growth of the overall industry.

Our backlog consists of purchase orders for products and services that we expect to ship or perform within the next year. Our backlog may fluctuate based on the timing of when purchase orders are received. As of December 31, 2019, our backlog was approximately \$80.0 million, compared to \$47.3 million at December 31, 2018. We consider backlog to be an indicator, but not the sole predictor, of future sales because our customers may cancel or defer orders without penalty.

Competition

We compete in communications equipment markets, providing products and services for the delivery of voice, data and video services. These markets are characterized by rapid change, converging technologies and a migration to solutions that offer superior advantages. These market factors represent both an opportunity and a competitive threat to us. We compete with numerous vendors in our core business, including ADTRAN, Calix, Huawei, Nokia, and ZTE, among others. In our FiberLAN business, our competitors include Cisco, Nokia, and Tellabs, among others. In our Ethernet switching business, our competitors include Cisco and Juniper Networks, among others. In addition, a number of companies have introduced products that address the same network needs that our products and solutions address, both domestically and internationally. The overall number of our competitors may increase, and the identity and composition of competitors may change. As we continue to expand our sales globally, we may see new competition in different geographic regions. Barriers to entry are relatively low, and new ventures to create products that do or could compete with our products are regularly formed. Many of our competitors have greater financial, technical, sales and marketing resources than we do.

The principal competitive factors in the markets in which we presently compete and may compete in the future include:

- product performance;
- feature capabilities;
- manufacturing capacity;
- interoperability with existing products;
- scalability and upgradeability;
- conformance to standards;
- breadth of services;
- reliability;
- ease of installation and use;
- geographic footprints for products;
- ability to provide customer financing;
- pricing;
- technical support and customer service; and
- brand recognition.

While we believe that we compete successfully with respect to each of these factors, we currently face and expect we will continue to face intense competition in our markets. In addition, the inherent nature of communications networking requires interoperability. As such, we must cooperate and at the same time compete with many companies.

Manufacturing and Operations

Operationally, we use a global sourcing procurement program to purchase and manage key raw materials and subassemblies through qualified suppliers, sub-contractors, original equipment and design manufacturers and electronic manufacturing service vendors. The manufacturing process uses a strategic combination of procurement from qualified suppliers and in-house manufacturing, throughout the process we manage the assembly, quality assurance, customer testing, final inspection and shipping of our products.

We manufacture our low volume, high mix products at our manufacturing facilities in Seminole, Florida, USA and Hannover, Germany. For certain products, we rely on subcontractors, primarily located in China, and original design manufacturers for high volume, low mix products.

Some completed products are procured to our specifications and shipped directly to our customers. We also acquire completed products from certain suppliers, which we configure and ship from our facility. Some of these purchases are significant. We purchase both standard off-the-shelf parts and components, which are generally available from more than one supplier, and single-source parts and components. We have generally been able to obtain adequate supplies to meet customer demand in a timely manner from our current vendors, or, when necessary, from alternate vendors. We believe that alternate vendors can be identified if current vendors are unable to fulfill our needs, or design changes can be made to employ alternate parts. The recent outbreak of the coronavirus in China and other countries has negatively impacted our supply chain in recent months and the continued spread of the virus could further negatively and materially impact our operations. See “Part II, Item 7 – Management’s Discussion and Analysis of Financial Condition and Results of Operations” of this Annual Report on Form 10-K for additional information.

We design, specify, and monitor all of the tests that are required to meet our quality standards. Our manufacturing and test engineers work closely with our design engineers to ensure manufacturability and testability of our products, and to ensure that manufacturing and testing processes evolve along with our technologies. Our manufacturing engineers specify, build, or procure our test stations, establish quality standards and protocols, and develop comprehensive test procedures and processes to assure the reliability and quality of our products. Products that are procured complete or partially complete are inspected, tested, or audited for quality control.

Our Quality Management System is compliant with, and we are certified to, ISO-9001:2015 by our external registrar, National Standards Authority of Ireland. ISO-9001:2015 requires that our processes be documented, followed and continuously improved. Internal audits are conducted on a regular schedule by our quality assurance personnel, and external audits are conducted by our external registrar each year. Our quality system is based upon our model for quality assurance in production and service to ensure our products meet rigorous quality standards.

We have generally been able to have sufficient production capacity to meet demand for our product offerings through a combination of existing and added capacity, additional employees and the outsourcing of products or components. The recent outbreak of the coronavirus in China and other countries has negatively impacted our supply chain in recent months. We believe that alternate vendors can be identified if current vendors are unable to fulfill our needs, or design changes can be made to employ alternate parts.

Compliance with Regulatory and Industry Standards

Our products must comply with a significant number of voice and data regulations and standards which vary by jurisdiction. Standards for new services continue to evolve, and we may need to modify our products or develop new versions to meet these standards. Standards setting and compliance verification in the United States are determined by the Federal Communications Commission, Underwriters Laboratories (a global safety certification company), Quality Management Institute (a management training and leadership company), Telecordia (an operations management and fraud prevention solutions company which is a subsidiary of Ericsson), and other communications companies. In international markets, our products must comply with standards issued, implemented and enforced by the regulatory authorities of foreign jurisdictions, as applicable, such as the European Telecommunications Standards Institute (“ETSI”), among others.

Environmental Matters

Our operations and manufacturing processes are subject to federal, state, local and foreign environmental protection laws and regulations. Such laws and regulations relate to the presence, use, handling, storage, discharge and disposal of certain hazardous materials and wastes, the pre-treatment and discharge of process waste waters and the control of process air pollutants. Under certain laws of the United States, we can be held responsible for cleanup costs at currently or formerly owned or operated locations or at third party sites to which our wastes were sent for disposal. To date, liabilities relating to contamination have not been significant, and have not had a material impact on our operations or results. We believe that our operations and manufacturing processes currently comply in all material respects with applicable environmental protection laws and regulations. If we fail to comply with any present or future laws or regulations, we could be subject to liabilities, the suspension of production or a prohibition on the sale of our products. In addition, such regulations could require us to incur significant expenses to comply with environmental laws or regulations, including expenses associated with the redesign of any non-compliant product or the development or installation of additional pollution control technology. From time to time new laws or regulations are enacted, and it is difficult to anticipate how such laws or regulations will be implemented and enforced, or the impact they will have on our operations or results.

Our operations in the European Union are subject to the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive and the Waste Electrical and Electronic Equipment Directive. We are aware of and are taking suitable action to comply with the new European Union Restriction of Hazardous Substances standards. Our operations in the United States or other countries, such as Japan and China are subject to similar legislation. Our failure to comply with any regulatory requirements or contractual obligations relating to environmental matters or hazardous materials could result in us being liable for costs, fines, penalties and third-party claims, and could jeopardize our ability to conduct business in the jurisdictions where such laws or the regulations apply.

Employees

As of December 31, 2019, we employed over 789 staff members worldwide. We consider the relationships with our employees to be positive. Competition for technical personnel in our industry is intense. We believe that our future success depends in part on our continued ability to hire, assimilate and retain qualified personnel. To date, we believe that we have been successful in recruiting qualified employees, but there is no assurance that we will continue to be successful in the future.

Website and Available Information

Our investor website address is <http://investor-dzsi.com>. The information on our website does not constitute part of this Annual Report on Form 10-K, or any other report, schedule or document we file or furnish to the SEC. On the “Investor Relations” section of our website at <http://investor-dzsi.com>, we make available the following filings available free of charge as soon as reasonably practicable after they are electronically filed with or furnished to the SEC: our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and any amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act.

ITEM 1A. RISK FACTORS

An investment in our common stock involves a high degree of risk. You should carefully consider the risks described below and the other information in this Annual Report on Form 10-K and in other filings we make with the SEC before making an investment decision. Our business, prospects, financial condition, or operating results could be harmed by any of these risks, as well as other risks not currently known to us or that we currently consider immaterial. If any of such risks and uncertainties actually occurs, our business, financial condition or operating results could differ materially from the plans, projections and other forward-looking statements included in the section titled “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and elsewhere in this report and in our other public filings. The trading price of our common stock could decline due to any of these risks, and, as a result, you may lose all or part of your investment.

Risks Related to our Business

We have a significant amount of indebtedness. As of December 31, 2019, the aggregate principal amount of our outstanding indebtedness was \$38.0 million, consisting of \$18.3 million in principal amount of outstanding borrowings under our short-term debt obligations and \$19.7 million in long-term related party borrowings. On February 27, 2019, the Company and certain of its subsidiaries (as co-borrowers or guarantors) entered into that certain Revolving Credit, Term Loan, Guaranty and Security Agreement and that certain Export-Import Revolving Credit, Guaranty and Security Agreement, in each case with PNC Bank, National Association (“PNC Bank”) and Citibank, N.A. as lenders, and PNC as agent for the lenders. We refer to such transactions and the agreements referenced above as the “PNC Credit Facilities”. On March 5, 2020, DASAN Network Solutions, Inc., a corporation organized under the laws of the Republic of Korea, and an indirect, wholly-owned subsidiary of the Company (“DNS Korea”) entered into a Loan Agreement with DNI, pursuant to which DNS Korea borrowed KRW 22.4 billion (\$18.5 million USD) from DNI (the “March 2020 DNI Loan”). DNS Korea will fully loan such borrowed funds to the Company, which will be used to repay and terminate the PNC Credit Facilities. See “Part II, Item 7 – Management’s Discussion and Analysis of Financial Condition and Results of Operations” of this Annual Report on Form 10-K for additional information.

In the event of a default and acceleration of our obligations under the March 2020 DNI Loan, we may not be able to obtain replacement financing at all or on commercially reasonable terms or on terms that are acceptable to us. Our level of indebtedness could have important consequences and could materially and adversely affect us in a number of ways, including:

- limiting our ability to obtain additional financing in the future for working capital, capital expenditures, acquisitions or general corporate purposes;
- limiting our flexibility to plan for, or react to, changes in our business or market conditions;
- requiring us to use a significant portion of any future cash flow from operations to repay or service the debt, thereby reducing the amount of cash available for other purposes;

- making us more highly leveraged than some of our competitors, which could place us at a competitive disadvantage; and
- making us more vulnerable to the impact of adverse economic and industry conditions and increases in interest rates.

The agreements governing the March 2020 DNI Loan and the instruments governing our other indebtedness contain certain covenants, limitations, and conditions with respect to the Company and its subsidiaries, including financial reporting obligations and customary events of default and require that certain of our assets be pledged as collateral for such loans. These terms, conditions and collateral requirements could restrict our ability to operate our business. If an event of default occurs under the March 2020 DNI Loan, DNI will be entitled to take various actions, including requiring the immediate repayment of all outstanding amounts borrowed under the March 2020 DNI Loan and seizing and/or selling the assets of the Company and the subsidiary guarantors to satisfy the obligations under the March 2020 DNI Loan.

In the past, we have violated certain financial covenants in our credit agreements and received waivers for these violations. At September 30, 2019, the Company was not in compliance with the maximum leverage ratio financial covenant under the PNC Credit Facilities, which represented an event of default thereunder. On November 8, 2019, the Company obtained a waiver of the foregoing event of default. As a condition for the issuance of the waiver, the Company voluntarily prepaid \$10.0 million of the outstanding term loan and paid a one-time fee of \$150,000. The Company would have been in further breach of this financial covenant as of December 31, 2019. The Company and DNS Korea entered into the March 2020 DNI Loan in part to repay and terminate the PNC Credit Facilities. While the Company believes the covenants in the March 2020 DNI Loan are more favorable than the covenants contained in the PNC Credit Facilities, there remains uncertainty as to whether DNS Korea will be able to satisfy some of the covenants included in the March 2020 DNI Loan. If the Company violates covenants in the March 2020 DNI Loan, the Company could be required to repay the amounts then outstanding under the March 2020 DNI Loan.

We cannot assure you that we will be able to generate cash flow in amounts sufficient to enable us to service our debt or to meet our working capital and capital expenditure requirements. If we are unable to generate sufficient cash flow from operations or to borrow sufficient funds to service our debt, we may be required to sell assets, reduce capital expenditures, purchase credit insurance or obtain additional financing. We cannot assure you that we will be able to engage in any of these actions on reasonable terms, if at all.

We may need additional capital, and we cannot be certain that additional financing will be available.

We need sufficient capital to fund our ongoing operations and may require additional financing in the future to expand our business, acquire assets or repay or refinance our existing debt. Our ability to obtain financing will depend, among other things, on our development efforts, business plans, operating performance and condition of the capital markets at the time we seek financing. We cannot assure you that additional financing will be available to us on favorable terms when required, or at all. Additionally, while there are no covenants in the March 2020 DNI Loan restricting our ability, or the ability of our subsidiaries, to borrow additional funds, the collateral requirements under the March 2020 DNI Loan may make it difficult for us to obtain additional secured financing. If we raise additional funds through the issuance of equity, equity-linked or debt securities, those securities may have rights, preferences or privileges senior to the rights of our common stock, and our stockholders may experience dilution.

If we need additional capital and cannot raise it on acceptable terms, we may not be able to, among other things:

- maintain existing operations;
- pay ordinary expenses;
- fund our business expansion or product innovation;
- pursue future business opportunities, including acquisitions;
- respond to unanticipated capital requirements;
- repay or refinance our existing debt;
- hire, train and retain employees; or
- respond to competitive pressures or unanticipated working capital requirements.

Our failure to do any of these things could seriously harm our business, financial condition, liquidity and operating results. In addition, we may be required to reduce the scope of our planned product development and sales and marketing efforts beyond the reductions that we have previously taken, and reduce operations in low margin regions, including reductions in headcount, which could have a material adverse effect on our business, operations, financial condition and liquidity.

We may not have the liquidity to support our future operations and capital requirements.

As of December 31, 2019, we had approximately \$28.7 million in cash and cash equivalents, including \$14.2 million in cash balances held by our international subsidiaries. If our operating performance does not improve, and we are unable to raise additional capital (as discussed in the prior risk factor), we may be unable to adequately fund our existing operations. Our current liquidity condition exposes us to the following risks:

- vulnerability to adverse economic conditions in our industry or the economy in general;
- a substantial portion of available cash is dedicated to debt servicing, rather than other purposes, including operations and new product innovation;
- limitations on our ability to adequately plan for, or react to, changes in our business and industry; and
- negative investor and customer perceptions about our financial stability, which could limit our ability to obtain financing or acquire customers.

Our current liquidity condition could be further harmed, and we may incur significant losses or expend significant amounts of capital if:

- the market for our products develops more slowly than anticipated;
- we fail to establish market share or generate revenue at anticipated levels;
- our capital expenditure forecasts change or prove to be inaccurate; or
- we fail to respond to unforeseen challenges or take advantage of unanticipated opportunities.

To meet our liquidity needs and to finance our capital expenditures and working capital needs for our business, we may be required to raise substantial additional capital, reduce our operations (including through the sale of assets) or both.

We have experienced significant losses and we may incur losses in the future. If we fail to generate sufficient revenue to sustain our profitability, our stock price could decline.

We had a net loss of \$13.3 million and net income of \$2.8 million for the years ended December 31, 2019 and 2018, respectively. Additionally, we have incurred significant losses in prior years. We have an accumulated deficit of \$29.2 million as of December 31, 2019. We have significant fixed expenses and expect that we will continue to incur substantial manufacturing, research and product development, sales and marketing, customer support, administrative and other expenses in connection with the ongoing development of our business. In addition, we may be required to spend more on research and product development than originally budgeted to respond to industry trends. We may also incur significant new costs related to acquisitions and the integration of new technologies and other acquisitions that may occur in the future. We may not be able to adequately manage costs and expenses or achieve or maintain adequate operating margins. As a result, our ability to sustain profitability in future periods will depend on our ability to generate and sustain higher revenue while maintaining reasonable costs and expense levels. If we fail to generate sufficient revenue to sustain profitability in future periods, we may continue to incur operating losses, which could be substantial, and our stock price could decline.

Our future operating results are difficult to predict and our stock price may continue to be volatile.

As a result of a variety of factors discussed in this Annual Report on Form 10-K, our revenues for a particular quarter are difficult to predict. Our revenue and operating results may vary significantly from quarter to quarter due to a number of factors, many of which are outside of our control. The primary factors that could affect our results of operations include the following:

- commercial acceptance of our products and services;
- fluctuations in demand for network access products;
- fluctuation in gross margin;
- our ability to attract and retain qualified and key personnel;
- the timing and size of orders from customers;
- the ability of our customers to finance their purchase of our products as well as their own operations;
- new product introductions, enhancements or announcements by our competitors;
- our ability to develop, introduce and ship new products and product enhancements that meet customer requirements in a timely manner;
- changes in our pricing policies or the pricing policies of our competitors;

- the ability of our company and our contract manufacturers to attain and maintain production volumes and quality levels for our products;
- our ability to obtain sufficient supplies of sole or limited source components;
- increases in the prices of the components we purchase, or quality problems associated with these components;
- unanticipated changes in regulatory requirements which may require us to redesign portions of our products;
- changes in accounting rules;
- integrating and operating any acquired businesses;
- our ability to achieve targeted cost reductions;
- how well we execute on our strategy and operating plans; and
- general economic conditions as well as those specific to the communications, internet and related industries.

Any of the foregoing factors, or any other factors discussed elsewhere herein, could have a material adverse effect on our business, operations, financial condition and liquidity that could adversely affect our stock price. We anticipate that our stock price and trading volume may continue to be volatile in the future, whether due to the factors described above, volatility in public stock markets generally (particularly in the technology sector) or otherwise.

In connection with the Keymile Acquisition, we assumed certain of Keymile’s liabilities, which could harm our business, operations, financial condition, and liquidity.

Pursuant to the definitive agreement for the Keymile Acquisition, we assumed certain of Keymile’s liabilities, including tax and pension liabilities, and any liabilities that may arise related to breaches of representations and warranties made by Keymile in connection with a prior sale of assets by Keymile that survive through 2022. Although the definitive agreement for the Keymile Acquisition entitles us to indemnification for certain losses incurred related to those assumed liabilities, our right to indemnification from the Keymile sellers is limited by the survival period of the representations and warranties included in the Keymile Acquisition definitive agreement and recovery is limited in amount to the purchase price of Keymile, or EUR 10.3 million. Additionally, our rights to recovery against such losses is limited under our and third party provided warranty and indemnity liability insurance coverage of up to EUR 35.3 million. If such claims or losses exceed such amount, or if they are not indemnifiable under the Keymile Acquisition definitive agreement, any such losses could negatively impact our financial situation. In addition, our closing of the Keymile Acquisition could give rise to substantial tax liabilities under German law, which could negatively impact our financial condition and liquidity.

Strategic acquisitions or investments that we have made or that we could pursue or make in the future may disrupt our operations and harm our business, operations, financial condition, and liquidity.

As part of our business strategy, we have made investments in and acquired other companies, including Keymile in 2019, that we believe are complementary to our core business and are consistent with our growth strategy. In the future we may continue to make investments in or acquire other companies or complementary solutions or technologies as part of our growth strategy. Any such acquisition or investment may divert the attention of management and cause us to incur various expenses in identifying, investigating, and pursuing suitable opportunities, whether or not the transactions are completed, and may result in unforeseen operating difficulties and expenditures. These transactions could also result in dilutive issuances of equity securities, the incurrence of debt or assumption of liabilities, and increase our risk of litigation exposure, which could adversely affect our operating results. In addition, if the resulting business from such a transaction fails to meet our expectations, our operating results, business, and financial condition may suffer or we may be exposed to unknown risks or liabilities.

Additionally, any significant acquisition would require the consent of our lenders. Any failure to receive such consent could delay or prohibit us from acquiring companies that we believe could enhance our business. Furthermore, we may dedicate significant time and capital resources in the pursuit of acquisition opportunities and may be unable to find and identify desirable acquisition targets or business opportunities or be successful in entering into an agreement with any particular strategic partner.

Upon the closing of any acquisition transaction, we will need to integrate the acquired organization and its products and services with our legacy operations. The integration process may be expensive, time-consuming and a strain on our resources and our relationships with employees, customers, distributors and suppliers, and ultimately may not be successful. The benefits or synergies we may expect from the acquisition of complementary or supplementary businesses may not be realized to the extent or in the time frame we initially anticipated. Mergers and acquisitions of high-technology companies are inherently subject to increased risk and to many factors outside of our control, and we cannot be certain that our previous or future acquisitions will be successful and will not materially adversely affect our business, operations, financial condition, and liquidity. Any failure to successfully acquire and integrate acquired organizations and their products and services could seriously harm our business, operations, financial condition, and liquidity.

Some of the risks that could affect our ability to successfully integrate acquired businesses, including Keymile's telecommunication systems business, include those associated with:

- failure to successfully further develop the acquired products or technology;
- insufficient revenues to offset increased expenses associated with acquisitions and where competitors in such markets have stronger market positions;
- conforming the acquired company's standards, policies, processes, procedures and controls with our operations;
- difficulties in entering markets in which we have no or limited prior experience;
- difficulties in integrating the operations, technologies, products and personnel of the acquired companies;
- coordinating new product and process development, especially with respect to highly complex technologies;
- potential loss of key employees, customers, distributors, vendors and other business partners of the companies we acquire following and continuing after the announcement of acquisition plans or transactions;
- hiring and training additional management and other critical personnel;
- in the case of foreign acquisitions, the need to integrate operations across different cultures and languages and to address the particular economic, currency, political and regulatory risks associated with specific countries;
- increasing the scope, geographic diversity and complexity of our operations;
- diversion of management's time and attention away from normal daily operations of the business and the challenges of managing larger and more widespread operations resulting from acquisitions;
- consolidation of facilities, integration of the acquired company's accounting, human resource and other administrative functions and coordination of product, engineering and sales and marketing functions;
- the geographic distance between the companies;
- failure to comply with covenants related to the acquired business;
- unknown, underestimated, and/or undisclosed liabilities for activities of the acquired company before the acquisition, including patent and trademark infringement claims, violations of laws, employment claims, pension liabilities, commercial disputes, tax liabilities and other known and unknown liabilities; and
- litigation or other claims in connection with the acquired company, including claims for terminated employees, customers, former stockholders or other third parties.

We identified material weaknesses in our internal control over financial reporting, and we cannot provide assurances that these weaknesses will be effectively remediated or that additional material weaknesses will not occur in the future. If our internal control over financial reporting or our disclosure controls and procedures are not effective, we may not be able to accurately report our financial results, prevent fraud or file our periodic reports in a timely manner, which may cause investors to lose confidence in our reported financial information and which may lead to a decline in our stock price.

We are responsible for establishing and maintaining adequate internal control over financial reporting to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. We assessed the effectiveness of our internal control over financial reporting as of December 31, 2019, the end of our fiscal year. In making this assessment, management used the criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee Sponsoring Organizations of the Treadway Commission. Based on our assessment, we have concluded that, as of December 31, 2019, our internal control over financial reporting was not effective because of the unremediated material weaknesses in our internal control over financial reporting described below.

Management concluded that, as of December 31, 2019, our internal control over financial reporting was not effective, because of the unremediated material weaknesses in our internal control over financial reporting described below. Management determined that the Company did not maintain a sufficient complement of personnel with appropriate accounting knowledge, experience and training in the application of US GAAP, including accounting for significant unusual transactions. In addition, the Company did not maintain an effective control environment as it did not appropriately identify internal controls over inventory valuation and revenue. Also, management determined that the Company did not design and maintain effective controls over the financial closing process, including controls surrounding monitoring and review of the activity of its foreign subsidiaries. These material weaknesses could result in a misstatement in the financial statements that would result in a material misstatement in the annual or interim consolidated financial statements that would not be prevented or detected.

If we are not able to correct material weaknesses or deficiencies in internal controls in a timely manner, our ability to record, process, summarize and report financial information accurately and within the time periods specified in the SEC's rules and forms will be adversely affected. Such a result could negatively impact the market price and trading liquidity of our common stock, weaken investor confidence in our reported financial information, subject us to civil and criminal investigations and penalties, and generally materially and adversely affect our business and financial condition.

The long and variable sales cycles for our products could cause revenue and operating results to vary significantly from quarter to quarter.

The target customers for our products have substantial and complex networks that they traditionally expand in large increments on a periodic basis. Accordingly, our marketing efforts are focused primarily on prospective customers that may purchase our products as part of a large-scale network deployment. Our target customers typically require a lengthy evaluation, testing and product qualification process. Throughout this process, we are often required to spend considerable time and incur significant expenses educating and providing information to prospective customers about the uses and features of our products. Even after a company makes the final decision to purchase our products, it could deploy our products over extended periods of time. The timing of deployment of our products varies widely, and depends on a number of factors, including our customers' skill sets, geographic density of potential subscribers, the degree of configuration and integration required to deploy our products, and our customers' ability to finance their purchase of our products as well as their operations. As a result of any of these factors, our revenue and operating results could vary significantly from quarter to quarter.

The market we serve is highly competitive and we may not be able to compete successfully.

Competition in communications equipment markets is intense. These markets are characterized by rapid change, converging technologies and a migration to networking solutions that offer superior advantages. We are aware of many companies in related markets that address particular aspects of the features and functions that our products provide. Currently, our primary competitors in our core business include ADTRAN, Calix, Huawei, Nokia and ZTE, among others. In our FiberLAN business, our competitors include Cisco, Nokia and Tellabs. In our Ethernet switching business, our competitors include Cisco, and Juniper. We also may face competition from other communications equipment companies or other companies that may enter our markets in the future. In addition, a number of companies have introduced products that address the same network needs that our products and solutions address, both domestically and internationally. Many of our competitors have longer operating histories, greater name recognition, larger customer bases and greater financial, technical, sales and marketing resources than we do and may be able to undertake more extensive marketing efforts, adopt more aggressive pricing policies and provide more customer financing than we can. In particular, we are encountering price-focused competitors from Asia, especially China, which places pressure on us to reduce our prices. If we are forced to reduce prices in order to secure customers, we may be unable to sustain gross margins at desired levels or achieve profitability. Competitive pressures could result in increased pricing pressure, reduced profit margins, increased sales and marketing expenses and failure to increase, or the loss of, market share, any of which could reduce our revenue and adversely affect our financial results. Moreover, our competitors may foresee the course of market developments more accurately than we do and could develop new technologies that render our products less valuable or obsolete.

In our markets, principal competitive factors include:

- product performance;
- interoperability with existing products;
- scalability and upgradeability;
- conformance to standards;
- breadth of services;
- reliability;
- ease of installation and use;
- geographic footprints for products;
- ability to provide customer financing;
- pricing;
- technical support and customer service; and
- brand recognition.

If we are unable to compete successfully against our current and future competitors, we may have difficulty obtaining or retaining customers, and we could experience price reductions, order cancellations, increased expenses and reduced gross margins, any of which could have a material adverse effect on our business, operations, financial condition, and liquidity.

If demand for our products and solutions does not develop as we anticipate, then our business operations, financial condition, and liquidity will be adversely affected.

Our future revenue depends significantly on our ability to successfully develop, enhance and market our products and solutions to our target markets. Most network service providers have made substantial investments in their current infrastructure, and they may elect to remain with their current architectures or to adopt new architectures in limited stages or over extended periods of time. A decision by a customer to purchase our products will involve a significant capital investment. We must convince our service provider customers that they will achieve substantial benefits by deploying our products for future upgrades or expansions. We may experience difficulties with product reliability, partnering, and sales and marketing efforts that could adversely affect our business and divert management attention and resources from our core business. We do not know whether a viable market for our products and solutions will develop or be sustainable in our businesses. If these markets do not develop or develop more slowly than we expect, our business, operations, financial condition and liquidity will be materially harmed.

We depend upon the development of new products and enhancements to existing products, and if we fail to predict and respond to emerging technological trends and customers' changing needs, our operating results and market share may suffer.

The markets for our products are characterized by rapidly changing technology, evolving industry standards, changes in end-user requirements, frequent new product introductions and changes in communications offerings from network service provider customers. Our future success depends on our ability to anticipate or adapt to such changes and to offer, on a timely and cost-effective basis, products that meet changing customer demands and industry standards. We may not have sufficient resources to successfully and accurately anticipate customers' changing needs and technological trends, manage long development cycles or develop, introduce and market new products and enhancements. The process of developing new technology is complex and uncertain, and if we fail to develop new products or enhancements to existing products on a timely and cost-effective basis, or if our new products or enhancements fail to achieve market acceptance, our business, operations, financial condition and liquidity would be materially adversely affected.

Because our products are complex and are deployed in complex environments, our products may have defects that we discover only after full deployment by our customers, which could have a material adverse effect on our business.

We produce highly complex products that incorporate leading-edge technology, including both hardware and software. Software often contains defects or programming flaws that can unexpectedly interfere with expected operations. In addition, our products are complex and are designed to be deployed in large quantities across complex networks. Because of the nature of these products, they can only be fully tested when completely deployed in large networks with high amounts of traffic, and there is no assurance that our pre-shipment testing programs will be adequate to detect all defects. As a result, our customers may discover errors or defects in our hardware or software, or our products may not operate as expected. If we are unable to cure a product defect, we could experience damage to our reputation, reduced customer satisfaction, loss of existing customers and failure to attract new customers, failure to achieve market acceptance, reduced sales opportunities, loss of revenue and market share, increased service and warranty costs, diversion of development resources, legal actions by our customers, and increased insurance costs. Defects, integration issues or other performance problems in our products could also result in damages to our customers, financial or otherwise. Our customers could seek damages for related losses from us, which could seriously harm our business, operations, financial condition and liquidity. A product liability claim brought against us, even if unsuccessful, would likely be time consuming and costly. The occurrence of any of these problems would seriously harm our business, operations, financial condition and liquidity.

Increased tariffs on products and goods that we purchase from off-shore sources (particularly Chinese sources) and changes in international trade policies and relations could have an adverse effect on our customers and operating results.

The pricing of our products to customers and our ability to conduct business with certain customers can be affected by changes in U.S. and other countries' trade policies. For example, while a trade deal was signed between the U.S. and China on January 15, 2020 that signals a cooling of tensions between the U.S. and China over trade, concerns over the stability of bilateral trade relations remain. Before the trade deal, the United States had recently imposed tariffs on a wide-range of products and goods manufactured in China that are directly or indirectly imported into the United States. In response, various countries and economic regions announced plans or intentions to impose retaliatory tariffs on a wide-range of products they import from the United States. Any newly imposed, announced and threatened U.S. tariffs and retaliatory tariffs could have the effect of increasing the cost of materials we use to manufacture certain products, which could result in lower margins. The tariffs could also result in disruptions to our supply chain, as suppliers struggle to fill orders from companies trying to purchase goods in bulk ahead of announced tariffs. Although we believe that the incremental costs to us of recent tariffs was immaterial, if new tariffs are imposed or if new tariffs apply to additional categories of components used in our manufacturing activities, and if we are unable to pass on the costs of tariffs to our customers, our operating results would be harmed. In addition, changes in the political environment, governmental policies, international trade policies and relations, or U.S.-China relations could result in

revisions to laws or regulations or their interpretation and enforcement, trade sanctions, or retaliatory actions by China in response to U.S. actions, which could have an adverse effect on our customers, business plans and operating results.

Sales to communications service providers are especially volatile, and weakness in sales orders from this industry could harm our business, operations, financial condition and liquidity.

Sales activity in the service provider industry depends upon the stage of completion of expanding network infrastructures, the availability of funding, and the extent to which service providers are affected by regulatory, economic and business conditions in the country of operations. Although some service providers may be increasing capital expenditures over the depressed levels that have prevailed over the last few years, weakness in orders from this industry could have a material adverse effect on our business, operations, financial condition and liquidity. Changes in technology, competition, overcapacity, changes in the service provider market, regulatory developments and constraints on capital availability have had a material adverse effect on many of our service provider customers, with many of these customers going out of business or substantially reducing their expansion plans. These conditions have materially harmed our business and operating results, and we expect that some or all of these conditions may continue for the foreseeable future. Finally, service provider customers typically have longer implementation cycles; require a broader range of services including design services; demand that vendors take on a larger share of risks; often require acceptance provisions, which can lead to a delay in revenue recognition; and expect financing from vendors. All these factors can add further risk to business conducted with service providers.

We rely on contract manufacturers for a portion of our manufacturing requirements.

We rely on contract manufacturers to perform a portion of the manufacturing operations for our products. These contract manufacturers build products for other companies, including our competitors. In addition, we do not have contracts in place with some of these providers and may not be able to effectively manage those relationships. We cannot be certain that our contract manufacturers will be able to fill our orders in a timely manner. We face a number of risks associated with this dependence on contract manufacturers including reduced control over delivery schedules, the potential lack of adequate capacity during periods of excess demand, poor manufacturing yields and high costs, quality assurance, increases in prices, and the potential misappropriation of our intellectual property. We have experienced in the past, and may experience in the future, problems with our contract manufacturers, such as inferior quality, insufficient quantities and late delivery of products.

A shortage of adequate component supply or manufacturing capacity could increase our costs or cause a delay in our ability to fulfill orders, and our failure to estimate customer demand properly could result in excess or obsolete component inventories that could adversely affect our gross margins.

Occasionally, we may experience a supply shortage, or a delay in receiving, certain component parts as a result of strong demand for the component parts and/or capacity constraints or other problems experienced by suppliers. If shortages or delays persist, the price of these components may increase, or the components may not be available at all, and we may also encounter shortages if we do not accurately anticipate our needs. Conversely, we may not be able to secure enough components at reasonable prices or of acceptable quality to build new products in a timely manner in the quantities or configurations needed. Accordingly, our revenue and gross margins could suffer until other sources can be developed. Our operating results would also be adversely affected if, anticipating greater demand than actually develops, we commit to the purchase of more components than we need. Furthermore, as a result of binding price or purchase commitments with suppliers, we may be obligated to purchase components at prices that are higher than those available in the current market. In the event that we become committed to purchase components at prices in excess of the current market price, our gross margins could decrease. In the past we experienced component shortages that adversely affected our financial results and, in the future, may continue to experience component shortages.

We depend on a limited source of suppliers for several key components. If we are unable to obtain these components on a timely basis, we will be unable to meet our customers' product delivery requirements, which would harm our business.

We currently purchase several key components from a limited number of suppliers. If any of our limited source of suppliers become insolvent, cease business or experience capacity constraints, work stoppages or any other reduction or disruption in output, they may be unable to meet our delivery schedules. Our suppliers may enter into exclusive arrangements with our competitors, be acquired by our competitors, stop selling their products or components to us at commercially reasonable prices, refuse to sell their products or components to us at any price or be unable to obtain or have difficulty obtaining components for their products from their suppliers. If we do not receive critical components from our limited source of suppliers in a timely manner, we will be unable to meet our customers' product delivery requirements. Any failure to meet a customer's delivery requirements could materially adversely affect our business, operations, and financial condition and liquidity and could materially damage customer relationships.

The loss of a key customer or a significant deterioration in the financial condition of a key customer could have a material adverse effect on the Company's results of operations.

The Company's revenue is dependent on several key customers. A loss of one or more of the Company's key customers, or a dispute or litigation with one of these key customers could affect adversely our revenue and results of operations. A significant

deterioration in the financial condition or bankruptcy filing of a key customer could affect adversely the Company's business, results of operations, and financial condition.

In addition, the Company is subject to credit risk associated with the concentration of accounts receivable from its key customers. As of December 31, 2019, two (2) customers represented 18% and 11% of net accounts receivable. If one or more of the Company's top customers were to become bankrupt or insolvent or otherwise were unable to pay for the products and services provided by the Company, then the Company may incur significant write-offs of accounts receivable or incur other impairment charges, which may have a material adverse effect on the Company's results of operations.

We have experienced significant turnover with respect to our executives and our board, and our business could be adversely affected by these and other transitions in our senior management team or if any future vacancies cannot be filled with qualified replacements in a timely manner.

We experienced significant turnover on our executive team and board in both 2018 and 2019, including the departure of our former Chief Financial Officer. As a result of this turnover, our remaining management team has been required to take on increased responsibilities, which could divert attention from key business areas. If we continue to experience similar turnover in the future, we may be unable to timely replace the talent and skills of our management team and directors.

Management transitions are often difficult and inherently cause some loss of institutional knowledge, which could negatively affect our results of operations and financial condition. Our ability to execute our business strategies may be adversely affected by the uncertainty associated with these transitions and the time and attention from the board and management needed to fill any future vacant roles could disrupt our business. If we are unable to successfully identify and attract adequate replacements for future vacancies in our management roles in a timely manner, we could experience increased employee turnover and harm to our business, growth, financial condition, results of operations and cash flows. We face significant competition for executives with the qualifications and experience we seek.

Further, we cannot guarantee that we will not face similar turnover in the future. Our senior management's knowledge of our business and industry would be difficult to replace, and any further turnover could negatively affect our business, growth, financial conditions, results of operations and cash flows.

Decreased effectiveness of share-based compensation could adversely affect our ability to attract and retain employees.

We have historically used equity incentives, including stock options, as a key component of our employee compensation program in order to align the interests of our employees with the interests of our stockholders, encourage employee retention and provide competitive compensation and benefit packages. If the trading price of our common stock declines, this would reduce the value of our share-based compensation to our present employees and could adversely affect our ability to retain existing or attract prospective employees. Difficulties relating to obtaining stockholder approval of equity compensation plans could also make it harder or more expensive for us to grant share-based payments to employees in the future.

Our success largely depends on our ability to retain and recruit key personnel, and any failure to do so could harm our ability to meet key objectives.

Our future success depends upon the continued services of our Chief Executive Officer and other key employees, and our ability to identify, attract and retain highly skilled technical, managerial, sales and marketing personnel who have critical industry experience and relationships that we rely on to build and operate our business. The loss of the services of any of our key employees, including our Chief Executive Officer, could delay the development and production of our products and negatively impact our ability to maintain customer relationships, which could harm our business, operations, financial condition and liquidity. Moreover, our historical inability to attract and retain sufficient qualified accounting personnel with expertise in US GAAP has adversely affected our ability to maintain an effective system of internal controls and our ability to produce reliable financial reports, which could materially and adversely affect our business.

We rely on the availability of third-party licenses.

Many of our products are designed to include software or other intellectual property licensed from third parties. It may be necessary in the future to seek or renew licenses relating to various elements of the technology used to develop these products. We cannot assure you that our existing or future third-party licenses will be available to us on commercially reasonable terms, if at all. Our inability to maintain or obtain any third-party license required to sell or develop our products and product enhancements could require us to obtain substitute technology of lower quality or performance standards, or at greater cost.

Our intellectual property rights could prove difficult to protect and enforce.

We generally rely on a combination of copyrights, patents, trademarks and trade secret laws and commercial agreements containing restrictions on disclosure and other appropriate terms to protect our intellectual property rights. We enter into confidentiality, employee, contractor and commercial agreements with our employees, consultants and corporate partners, and control access to and distribution of our proprietary information and use of our intellectual property and technology. Despite our efforts to protect our proprietary rights, unauthorized parties, including those affiliated with foreign governments, may

attempt to copy or otherwise obtain and use our products, technology or intellectual property. Monitoring unauthorized use of our technology and intellectual property is difficult, and we do not know whether the steps we have taken will prevent unauthorized use of our technology, particularly in foreign countries or jurisdictions where laws may not protect our proprietary rights as extensively as in the United States. We cannot assure you that our pending, or any future, patent applications will be granted, that any existing or future patents will not be challenged, invalidated, or circumvented, or that any existing or future patents will be enforceable or that infringement by third parties will even be detected. While we are not dependent on any individual patents, if we are unable to protect our proprietary rights, we may find ourselves at a competitive disadvantage to others who need not incur the substantial expense, time and effort required to create the innovative products.

Claims that our current or future products or components contained in our products infringe the intellectual property rights of others may be costly and time consuming to defend and could adversely affect our ability to sell our products.

The communications equipment industry is characterized by the existence of a large number of patents and frequent claims and related litigation regarding patent, copyright, trademark and other intellectual property rights, that may relate to technologies and related standards that are relevant to us. From time to time, we receive correspondence from companies claiming that our products are using technology covered by or related to the intellectual property rights of these companies and inviting us to discuss or demanding licensing or royalty arrangements for the use of the technology or seeking payment for damages, injunctive relief and other available legal remedies through litigation. These companies also include third-party non-practicing entities (also known as patent trolls) that focus on extracting royalties and settlements by enforcing patent rights through litigation or the threat of litigation. These companies typically have little or no product revenues and therefore our patents could provide little or no deterrence against such companies filing patent infringement lawsuits against us. In addition, third parties have initiated and could continue to initiate litigation against our manufacturers, suppliers, distributors or even our customers alleging infringement or misappropriation of their proprietary rights with respect to existing or future products, or components of our products. For example, various proceedings have been commenced against Broadcom Corporation and other parties alleging patent infringement in various jurisdictions, and in some cases the courts have issued rulings adverse to Broadcom enjoining Broadcom from offering, distributing, using or importing products that include the challenged intellectual property. Although we are not party to these proceedings, adverse rulings or injunctive relief awarded against Broadcom or other key suppliers of components for our products could result in delays or stoppages in the shipment of affected components, or require us to recall, modify or redesign our products containing such components. Regardless of the merit of claims against us or our manufacturers, suppliers, distributors or customers, intellectual property litigation can be time consuming and costly, and result in the diversion of the attention of technical and management personnel. Any such litigation could force us to stop manufacturing, selling, distributing, exporting, incorporating or using products or components that include the challenged intellectual property, or to recall, modify or redesign such products. In addition, if a party accuses us of infringing upon its proprietary rights, we may have to enter into royalty or licensing agreements, which may not be available on terms acceptable to us, if at all. If we are unsuccessful in any such litigation, we could be subject to significant liability for damages and loss of our proprietary rights. Any of these events or results could have a material adverse effect on our business, operations, financial condition and liquidity.

Our collection, processing, storage, use, and transmission of personal data could give rise to liabilities as a result of governmental regulation, increasing legal requirements.

We collect, process, store, use, and transmit personal data on a daily basis. Personal data is increasingly subject to legal and regulatory protections around the world, which vary widely in approach and which possibly conflict with one another. In recent years, for example, U.S. legislators and regulatory agencies, such as the Federal Trade Commission, as well as U.S. states have increased their focus on protecting personal data by law and regulation and have increased enforcement actions for violations of privacy and data protection requirements. The European Commission also recently approved and adopted the GDPR, a recent data protection law, which became effective in May 2018. These data protection laws and regulations are intended to protect the privacy and security of personal data that is collected, processed, and transmitted in or from the relevant jurisdiction. Implementation of and compliance with these laws and regulations may be more costly or take longer than we anticipate, or could otherwise adversely affect our business operations, which could negatively impact our financial position or cash flows.

If we experience a significant disruption in, or breach in security of, our information technology systems, our business could be adversely affected.

We rely on several centralized information technology systems to provide products and services, maintain financial records, process orders, manage inventory, process shipments to customers and operate other critical functions. If we experience a prolonged system disruption in the information technology systems that involve our interactions with customers or suppliers, it could result in the loss of sales and customers and significant incremental costs, which could adversely affect our business. In addition, our information technology systems could be susceptible to damage, disruptions or shutdowns due to power outages, hardware failures, computer viruses, attacks by computer hackers, telecommunication failures, user errors, catastrophes or other unforeseen events. Furthermore, security breaches of our information technology systems could result in the misappropriation or unauthorized disclosure of confidential information belonging to the company or our employees, partners, customers or suppliers, which could result in significant financial, legal or reputational damage to the Company.

Compliance or the failure to comply with current and future environmental regulations could cause us significant expense.

We are subject to a variety of federal, state, local and foreign environmental regulations. If we fail to comply with any present or future regulations, we could be subject to liabilities, the suspension of production or prohibitions on the sale of our products. In addition, such regulations could require us to incur other significant expenses to comply with environmental regulations, including expenses associated with the redesign of any non-compliant product. From time to time new regulations are enacted, and it is difficult to anticipate how such regulations will be implemented and enforced and the impact that they could have on our operations or results. For example, in 2003 the European Union enacted the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive and the Waste Electrical and Electronic Equipment Directive, for implementation in European Union member states. We are aware of similar legislation that is currently in force or has been considered in the U. S., as well as other countries, such as Japan and China. Our failure to comply with any such regulatory requirements or contractual obligations could result in us being liable for costs, fines, penalties or third-party claims, and could jeopardize our ability to conduct business in countries or jurisdictions where such regulations apply.

Failure to comply with the U.S. Foreign Corrupt Practices Act and similar laws associated with our international activities could subject us to significant civil or criminal penalties.

Failure to comply with the Foreign Corrupt Practices Act could subject us to significant civil or criminal penalties. A significant portion of our revenues is generated from sales outside of the United States. As a result, we are subject to the U.S. Foreign Corrupt Practices Act (the “FCPA”). The FCPA generally prohibits U.S. companies and their intermediaries from making corrupt payments to foreign officials for the purpose of obtaining or keeping business or otherwise obtaining favorable treatment and requires companies to maintain adequate record-keeping and internal accounting practices to accurately reflect the transactions of the company. The FCPA applies to companies, individual directors, officers, employees and agents. Under the FCPA, U.S. companies may be held liable for the corrupt actions taken by employees, strategic or local partners or other representatives. If we or our intermediaries fail to comply with the requirements of the FCPA or similar legislation, governmental authorities in the U.S. and elsewhere could seek to impose civil and/or criminal fines and penalties which could have an adverse effect on our results of operations, financial condition and cash flow.

Our business and future operating results are subject to global economic and market conditions.

Market turbulence and weak economic conditions, as well as concerns about energy costs, geopolitical issues, the availability and cost of credit, business and consumer confidence, and unemployment could impact our business in a number of ways, including:

Potential deferment of purchases and orders by customers: Uncertainty about global economic conditions could cause consumers, businesses and governments to defer purchases in response to flat revenue budgets, tighter credit, decreased cash availability and weak consumer confidence. Accordingly, future demand for our products could differ materially from our current expectations.

Customers’ inability to obtain financing to make purchases and/or maintain their business: Some of our customers require substantial financing in order to finance their business operations, including capital expenditures on new equipment and equipment upgrades, and make purchases from us. The potential inability of these customers to access the capital needed to finance purchases of our products and meet their payment obligations to us could adversely impact our business, operations, financial condition, and liquidity. While we monitor these situations carefully and attempt to take appropriate measures to protect ourselves, including factoring credit arrangements to financial institutions, it is possible that we may have to defer revenue until cash is collected or write-down or write-off uncollectible accounts. Such write-downs or write-offs, if large, could have a material adverse effect on our business, operations, financial condition, and liquidity. If our customers become insolvent due to market and economic conditions or otherwise, it could have a material adverse effect on our business, operations, financial condition and liquidity.

Negative impact from increased financial pressures on third-party dealers, distributors and retailers: We make sales in certain regions through third-party dealers, distributors and retailers. These third parties may be impacted, among other things, by a significant decrease in available credit. If credit pressures or other financial difficulties result in insolvency for these third parties and we are unable to successfully transition end customers to purchase our products from other third parties, or from us directly, it could adversely impact our business, operations, financial condition, and liquidity.

Negative impact from increased financial pressures on key suppliers: Our ability to meet customers’ demands depends, in part, on our ability to obtain timely and adequate delivery of quality materials, parts and components from our suppliers. Certain of our components are available only from a single source or limited sources. If certain key suppliers were to become capacity constrained or insolvent, it could result in a reduction or interruption in supplies or a significant increase in the price of supplies and adversely impact our financial condition and results of operations. In addition, credit constraints of key suppliers could result in accelerated payment of accounts payable by us, impacting our cash flow.

We may experience material adverse impacts on our business, operations, financial condition, and liquidity as a result of weak or recessionary economic or market conditions in the United States, Korea, Germany, or the rest of the world.

Due to the international nature of our business, political or economic changes or other factors in a specific country or region could harm our future revenue, costs and expenses and financial condition.

We currently have significant operations in India, Korea, and Vietnam, as well as sales and technical support teams in various locations around the world. We expect to continue expanding our international operations in the future. The successful management and expansion of our international operations requires significant human effort and the commitment of substantial financial resources. Further, our international operations may be subject to certain risks, disruptions and challenges that could materially harm our business, operations, financial condition, and liquidity, including:

- unexpected changes in laws, policies and regulatory requirements, including but not limited to regulations related to import-export control;
- trade protection measures, tariffs, embargoes and other regulatory requirements which could affect our ability to import or export our products into or from various countries;
- political unrest or instability, acts of terrorism or war in countries where we or our suppliers or customers have operations, including heightened security concerns stemming from North Korea in relation to our operations in Korea;
- political considerations that affect service provider and government spending patterns;
- differing technology standards or customer requirements;
- developing and customizing our products for foreign countries;
- fluctuations in currency exchange rates, foreign exchange controls and restrictions on cash repatriation;
- longer accounts receivable collection cycles and financial instability of customers;
- requirements for additional liquidity to fund our international operations;
- difficulties and excessive costs for staffing and managing foreign operations;
- ineffective legal protection of our intellectual property rights in certain countries;
- potentially adverse tax consequences; and
- changes in a country's or region's political and economic conditions.

In addition, some of our customer purchase agreements are governed by foreign laws and regulations, which may differ significantly from the laws and regulations of the United States. We may be limited in our ability to enforce our rights under these agreements and to collect damages, if awarded. Any of these factors could harm our existing international operations and business or impair our ability to continue expanding into international markets.

We face exposure to foreign currency exchange rate fluctuations.

We conduct significant business in Korea, Japan, India, Vietnam, Europe, Middle East and Latin America, all of which subject us to foreign currency exchange rate risk.

We have in the past and may in the future undertake a hedging program to mitigate the impact of foreign currency exchange rate fluctuations. The use of such hedging activities may not offset any or more than a portion of the adverse financial effects of unfavorable movements in foreign currency exchange rates over the limited time the hedges are in place. Moreover, the use of hedging instruments may introduce additional risks if we are unable to structure effective hedges with such instruments, which could adversely affect our business, operations, financial condition, and liquidity.

As such, our results of operations and our cash flows could be impacted by changes in foreign currency exchange rates.

Natural disasters, public health crises, political crises, and other catastrophic events or other events outside of our control may damage our facilities or the facilities of third parties on which we depend, and could materially impact our supply chain and the operations of our customers and suppliers.

Our global headquarters are located in California near major geologic faults that have experienced earthquakes in the past. An earthquake or other natural disaster or power shortages or outages could disrupt operations or impair critical systems. Any of these disruptions or other events outside of our control could affect our business negatively, harming our operating results. In addition, if any of our facilities or the facilities of our suppliers, contract manufacturers, third-party service providers, or customers, is affected by natural disasters, such as earthquakes, tsunamis, power shortages or outages, floods or monsoons, public health crises, such as pandemics and epidemics, political crises, such as terrorism, war, political instability or other conflict, or other events outside of our control, our business and operating results could suffer. Disasters occurring at our or our vendors' facilities also could impact our reputation.

The COVID-19 outbreak has had a material impact on our business and a sustained global outbreak could have a further material adverse effect on our business, financial condition and results of operations.

In December 2019, a strain of coronavirus, now known as COVID-19, was reported to have surfaced in Wuhan, China, resulting in increased travel restrictions and the extended shutdown of certain businesses in the region and within Greater China. Since that time, other countries including the United States, South Korea, Italy and Japan have experienced widespread or sustained transmission of the virus, and there is a risk that the virus will continue to spread to additional countries.

The Company relies on suppliers and contract manufacturers located in China and has significant business operations in South Korea and Japan. The outbreak may have a significant impact on our first quarter 2020 results, as we have experienced a negative impact on our supply chain in Asia and softer product demand due to the effects of the virus. These effects include travel restrictions, business closures, public health concerns, and other actions affecting the supply of labor and the export of raw materials and finished products. If the virus continues to spread, the effects of the virus could continue to materially and adversely affect our financial condition and results of operations. If we are forced to arrange alternative manufacturing and supply sources, our cost of production could increase materially, negatively affecting our financial condition and results of operations.

Given the ongoing and dynamic nature of the virus and the worldwide response related thereto, it is difficult to predict the full impact of the COVID-19 outbreak on our business. The impact of a continued COVID-19 outbreak could have a material adverse effect on our business, financial condition and results of operations.

Risks Related to our Industry

The telecommunications networking business requires the application of complex revenue and expense recognition rules and the regulatory environment affecting generally accepted accounting principles is uncertain. Changes in financial accounting standards or practices may cause adverse, unexpected financial reporting fluctuations and harm our business.

The nature of our business requires the application of complex revenue and expense recognition rules and the current regulatory environment affecting generally accepted accounting principles in the United States (“U.S. GAAP”) is uncertain. Significant changes in U.S. GAAP could affect our financial statements going forward and may cause adverse, unexpected financial reporting fluctuations and harm our operating results. U.S. GAAP is subject to interpretation by the FASB, the SEC and various bodies formed to promulgate and interpret appropriate accounting principles. In addition, we have in the past and may in the future need to significantly change our customer contracts, accounting systems and processes when we adopt future or proposed changes in accounting principles. The cost and effect of these changes may negatively impact our results of operations during the periods of transition.

Changes in government regulations related to our business could harm our operations, financial condition, and liquidity.

Our operations are subject to various laws and regulations, including those regulations promulgated by the Federal Communications Commission (“FCC”). The FCC has jurisdiction over the entire communications industry in the United States and, as a result, our existing and future products and our customers’ products are subject to FCC rules and regulations. Changes to current FCC rules and regulations and future FCC rules and regulations could negatively affect our business. Non-compliance with the FCC’s rules and regulations would expose us to potential enforcement actions, including monetary forfeitures, and could damage our reputation among potential customers. The uncertainty associated with future FCC decisions may cause network service providers to delay decisions regarding their capital expenditures for equipment for broadband services. In addition, international regulatory bodies establish standards that may govern our products in foreign markets. The SEC has adopted disclosure rules regarding the use of “conflict minerals” mined from the Democratic Republic of Congo and adjoining countries and procedures regarding a manufacturer’s efforts to prevent the sourcing of such conflict minerals. These rules may have the effect of reducing the pool of suppliers who can supply “conflict free” components and parts, and we may not be able to obtain “conflict free” products or supplies in sufficient quantities for our operations. Also, we may face reputational challenges with our customers, stockholders and other stakeholders if we are unable to sufficiently verify the origins for the conflict minerals used in our products. In addition, governments and regulators in many jurisdictions have implemented or are evaluating regulations relating to cyber security, privacy and data protection, which can affect the markets and requirements for networking and communications equipment. We are unable to predict the scope, pace or financial impact of government regulations and other policy changes that could be adopted in the future, any of which could negatively impact our operations and costs of doing business. Because of our smaller size, legislation or governmental regulations can significantly increase our costs and affect our competitive position. Changes to or future domestic and international regulatory requirements could result in postponements or cancellations of customer orders for our products and services, which could harm our business, operations, financial condition and liquidity. Further, we cannot be certain that we will be successful in obtaining or maintaining regulatory approvals that could, in the future, be required to operate our business.

Industry consolidation may lead to increased competition and could harm our operating results.

There has been a trend toward industry consolidation in the communications equipment market for several years. We expect this trend to continue as companies attempt to strengthen or hold their market positions in an evolving industry and as companies are acquired or are unable to continue operations. We believe that industry consolidation may result in stronger competitors that are better able to compete as sole-source vendors for customers. This could have a material adverse effect on our business, operations, financial condition, and liquidity. Furthermore, rapid consolidation could result in a decrease in the number of customers we serve. The loss of a major customer could have a material adverse effect on our business, operations, financial condition, and liquidity.

Risks Related to our Common Stock

DNI owns a significant amount of our outstanding common stock and has the ability to exert significant influence or control over any matters that require stockholder approval, including the election of directors and the approval of certain transactions, and DNI's interests may conflict with our interests and the interests of other stockholders.

As of December 31, 2019, DNI owned approximately 44.3% of the outstanding shares of our common stock, representing a significant amount of the votes entitled to be cast by the holders of our outstanding common stock at a stockholder meeting. Due to its significant ownership percentage of our common stock, DNI has the ability to substantially influence or control the outcome of any matter submitted for the vote of our stockholders, including the election of directors and the approval of certain transactions. The interests of DNI may conflict with the interests of our other stockholders or with holders of our indebtedness and may cause us to take actions that our other stockholders or holders of our indebtedness do not view as beneficial.

DNI's large concentration of stock ownership may make it more difficult for a third party to acquire us or discourage a third party from seeking to acquire us. A potential third-party acquirer would be required to negotiate any such transaction with DNI, and the interests of DNI with respect to such transaction may be different from the interests of our other stockholders or with holders of our indebtedness.

Additionally, two of the Company's directors serve as executive officers of DNI – Min Woo Nam (who also serves as Chairman of the Board, Chairman of the Compensation Committee and Chairman of the Corporate Governance and Nominating Committee of the Company) is the Chief Executive Officer and Chairman of the Board of Directors of DNI and Choon Yul Yoo is the Chief Operating Officer of DNI. Each of Messrs. Nam and Yoo owe fiduciary duties to us and, in addition, have duties to DNI. As a result, these directors may face real or apparent conflicts of interest with respect to matters affecting both us and DNI.

Prior to May 20, 2019, DNI owned more than 50% of the outstanding shares of our common stock, which allowed us to elect to be treated as a "controlled company" under Nasdaq Marketplace Rules. As a "controlled company," we were exempt from certain corporate governance requirements under the Nasdaq Marketplace Rules, including the requirement that we have a majority of independent directors on the Board of Directors and requirements with respect to compensation and nominating and corporate governance committees. Following the loss of "controlled company" status, we are required to phase in compliance with the Nasdaq corporate governance requirements over a one-year period. As of the date hereof, the Company is relying on the "phase-in" transition schedule with respect to the composition of the compensation committee and the nominating and corporate governance committee. The Board intends to cause both of these committees to consist solely of independent directors on or before May 20, 2020.

Our amended and restated bylaws provide that the Court of Chancery of the State of Delaware will be the sole and exclusive forum for substantially all disputes between us and our stockholders (except for causes of action arising under the federal securities laws), which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers, or employees.

Our amended and restated bylaws (the "Bylaws") provide that the Court of Chancery of the State of Delaware is the sole and exclusive forum for:

- any derivative action or proceeding brought on behalf of the Company;
- any action asserting a claim of breach of a fiduciary duty owed by any director, officer, employee or agent of the Company to the Company or the Company's stockholders;
- any action asserting a claim against the Company arising pursuant to any provision of the General Corporation Law of the State of Delaware, the Certificate of Incorporation or our Bylaws; and
- any action asserting a claim against the Corporation governed by the internal affairs doctrine, in each such case subject to said Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein; provided, that with respect to any derivative action or proceeding brought on our behalf to enforce any liability or duty created by the Exchange Act or the rules and regulations thereunder, the exclusive forum will be the federal district courts of the United States. The exclusive forum provision in our Bylaws does not apply to resolving any complaint asserting a cause of action arising under the Securities Act.

These exclusive forum provisions may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers, or other employees, which may discourage lawsuits against us and our directors, officers and other employees. If a court were to find the exclusive forum provision in our Bylaws to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving the dispute in other jurisdictions, which could seriously harm our business. For example, the Court of Chancery of the State of Delaware recently determined that the exclusive forum provision of federal district courts of the United States for resolving any complaint asserting a cause of action arising under the Securities Act is not enforceable. However, this decision is pending before the Delaware Supreme Court and could be overturned.

The limitation of liability and indemnification provisions could harm our stockholders' investments and discourage them from suing our directors for breach of their fiduciary duties.

The limitation of liability and indemnification provisions in our certificate of incorporation, as restated, may discourage stockholders from bringing a lawsuit against directors for breach of their fiduciary duties. They may also reduce the likelihood of derivative litigation against directors and officers, even though an action, if successful, might benefit us and our stockholders. A stockholder's investment may be harmed to the extent we pay the costs of settlement and damage awards against directors and officers pursuant to these indemnification provisions. Insofar as indemnification for liabilities under the Securities Act may be permitted to directors, officers or persons controlling us pursuant to the foregoing provisions, we have been informed that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act and is therefore unenforceable. There is no pending litigation or proceeding naming any of our directors or officers as to which indemnification is being sought, nor are we aware of any pending or threatened litigation that may result in claims for indemnification by any director or officer.

There is a limited public market of our common stock.

There is a limited public market for our common stock. The average daily trading volume in our common stock during the 12 months ended December 31, 2019 was approximately 75,000 shares per day. We cannot provide assurances that a more active trading market will develop or be sustained. As a result of low trading volume in our common stock, the purchase or sale of a relatively small number of shares of our common stock could result in significant price fluctuations and it may be difficult for holders to sell their shares without depressing the market price of our common stock.

DNI, our largest stockholder, owned 9.5 million shares of our common stock as of December 31, 2019 and has the right to require us to register, from time to time, the resale of those shares with the SEC. If DNI were to exercise its registration rights, its shares would become eligible for resale upon registration without restriction as to volume limitations. Our stock price could suffer a significant decline as a result of any sudden increase in the number of shares sold in the public market or market perception that the increased number of shares available for sale will exceed the demand for our common stock.

We do not expect to declare or pay dividends in the foreseeable future.

We do not expect to declare or pay dividends in the foreseeable future, as we anticipate that we will invest future earnings in the development and growth of our business. Therefore, holders of our common stock will not receive any return on their investment unless they sell their securities, and holders may be unable to sell their securities on favorable terms or at all.

Future issuances of additional equity securities could result in dilution of existing stockholders' equity ownership.

We may determine from time to time to issue additional equity securities to raise additional capital, support growth, or, as we have in recent years, to make acquisitions. Further, we may issue stock options, grant restricted stock awards or other equity awards to retain, compensate and/or motivate our employees and directors. These issuances of our securities could dilute the voting and economic interests of existing stockholders.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None

ITEM 2. PROPERTIES

We lease our worldwide headquarters, which are located in Alameda, California. In March 2020, we announced that we entered into a lease in Plano, Texas and that we will be relocating our corporate headquarters and our U.S. engineering center to that location during 2020. We intend to retain space in our facility in Alameda, California.

We also lease facilities for office space in Seoul, South Korea as well as lease facilities for manufacturing, research and development purposes at locations in the United States including Seminole, Florida and Alpharetta, Georgia, as well as Hannover, Germany through the acquisition of Keymile. We maintain smaller offices to provide sales and customer support at various domestic and international locations. We manufacture many of our more complex products at our manufacturing facility in Florida. We believe that our existing facilities are suitable and adequate for our present purposes.

ITEM 3. LEGAL PROCEEDINGS

From time to time, the Company is subject to various legal proceedings, claims and litigation arising in the ordinary course of business. While the outcome of these matters is currently not determinable, the Company records an accrual for legal contingencies that it has determined to be probable to the extent that the amount of the loss can be reasonably estimated. The Company does not expect that the ultimate costs to resolve these matters will have a material adverse effect on its consolidated financial position, results of operations or cash flows. However, litigation is subject to inherent uncertainties, and unfavorable rulings could occur. If an unfavorable ruling were to occur, there exists the possibility of a material adverse impact on the results of operations and cash flows of the reporting period in which the ruling occurs, or future periods.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

INFORMATION ABOUT OUR EXECUTIVE OFFICERS

Set forth below is information concerning our executive officers as of December 31, 2019.

Name	Age	Office
Il Yung Kim	63	Chief Executive Officer, President
Thomas J. Cancro	52	Chief Financial Officer, Corporate Treasurer
Philip Yim	58	Chief Operating Officer

Il Yung Kim has served as our President and Chief Executive Officer since September 11, 2017. Mr. Kim joined us in connection with the Merger and has served as a member of our Board of Directors since September 9, 2016 and as Co-Chief Executive Officer from September 9, 2016 to September 11, 2017, and Acting Chief Financial Officer from September 11, 2017 to December 1, 2017. Prior to the Merger, Mr. Kim served as a consultant to DNI in connection with the Merger. From September 2014 to August 2016, Mr. Kim served as Chief Executive Officer of TukTak in Korea, an online startup company, which enables people with creative talents to collaborate and produce goods and services online. From December 2014 to August 2016, he also served as a strategic adviser for InMobi, a global mobile advertising platform provider. Previously, Mr. Kim held various positions with Korea Telecom, including President and executive board member from 2013 to 2014, and Chief Strategy Officer from 2010 to 2013. Mr. Kim commenced his career with British Telecom (now known as BT Group plc) in 1982, where he held senior positions, including Vice President of Technology and Innovation and Programme Director and Head of Technology and Investment. Mr. Kim holds a Bachelor of Science (with Honors) in Electronic Engineering and a Master of Science Degree in Microwave and Modern Optics from University College, University of London.

Thomas J. Cancro was appointed to the position of Chief Financial Officer and Corporate Treasurer on November 25, 2019. Mr. Cancro recently served as Controller of GE Global Research, General Electric Company's technology research and IP-licensing business unit. Prior roles include executive positions at Verizon Communications Inc. ("Verizon"), including Chief Financial Officer of Verizon's joint venture with AT&T Inc. and Deutsche Telekom AG, and an executive role in Verizon's Treasury organization, where he advised the company as to capital markets strategy. He also served as Chief Accounting Officer and Corporate Controller of GFI Group Inc., a FinTech provider of wholesale brokerage services and SaaS software solutions (now a subsidiary of BGC Partners, Inc.), and as Senior Vice President and Corporate Controller of MasTec, Inc., a Fortune 500 telecommunications and energy infrastructure service provider. Mr. Cancro holds a Bachelor of Science degree in Accounting from the Pennsylvania State University and began his career at PricewaterhouseCoopers LLP. He is a Certified Public Accountant and also holds a CFA Charter.

Philip Yim has served as our Chief Operating Officer since August 2018. Mr. Yim joined the Company in June 2017 as our Vice President of Engineering, and in August 2018 he was promoted to Chief Operating Officer. Prior to joining DZS, Mr. Yim held several global multinational executive leadership positions across global operations, marketing, development, business and sales, including as Executive Vice President of Global Program Management for Allied Telesis, Inc. from February 2012 to May 2017. Mr. Yim has a Bachelor of Engineering from the University of Bradford in West Yorkshire, U.K.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Our common stock is listed on the Nasdaq Capital Market under the symbol "DZSI".

As of March 11, 2020, we had 488 registered stockholders of record. A substantially greater number of holders of DZS common stock are "street name" or beneficial holders, whose shares are held of record by banks, brokers or financial institutions.

Dividend Policy

We have never paid or declared any cash dividends on our common stock or other securities and do not anticipate paying cash dividends in the foreseeable future. Any future determination to pay cash dividends will be at the discretion of the Board of Directors, subject to any applicable restrictions under our debt and credit agreements, and will be dependent upon our financial condition, results of operations, capital requirements, general business condition and such other factors as the Board of Directors may deem relevant.

ITEM 6. SELECTED FINANCIAL DATA

Not Required

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Overview

We are a global provider of ultra-broadband network access solutions and communications platforms deployed by advanced Tier 1, 2 and 3 service providers and enterprise customers. We operate in a single reporting segment. We research, develop, test, sell, manufacture and support communications equipment in five major areas: broadband access, Ethernet switching, mobile fronthaul/backhaul, Passive Optical LAN and SDN/NFV solutions:

- Our broadband access products offer a variety of solutions for carriers and service providers to connect residential and business customers, either using high-speed fiber or leveraging their existing deployed copper networks to offer broadband services to customer premises. Once our broadband access products are deployed, the service provider can offer voice, high-definition and ultra-high-definition video, high-speed internet access and business class services to their customers.
- Our Ethernet switching products provide a high-performance and manageable solution that bridges the gap from carrier access technologies to the core network. Our products support pure Ethernet switching as well as layer 3 IP and MPLS and are currently being developed for deployment as part of SDNs.
- Our mobile fronthaul/backhaul products provide a robust, manageable and scalable solution for mobile operators that enable them to upgrade their mobile fronthaul/backhaul systems and migrate to 5G and beyond. Our mobile backhaul products may be collocated at the radio access node base station and can aggregate multiple radio access node base stations into a single backhaul for delivery of mobile traffic to the radio access node network controller. We provide standard Ethernet/IP or MPLS interfaces and interoperate with other vendors in these networks.
- Our FiberLAN portfolio of POL products are designed for enterprise, campus, hospitality, and entertainment arena usage. Our FiberLAN portfolio includes our high-performance, high-bandwidth GPON OLTs connected to the industry's most diverse ONT product line, which include units with integrated PoE to power a wide range of PoE-enabled access devices.
- Our SDN/NFV strategy is to develop tools and building blocks that will allow service providers to migrate their networks' full complement of legacy control plane and data plane devices to a centralized intelligent controller that can reconfigure the services of the hundreds of network elements in real time for more controlled and efficient provision of bandwidth and latency across the network. The migration move to SDN/NFV will provide better service for end customers and a more efficient and cost-effective use of hardware resources for service providers.

Going forward, our key financial objectives include the following:

- Increasing revenue while continuing to carefully control costs;
- Continuing investments in strategic research and product development activities that will provide the maximum potential return on investment; and
- Minimizing consumption of our cash and cash equivalents.

Recent Developments

DNI

On March 5, 2020, DASAN Network Solutions, Inc., a corporation organized under the laws of the Republic of Korea, and an indirect, wholly-owned subsidiary of the Company ("DNS Korea") entered into a Loan Agreement with DNI, pursuant to which DNS Korea borrowed KRW 22.4 billion (\$18.5 million USD) from DNI (the "March 2020 DNI Loan"). DNS Korea will fully loan such borrowed funds to the Company, which will be used to repay and terminate the PNC Credit Facilities.

Relocation of Corporation Headquarters and New Facilities in Alameda, California

On March 2, 2020, the Company announced its plans to relocate its corporate headquarters from California to Plano, Texas and establish a new U.S.-based Engineering Center of Excellence in Plano. In connection with the planned relocation, the Company entered into sublease agreements with Huawei Technologies, Inc. and Futurewei Technologies, Inc. to sublease an aggregate of approximately 16,300 square feet located at Legacy Place, 5700 Tennyson Parkway, Plano, Texas.

On July 9, 2019, the Company entered into a lease agreement with Family Stations, Inc. to lease approximately 16,500 square feet located at 1350 South Loop Road, Alameda, California. The Alameda location will replace the Company's current facilities in Oakland, California.

Appointment of New Chief Financial Officer

On November 25, 2019, the Company appointed Thomas J. Cancro to the position of Chief Financial Officer and Corporate Treasurer. Mr. Cancro recently served as Controller of GE Global Research, General Electric Company's technology research and IP-licensing business unit. Prior roles include executive positions at Verizon Communications Inc. ("Verizon"), including Chief Financial Officer of Verizon's joint venture with AT&T Inc. and Deutsche Telekom AG, and an executive role in Verizon's Treasury organization, where he advised the company as to capital markets strategy. He also served as Chief Accounting Officer and Corporate Controller of GFI Group Inc., a FinTech provider of wholesale brokerage services and SaaS software solutions (now a subsidiary of BGC Partners, Inc.), and as Senior Vice President and Corporate Controller of MasTec, Inc., a Fortune 500 telecommunications and energy infrastructure service provider. Mr. Cancro holds a Bachelor of Science degree in Accounting from the Pennsylvania State University and began his career at PricewaterhouseCoopers LLP. He is a Certified Public Accountant and also holds a CFA Charter.

Keymile Acquisition

On January 3, 2019, ZTI Merger Subsidiary III Inc., a Delaware corporation and our wholly owned subsidiary, acquired all of the outstanding shares of Keymile GmbH, a limited liability company organized under the laws of Germany ("Keymile"), from Riverside KM Beteiligung GmbH, also a limited liability company organized under the laws of Germany ("Riverside"), pursuant to a share purchase agreement. The Company refers to this transaction as the "Keymile Acquisition." The aggregate cash purchase price paid for all of the shares of Keymile and certain of its subsidiaries was EUR 10,250,000 (\$11.8 million), which was paid with a combination of cash, a loan from DNI, and a draw under our Wells Fargo Bank ("Wells Fargo") credit facility (as amended, the "Wells Fargo Facility"). Following the closing of the Keymile Acquisition, Keymile became our indirect wholly owned subsidiary.

Keymile is a leading solution provider and manufacturer of telecommunication systems for broadband access. The Company believes the Keymile Acquisition complements and strengthens our portfolio of broadband access solutions, which now includes a series of multi-service access platforms, including ultra-fast broadband copper access based on very-high-bit-rate DSL ("VDSL/Vectoring") & G. Fast technology.

DZS Japan

On July 31, 2019, the Company acquired the remaining 30.9% non-controlling interest of DZS Japan, Inc. ("DZS Japan"), and DZS Japan became a wholly owned subsidiary of the Company. The Company acquired the remaining interest in DZS Japan for total cash consideration of \$950,000, consisting entirely of payments to the former shareholder (Handysoft).

Trends and Uncertainties

In December 2019, a strain of coronavirus, now known as COVID-19, was reported to have surfaced in Wuhan, China, resulting in increased travel restrictions and the extended shutdown of certain businesses in the region and within Greater China. Since that time, other countries including the United States, South Korea, Italy and Japan have experienced widespread or sustained transmission of the virus, and there is a risk that the virus will continue to spread to additional countries.

The Company relies on suppliers and contract manufacturers located in China and has significant business operations in South Korea and Japan. The outbreak has had a significant impact on our first quarter 2020 results, as we have experienced a negative impact on our Chinese supply chain and softer product demand in EMEA due to the effects of the virus. These effects include travel restrictions, business closures, public health concerns, and other actions affecting the supply of labor and the export of raw materials and finished products. If the virus continues to spread, the effects of the virus could continue to materially and adversely affect our financial condition and results of operations. If we are forced to arrange alternative manufacturing and supply sources, our cost of production could increase materially, negatively affecting our financial condition and results of operations.

Given the ongoing and dynamic nature of the virus and the worldwide response related thereto, it is difficult to predict the full impact of the COVID-19 outbreak on our business. The impact of a continued COVID-19 outbreak could have a material adverse effect on our business, financial condition and results of operations.

Impact of Inflation and Changing Price

The financial statements and related data presented herein have been prepared in accordance with U.S. GAAP, which requires the measurement of financial position and operating results in terms of historical dollars without considering changes in the relative purchasing power of money over time due to inflation. Although our operations are influenced by general economic conditions, we do not believe that inflation had a material effect on our results of operations during our fiscal year ended December 31, 2019.

Critical Accounting Policies and Estimates

Management's discussion and analysis of our financial condition and results of operations is based upon our consolidated financial statements, which have been prepared in accordance with U.S. GAAP. The preparation of these consolidated financial statements requires management to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue and expenses, and related disclosure of contingent assets and liabilities. The policies discussed below are considered by management to be critical because changes in such estimates can materially affect the amount of our reported net income or loss. For all of these policies, management cautions that actual results could differ materially from such estimates under different assumptions or conditions.

Revenue Recognition

We recognize revenues when we transfer control of promised goods or services to our customers in an amount that reflects the consideration to which we expect to be entitled to in exchange for those goods or services.

We generate revenue primarily from sales of products and services, including, extended warranty service and customer support. Our revenue from product sales is recognized at a point in time when control of the goods is transferred to our customers, generally occurring upon shipment or delivery, dependent upon the terms of the underlying contract. Our revenue from services is generally recognized over time on a ratable basis over the contract term, using an output measure of progress, as the contracts usually provide our customers equal benefit throughout the contract period. We typically invoice customers for support contracts in advance, for periods ranging from one (1) to five (5) years.

Our transaction price is calculated as selling price net of variable consideration. Our sales to certain distributors are made under arrangements which provide our distributors with volume discounts, price adjustments, and other allowances under certain circumstances. These adjustments and allowances are accounted for as variable consideration. To estimate variable consideration, we analyze historical data, channel inventory levels, current economic trends and changes in our customer demand for our products, among other factors. Historically, variable consideration has not been a significant component of our contracts with customers.

For contracts with customers that contain multiple performance obligations, we account for the promises separately as individual performance obligations if they are distinct. In determining whether performance obligations meet the criteria for being distinct, we consider a number of factors, including the degree of interrelation and interdependence between obligations and whether or not the good or service significantly modifies or transforms another good or service in the contract. After identifying the separate performance obligations, we allocate transaction price to the separate performance obligations on a relative standalone selling price basis. Standalone selling prices for products are determined using either an adjusted market assessment or expected cost-plus margin. For customer support and extended warranty services, standalone selling price is primarily based on the prices charged to our customers on a standalone basis. Unsatisfied and partially unsatisfied performance obligations as of the end of the reporting period primarily consist of products and services for which our customer purchase orders have been accepted and that are in the process of being delivered.

We record contract assets when it has a right to consideration and record accounts receivable when it has an "unconditional" right to consideration. We record deferred revenue when cash payments received (or unconditional rights to receive cash) in advance of fulfilling our performance obligations.

Our payment terms vary by the type and location of our customer and the products or services offered. For certain products or services and customer types, we require payment before the products or services are delivered to the customer.

Allowances for Sales Returns and Doubtful Accounts

We record an allowance for sales returns for estimated future product returns related to current period product revenue. The allowance for sales returns is recorded as a reduction of revenue and accrued and other liabilities. We base our allowance for sales returns on periodic assessments of historical trends in product return rates and current approved returned products. If the actual future returns were to deviate from the historical data on which the reserve had been established, our future revenue could be adversely affected.

We record an allowance for doubtful accounts for estimated losses resulting from the inability of customers to make payments for amounts owed to us. The allowance for doubtful accounts is recorded as a charge to general and administrative expenses. We base our allowance on periodic assessments of our customers' liquidity and financial condition through analysis of information obtained from credit rating agencies, financial statement reviews and historical collection trends. Additional allowances may be required in the future if the liquidity or financial condition of our customers deteriorates, resulting in doubts about their ability to make payments.

Inventories

Inventories are stated at the lower of cost or net realizable value, with cost being determined using the first-in, first-out (FIFO) method. In assessing the net realizable value of inventories, we are required to make judgments as to future demand requirements and compare these with the current or committed inventory levels. Once inventory has been written down to its estimated net realizable value, its carrying value cannot be increased due to subsequent changes in demand forecasts. To the extent that a severe decline in forecasted demand occurs, or we experience a higher incidence of inventory obsolescence due to rapidly changing technology and customer requirements, we may incur significant charges for excess inventory. We also evaluate the terms of its agreements with its suppliers and establish accruals for estimated losses on adverse purchase commitments as necessary, applying the same lower of cost or net realizable value approach that is used to value inventory.

Goodwill and Other Acquisition-Related Intangible Assets

Goodwill and other acquisition-related intangible assets not subject to amortization are tested annually for impairment and are tested for impairment more frequently if events and circumstances indicate that the asset might be impaired.

Factors we consider important which could trigger an impairment review, include, but are not limited to, significant changes in the manner of use of its acquired assets, significant changes in the strategy for the Company's overall business or significant negative economic trends. If this evaluation indicates that the value of an intangible asset may be impaired, an assessment of the recoverability of the net carrying value of the asset over its remaining useful life is made. If this assessment indicates that the cost of an intangible asset is not recoverable, based on the estimated undiscounted future cash flows or other comparable market valuations of the entity or technology acquired over the remaining amortization period, the net carrying value of the related intangible asset will be reduced to fair value and the remaining amortization period may be adjusted. An impairment loss is recognized to the extent that the carrying amount exceeds the asset's fair value.

In the application of impairment testing, we are required to make estimates of future operating trends and resulting cash flows and judgments on discount rates and other variables. Actual future results and other assumed variables could differ from these estimates.

Business Combination

We allocate the fair value of purchase consideration to the tangible assets acquired, liabilities assumed and intangible assets acquired based on their estimated fair values. The excess of the fair value of purchase consideration over the fair values of these identifiable assets and liabilities is recorded as goodwill. When determining the fair values of assets acquired and liabilities assumed, management makes significant estimates and assumptions, especially with respect to intangible assets and certain tangible assets such as inventory acquired in the transaction.

Critical estimates in valuing certain tangible and intangible assets include but are not limited to future expected cash flows from the underlying assets and discount rates. Management's estimates of fair value are based upon assumptions believed to be reasonable, but which are inherently uncertain and unpredictable and, as a result, actual results may differ from estimates.

Income Tax

We use the asset and liability method to account for income taxes. Under this method, deferred tax assets and liabilities are determined based on differences between the financial reporting and the income tax bases of assets and liabilities. Deferred tax assets and liabilities are measured using enacted tax rates and laws that will be in effect when the differences are expected to reverse. Valuation allowances are established, when necessary, to reduce deferred tax assets to the amount expected to be realized.

RESULTS OF OPERATIONS

We list in the table below the historical consolidated statement of comprehensive income (loss) as a percentage of total net revenue for the periods indicated.

	Year ended December 31,	
	2019	2018
Net revenue:		
Third parties	99%	98%
Related parties	1%	2%
Total net revenue	100%	100%
Cost of revenue:		
Products and services - third parties	66%	66%
Products and services - related parties	—	2%
Amortization of intangible assets	1%	—
Total cost of revenue	67%	68%
Gross profit	33%	32%
Operating expenses:		
Research and product development	13%	13%
Selling, marketing, general and administrative	20%	17%
Restructuring and other charges	2%	—
Amortization of intangible assets	—	—
Goodwill impairment charge	—	—
Total operating expenses	35%	30%
Operating income (loss)	(2)%	3%
Interest income	—	—
Interest expense	(1)%	(1)%
Other income (expense), net	—	—
Income (loss) before income taxes	(3)%	2%
Income tax provision (benefit)	1%	1%
Net income (loss)	(4)%	1%
Net income (loss) attributable to non-controlling interest	—	—
Net income (loss) attributable to DASAN Zhone Solutions, Inc.	(4)%	1%

2019 COMPARED WITH 2018

Net Revenue

The following table presents our revenues by source (in millions):

	2019	2018	Increase (Decrease)	% change
Products	\$ 286.3	\$ 269.3	\$ 17.0	6.3%
Services	20.6	13.0	7.6	58.5%
	\$ 306.9	\$ 282.3	\$ 24.6	8.7%

Net revenue increased 8.7% or \$24.6 million to \$306.9 million for 2019 compared to \$282.3 million for 2018. The increase in product revenue was primarily due to product lines added with the acquisition of KEYMILE.

Service revenue represents revenue from maintenance and other services associated with product shipments. The increase in service revenue was primarily related to a greater number of products under contract for maintenance and extended warranty.

Information about our net revenue by geography is summarized below (in millions):

	2019	2018	Increase (Decrease)	% change
Revenue by geography:				
United States	\$ 36.4	\$ 50.8	\$ (14.4)	-28.3%
Canada	4.7	4.4	0.3	6.8%
Total North America	41.1	55.2	(14.1)	-25.5%
Latin America	23.8	27.6	(3.8)	-13.8%
Europe, Middle East, Africa	78.4	34.7	43.7	125.9%
Korea	79.1	76.0	3.1	4.1%
Other Asia Pacific	84.5	88.8	(4.3)	-4.8%
Total International	265.8	227.1	38.7	17.0%
Total	\$ 306.9	\$ 282.3	\$ 24.6	8.7%

Net revenue increased 8.7% or \$24.6 million to \$306.9 million for 2019 compared to \$282.3 million for 2018. The increase in net revenue was primarily due to the acquisition of KEYMILE and, to a lesser extent, growth from the Middle East and Africa region, which more than offset the decline in North America. Across international markets, Asia-Pacific (including Korea) contributed approximately 53.4% of net revenue and EMEA contributed approximately 25.5% of net revenue in 2019, primarily due to the acquisition of KEYMILE.

We anticipate that our results of operations in any given period may depend to a large extent on sales to a small number of large accounts. As a result, our revenue for any quarter may be subject to significant volatility based upon changes in orders from one or a small number of key customers.

Cost of Revenue and Gross Profit

Total cost of revenue increased 8.2% to \$206.8 million for 2019, compared to \$191.0 million for 2018. Total cost of revenue was 67.4% of net revenue for 2019, compared to 67.7% of net revenue for 2018, which resulted in an increase in gross profit percentage to 32.6% in 2019 from 32.3% in 2018. The increase in total cost of revenue, was primarily due to the acquisition of KEYMILE. The decrease in the total cost of revenue as a percentage of sales was primarily due to the mix of products sold.

We expect that in the future our cost of revenue as a percentage of net revenue will vary depending on the mix and average selling prices of products sold. In addition, continued competitive and economic pressures could cause us to reduce our prices, adjust the carrying values of our inventory, or record inventory expenses relating to discontinued products and excess or obsolete inventory.

Research and Product Development Expenses

Research and development expenses include personnel costs, outside contractor and consulting services, depreciation on lab equipment, costs of prototypes and overhead allocations. Research and product development expenses increased by 12.6% to \$38.5 million for 2019 compared to \$35.3 million for 2018. The increase was primarily due to research and product development expenses related to Keymile of \$5.3 million, partially offset by a decrease in these expenses in the U.S. and Other Asia Pacific region, in part due to lower headcount related costs.

We intend to continue to invest in research and product development to attain our strategic product development objectives, while seeking to manage the associated costs through expense controls.

Selling, Marketing, General and Administrative Expenses

Selling, marketing, general and administrative expenses include personnel costs for sales, marketing, administration, finance, information technology, human resources and general management as well as legal and accounting expenses, rent, utilities, trade show expenses and related travel costs.

Selling, marketing, general and administrative expenses increased 26.7% to \$61.2 million for 2019 compared to \$48.3 million for 2018. The increase in selling, marketing, general and administrative expenses was primarily due to the inclusion of KEYMILE's operations in 2019.

Restructuring and Other Charges and Goodwill Impairment

During the fourth quarter of 2019, the Company recorded restructuring and other charges of \$4.9 million consisting primarily of severance and other termination related benefits of \$3.9 million, and an impairment charge of \$1.0 million related to a right-of-use asset from an operating lease, associated with cost reductions implemented at KEYMILE. During the fourth quarter of 2019, the Company recorded an impairment of goodwill of \$1.0 million associated with KEYMILE as part of the Company's annual evaluation of goodwill for impairment.

Interest Expense, net

Interest expense, net was \$3.5 million and \$1.5 million for 2019 and 2018, respectively. This increase in interest expense was primarily related to higher average borrowings during 2019.

Other Income (Expense), net

Other income, net was \$0.9 million for 2019 compared to Other expense, net of \$1.1 million in 2018. The main reason for the increase in Other Income, net was due to foreign currency exchange gains in 2019 compared to foreign currency exchange losses in 2018.

Income Tax Provision (Benefit)

We recorded an income tax expense of \$3.6 million for 2019 compared to \$1.7 million for 2018. The increase in income tax expense was primarily due to taxable income generated in higher taxed jurisdictions, including Korea and Japan.

OTHER PERFORMANCE MEASURES

In managing our business and assessing our financial performance, we supplement the information provided by our U.S. GAAP results with adjusted earnings before stock-based compensation, interest, taxes, and depreciation, or Adjusted EBITDA, a non-U.S. GAAP financial measure. We define Adjusted EBITDA as net income (loss) plus (i) interest expense, net, (ii) provision (benefit) for taxes, (iii) depreciation and amortization, (iv) stock-based compensation, and (v) the impact of material transactions or events that we believe are not indicative of our core operating performance, such as restructuring and other charges, goodwill impairment, bargain purchase gain, any of which may or may not be recurring in nature. We believe that the presentation of Adjusted EBITDA enhances the usefulness of our financial information by presenting a measure that management uses internally to monitor and evaluate our operating performance and to evaluate the effectiveness of our business strategies. We believe Adjusted EBITDA also assists investors and analysts in comparing our performance across reporting periods on a consistent basis because it excludes the impact of items that we do not believe reflect our core operating performance.

Adjusted EBITDA has limitations as an analytical tool. Some of these limitations are:

- Adjusted EBITDA does not reflect our cash expenditures, or future requirements for capital expenditures or contractual requirements;
- Adjusted EBITDA does not reflect changes in, or cash requirements for, our working capital needs;
- Adjusted EBITDA does not reflect the interest expense, or the cash requirements necessary to service interest or principal payments, on our debts;
- Although depreciation and amortization are non-cash expenses, the assets being depreciated and amortized will often have to be replaced in the future, and Adjusted EBITDA does not reflect any cash requirements for such replacements;
- Non-cash compensation is and will remain a key element of our overall long-term incentive compensation package, although we exclude it as an expense when evaluating our ongoing operating performance for a particular period; and
- Other companies in our industry may calculate Adjusted EBITDA and similar measures differently than we do, limiting its usefulness as a comparative measure.

Because of these limitations, Adjusted EBITDA should not be considered in isolation or as a substitute for net income (loss) or any other performance measures calculated in accordance with U.S. GAAP or as a measure of liquidity. Management understands these limitations and compensates for these limitations by relying primarily on our U.S. GAAP results and using Adjusted EBITDA only as a supplemental measure.

Set forth below is a reconciliation of net income (loss) to Adjusted EBITDA, which we consider to be the most directly comparable GAAP financial measure to Adjusted EBITDA (in thousands):

	Year Ended December 31,	
	2019	2018
Net income (loss)	\$ (13,263)	\$ 2,836
Add (deduct):		
Interest expense, net	3,525	1,474
Income tax (benefit) provision	3,585	1,724
Restructuring and other charges	4,908	—
Goodwill impairment charge	1,003	—
Depreciation and amortization	5,115	2,702
Stock-based compensation	3,508	2,080
Inventory step-up amortization	577	—
Merger and acquisition transaction costs	337	1,404
Adjusted EBITDA	<u>\$ 9,295</u>	<u>\$ 12,220</u>

LIQUIDITY AND CAPITAL RESOURCES

Our operations have historically and continue to be financed through a combination of our existing cash and cash equivalents, cash generated in the business, borrowings, and sales of equity.

The following table summarizes the information regarding our cash and cash equivalents and working capital (in thousands):

	December 31, 2019	December 31, 2018
Cash and cash equivalents	\$ 28,747	\$ 27,709
Working capital	114,885	75,280

The Company had a net loss of \$13.3 million for the years ended December 31, 2019 and net income of \$2.8 million for the years ended December 31, 2018.

As of December 31, 2019, we had an accumulated deficit of \$29.2 million and working capital of \$114.9 million. As of December 31, 2019, we had \$28.7 million in cash and cash equivalents, which included \$14.2 million in cash balances held by our international subsidiaries, and \$38.0 million in aggregate debt. In addition, as of December 31, 2019, we had \$4.5 million committed as security for letters of credit under our revolving credit facilities.

Our current lack of liquidity could harm us by:

- increasing our vulnerability to adverse economic conditions in our industry or the economy in general;
- requiring substantial amounts of cash to be used for debt servicing, rather than other purposes, including operations;
- limiting our ability to plan for, or react to, changes in our business and industry; and
- influencing investor and customer perceptions about our financial stability and limiting our ability to obtain financing or acquire customers.

However, we continue to focus on cost management, operating efficiency and restrictions on discretionary spending. In addition, if necessary, we may sell assets, issue debt or equity securities or purchase credit insurance. We may also reduce the scope of our planned product development, reduce sales and marketing efforts and reduce our operations in low margin regions, including reductions in headcount. Since December 31, 2019, and as described below under the header *March 2020 DNI Loan*, we entered into a Loan Agreement with DNI, and the Company intends to use a portion of such funds to repay in full and terminate the Company's existing credit facility with PNC Bank. Based on our current plans and current business conditions, we believe that these measures along with our existing cash and cash equivalents will be sufficient to satisfy our anticipated cash requirements for at least the next twelve (12) months from the date of this Annual Report on Form 10-K.

Our ability to meet our obligations as they become due in the ordinary course of business for the next twelve (12) months will depend on our ability (i) to achieve forecasted results of operations, (ii) access funds under new credit facilities and/or raise additional capital through sale of our common stock to the public, and (iii) effectively manage working capital requirements. If we cannot raise additional funds when we need or want them, our operations and prospects could be negatively affected. We believe that we will achieve forecasted results of operations assumes that, among other things, we will continue to be successful in implementing its business strategy and that there will be no material adverse development in our business, liquidity or capital

requirements. If one or more of these factors do not occur as expected, it could cause us to fail to meet its obligations as they come due.

Operating Activities

Net cash used for operating activities was \$22.7 million and \$12.2 million in 2019 and 2018, respectively. The \$10.5 million increase in cash used for operating activities in 2019 was primarily due to an increase of \$7.5 million in our net loss (excluding non-cash items) compared to 2018, as well as a \$3.0 million increase in cash used for working capital.

Investing Activities

Cash flow used in investing activities of \$7.0 million in 2019 consists primarily of the Keymile acquisition and purchases of property, plant and equipment, compared with \$1.2 million of cash flow used in investing activities in 2018.

Financing Activities

Cash provided by financing activities totaled \$28.0 million in 2019, and consisted primarily of proceeds from issuance of common stock of \$42.5 million, as well as proceeds from borrowings of \$25.0 million, partially offset by a net outflow associated with the repayment of short term borrowings of \$20.1 million, the repayment of long term debt of \$11.9 million, as well as the repayment of a related party loan of \$5.0 million. This compared to cash provided by financing activities of \$19.0 million in 2018.

Debt Facilities

DNI Loan

On March 5, 2020, DNS Korea, the Company's wholly-owned, indirect subsidiary entered into a Loan Agreement with DNI (the "March 2020 DNI Loan"). The March 2020 DNI Loan was negotiated and approved on behalf of the Company and its subsidiaries by a special committee of the Board of Directors of the Company (the "Special Committee") consisting of directors determined to be independent from DNI. The March 2020 DNI Loan consists of a term loan in the amount of KRW 22.4 billion (\$18.5 million USD) with interest payable semi-annually at an annual rate of 4.6% and maturing on March 11, 2022. No principal payments are due on the March 2020 DNI Loan until the maturity date, but DNS Korea may prepay the loan, or a portion thereof, without penalty.

As security for the March 2020 DNI Loan (and other existing loans between DNI and DNS Korea and/or DNS California), (i) DNS California, a wholly-owned, direct subsidiary of the Company and the sole stockholder of DNS Korea, agreed to pledge the outstanding shares of DNS Korea to DNI and (ii) DNS Korea granted a security interest in its personal property assets, accounts receivable and intellectual property assets to DNI. The March 2020 DNI Loan includes certain covenants consisting of financial reporting obligations, a maintenance covenant whereby DNS Korea agreed to maintain a minimum stockholders' equity value in an amount equal to or greater than KRW 43.3 billion (\$35.8 million), and customary events of default. If an event of default occurs and is not remedied within the applicable cure period, DNI will be entitled to take various actions, including requiring the immediate repayment of all outstanding amounts under the March 2020 DNI Loan and selling the shares or assets of DNS Korea.

DNS Korea loaned the funds borrowed under the March 2020 DNI Loan to the Company, and the Company intends to use a portion of such funds to repay in full and terminate the PNC Credit Facilities, described below.

PNC Credit Facilities

On February 27, 2019, the Company and certain of its subsidiaries (as co-borrowers or guarantors) entered into that certain Revolving Credit, Term Loan, Guaranty and Security Agreement and that certain Export-Import Revolving Credit, Guaranty and Security Agreement, in each case with PNC Bank, National Association ("PNC Bank") and Citibank, N.A. as lenders, and PNC as agent for the lenders. We refer to such transactions and the agreements referenced above as the "PNC Credit Facilities".

The PNC Credit Facilities provided for a \$25 million term loan and a \$15 million revolving line of credit (including subfacilities for Ex-Im transactions, letters of credit and swing loans) with a \$10 million incremental increase option. The amount the Company was able to borrow on the revolving line of credit at any time was based on eligible accounts receivable and other conditions, less certain reserves. Borrowings under the PNC Credit Facilities bore interest at a floating rate equal to either the PNC prime rate or the LIBOR rate for the applicable period, plus a margin that was based on the type of advance.

The Company used a portion of the funds borrowed from the term loan under the PNC Credit Facilities to (i) repay \$5.0 million of existing related party indebtedness with DNI plus accrued interest, (ii) repay \$1.5 million revolving line of credit outstanding balance plus accrued interest and fees and cash collateralize \$3.6 million in outstanding letters of credit under the Company's former senior secured credit facilities with Wells Fargo Bank (the "Former WFB Facility"), described below, and (iii) repay \$5.6 million in short-term debt in Korea and Japan. The Company's obligations under the PNC Credit Facilities were secured by substantially all of the personal property assets of the Company and its subsidiaries that were co-borrowers or guarantors under the PNC Credit Facilities, including their intellectual property.

The PNC Credit Facilities had a three-year term and were scheduled to mature on February 27, 2022. The PNC Credit Facilities contemplated repayment of the term loan in quarterly installments over the term of the loan, with the balance of the term loan and revolving line of credit due at maturity.

The PNC Credit Facilities had a three-year term and were scheduled to mature on February 27, 2022. The PNC Credit Facilities contemplated repayment of the term loan in quarterly installments over the term of the loan, with the balance of the term loan and revolving line of credit due at maturity. The interest rate on the term loan was 8.12% at December 31, 2019. On July 2, 2019, \$4.4 million in outstanding borrowings under the revolving line of credit (which represented all outstanding borrowings under the revolving line of credit) was repaid in full.

The PNC Credit Facilities contained certain covenants, limitations, and conditions with respect to the Company, including a maximum leverage ratio, a minimum fixed charge coverage ratio, and a minimum liquidity covenant, as well as financial reporting obligations, and usual and customary events of default. At September 30, 2019, the Company was not in compliance with the maximum leverage ratio financial covenant in the PNC Credit Facilities, which represented an event of default thereunder. On November 8, 2019, the Company obtained a waiver of the foregoing event of default from PNC Bank. As a condition for the issuance of such waiver, the Company voluntarily prepaid \$10.0 million of the outstanding term loan and paid a one-time fee of \$150,000. The Company would have been in further breach of this financial covenant as of December 31, 2019. As discussed further in Note 7 to the consolidated financial statements, in March 2020, the Company entered into a term loan with DNI in the amount of KRW 22.4 billion (\$18.5 million). The Company plans to use the proceeds of such loan to repay in full the PNC Credit Facilities, and thus does not expect to be in breach of its financial covenants for the period ended December 31, 2019. Covenants under the March 2020 DNI loan are significantly less restrictive than under the PNC Credit Facilities.

As of December 31, 2019, the Company had \$13.1 million in outstanding term loan borrowings under the PNC Credit Facilities, and no outstanding borrowings under the revolving line of credit.

Former Wells Fargo Bank Facility

On February 27, 2019, in connection with the entry into the PNC Credit Facilities, the Company repaid \$1.5 million in principal amount of outstanding borrowings plus accrued interest and fees under the Former WFB Facility and cash collateralized \$3.6 million in outstanding letters of credit under the Former WFB Facility and terminated the Former WFB Facility. Refer to footnote 7. *Debt*, of the Consolidated Financial Statements, included in this Form 10-K, for further details about the Former WFB Facility.

Bank and Trade Facilities - Foreign Operations

Certain of our foreign subsidiaries have entered into various financing arrangements with foreign banks and other lending institutions consisting primarily of revolving lines of credit, trade facilities, term loans and export development loans. These facilities are renewed on an annual basis and are generally secured by a security interest in certain assets of the applicable foreign subsidiaries and supported by guarantees given by DNI or third parties. Payments under such facilities are made in accordance with the given lender's amortization schedules. As of December 31, 2019 and December 31, 2018, we had an aggregate outstanding balance of \$15.8 million and \$24.8 million, respectively, under such financing arrangements, and the interest rate per annum applicable to outstanding borrowings under these financing arrangements as of December 31, 2019 and December 31, 2018 ranged from 0% to 4.5% and 0% to 6.1%, respectively.

Related - Party Debt

In February 2016, DNS borrowed \$1.8 million from DNI for capital investment with an interest rate of 4.6% per annum. On February 27, 2019, in connection with the entry into the PNC Credit Facilities, the Company amended the terms of this loan to extend the repayment date to May 27, 2022. As of December 31, 2019, the \$1.8 million remained outstanding.

In September, 2016, the Company entered into a loan agreement with DNI for a \$5.0 million unsecured subordinated term loan facility. The term loan was scheduled to mature in September 2021 and was pre-payable at any time by the Company without premium or penalty. The interest rate under this facility was 4.6% per annum. In February 2019, the Company repaid the term loan in full plus accrued interest in connection with the entry into the PNC Credit Facilities, thereby terminating the loan agreement.

In March 2018, Dasan Network Solutions, Inc., a subsidiary of the Company incorporated under the laws of Korea ("DNS Korea") borrowed \$5.8 million from DNI, of which \$4.5 million was repaid on August 8, 2018. The loan bears interest at a rate of 4.6%. On February 27, 2019, in connection with the entry into the PNC Credit Facilities, the Company amended the terms of this loan to extend the repayment date to May 27, 2022. As of December 31, 2019, \$1.3 million remained outstanding.

On December 27, 2018, the Company entered into a loan agreement with DNI, for a \$6.0 million term loan with an interest rate of 4.6% per annum. On February 27, 2019, in connection with the entry into the PNC Credit Facilities, the Company amended

the terms of the term loan to extend the repayment date to May 27, 2022 and to terminate any security granted to DNI with respect to such term loan. As of December 31, 2019, the \$6.0 million remained outstanding.

The modifications resulting from the amendments described in the four preceding paragraphs were limited to the extension of the maturity dates and removal of the collateral on the outstanding term loans with DNI. There were no fees paid to DNI or external costs otherwise incurred in connection with these modifications. Interest expense on these related party borrowings was \$0.4 million in both 2019 and 2018.

As of December 31, 2019 and 2018, the Company had borrowings of \$9.1 million and \$14.1 million, respectively, outstanding from DNI. The outstanding balance at December 31, 2019 consisted of a \$6.0 million unsecured subordinated term loan facility which matures in May 2022, a \$1.8 million loan for capital investment which matures in May 2022, and KRW 1.5 billion (\$1.3 million) outstanding under a secured loan to DNS Korea which matures in May 2022. All three loans bear interest at a rate of 4.6% per annum.

As noted above under “Debt Facilities – DNI Loan,” on March 5, 2020, DNS Korea entered into a subsequent loan transaction with DNI in the amount of KRW 22.4 billion (\$18.5 million USD), which loan matures on March 11, 2022. The loan bears interest at a rate of 4.6% and is secured by accounts receivable, personal property, intellectual property and the shares of DNS Korea. All four loans are secured by the same collateral and are pre-payable without premium or penalty.

Future Requirements and Funding Sources

Our fixed commitments for cash expenditures consist primarily of payments under operating leases, inventory purchase commitments, and payments of principal and interest for debt obligations.

From time to time, we may provide or commit to extend credit or credit support to our customers. This financing may include extending the terms for product payments to customers. Any extension of financing to our customers will limit the capital that we have available for other uses.

Our accounts receivable, while not considered a primary source of liquidity, represent a concentration of credit risk because a significant portion of the accounts receivable balance at any point in time typically consists of a relatively small number of customer account balances. As of December 31, 2019, two (2) customers, APSFL and Softbank, accounted for 18% and 11%, respectively, of our net accounts receivable. Our receivables from customers in countries other than the U.S. represented 94% of accounts receivable. We do not currently have any material commitments for capital expenditures, or any other material commitments aside from operating leases for our facilities, inventory purchase commitments and debt.

Contractual Commitments and Off-Balance Sheet Arrangements

At December 31, 2019, our future contractual commitments by fiscal year were as follows (in thousands):

	Payments due by period					
	Total	2020	2021	2022	2023	2024 and thereafter
Operating leases	\$ 24,725	\$ 5,287	\$ 4,655	\$ 4,211	\$ 3,795	\$ 6,777
Purchase commitments	4,354	4,354	—	—	—	—
Short-term debt - bank and trade facilities	18,279	18,279	—	—	—	—
Long-term debt - bank and trade facilities	10,625	—	3,438	7,187	—	—
Long-term debt - related party	9,096	—	—	9,096	—	—
Total future contractual commitments	<u>\$ 67,079</u>	<u>\$ 27,920</u>	<u>\$ 8,093</u>	<u>\$ 20,494</u>	<u>\$ 3,795</u>	<u>\$ 6,777</u>

Operating Leases

Future minimum operating lease obligations in the table above include primarily payments for our office locations and manufacturing, research and development locations, which expire at various dates through 2025. See Note 14 “Commitments and Contingencies” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our operating leases.

Purchase Commitments

The purchase commitments shown above represent non-cancellable inventory purchase commitments as of December 31, 2019.

Short-term and Long-term Debt

The debt obligation amount shown above represents scheduled principal repayments, but not the associated interest payments which may vary based on changes in market interest rates. See Note 7 “Debt” of the Notes to Consolidated Financial Statements included in this Annual Report on Form 10-K for further discussion regarding our operating leases.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISKS

Not required

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES

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No financial statement schedules are required because all the relevant data is included elsewhere in these consolidated financial statements.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Stockholders
DASAN Zhone Solutions, Inc.

Opinion on the financial statements

We have audited the accompanying consolidated balance sheet of DASAN Zhone Solutions, Inc. (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2019, the related consolidated statements of comprehensive income (loss), stockholders’ equity and non-controlling interest, and cash flows for the year then ended, and the related notes (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2019, and the results of its operations and its cash flows for the year then ended, in conformity with accounting principles generally accepted in the United States of America.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the Company’s internal control over financial reporting as of December 31, 2019, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”), and our report dated March 24, 2020 expressed an adverse opinion.

Change in accounting principle

As discussed in Note 1 to the financial statements, the Company has changed its method of accounting for leases on January 1, 2019 using the modified retrospective approach due to the adoption of the new leasing standard.

Basis for opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audit included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. Our audit also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audit provides a reasonable basis for our opinion.

/s/ GRANT THORNTON LLP

We have served as the Company’s auditor since 2019.

San Francisco, California
March 24, 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Stockholders
DASAN Zhone Solutions, Inc.

Opinion on internal control over financial reporting

We have audited the internal control over financial reporting of DASAN Zhone Solutions, Inc. (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2019, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”). In our opinion, because of the effect of the material weaknesses described in the following paragraphs on the achievement of the objectives of the control criteria, the Company has not maintained effective internal control over financial reporting as of December 31, 2019, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by COSO.

A material weakness is a deficiency, or combination of control deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company’s annual or interim financial statements will not be prevented or detected on a timely basis. Material weaknesses have been identified and included in management’s assessment related to insufficiency of qualified personnel, including a lack of qualified personnel to account for significant unusual transactions; financial close and reporting, including monitoring foreign subsidiaries; and the Company’s control environment, specifically inventory valuation and revenue.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the consolidated financial statements of the Company as of and for the year ended December 31, 2019. The material weaknesses identified above were considered in determining the nature, timing, and extent of audit tests applied in our audit of the 2019 consolidated financial statements, and this report does not affect our report dated March 24, 2020 which expressed an unqualified opinion on those financial statements.

Basis for opinion

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Annual Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and limitations of internal control over financial reporting

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ GRANT THORNTON LLP

San Francisco, California
March 24, 2020

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of DASAN Zhone Solutions, Inc.

Opinion on the Financial Statements

We have audited the consolidated balance sheet of DASAN Zhone Solutions, Inc. and its subsidiaries (the “Company”) as of December 31, 2018, and the related consolidated statements of comprehensive income (loss), of stockholders’ equity and non-controlling interest and of cash flows for the year then ended, including the related notes (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018, and the results of its operations and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company’s consolidated financial statements based on our audit. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits of these consolidated financial statements in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud.

Our audit included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audit also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. We believe that our audit provides a reasonable basis for our opinion.

/s/ PricewaterhouseCoopers LLP

San Jose, California

March 12, 2019

We served as the Company's auditor from 2016 to 2019.

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES

Consolidated Balance Sheets
(In thousands, except par value)

	As of December 31,	
	2019	2018
Assets		
Current assets:		
Cash and cash equivalents	\$ 28,747	\$ 27,709
Restricted cash	4,646	7,003
Accounts receivable - trade, net of allowance for doubtful accounts of \$393 in 2019 and \$328 in 2018		
Third parties	96,865	71,034
Related parties	—	583
Other receivables		
Suppliers and others	8,092	12,923
Related parties	32	65
Inventories	35,439	33,868
Contract assets	16,680	11,381
Prepaid expenses and other current assets	4,185	4,185
Total current assets	<u>194,686</u>	<u>168,751</u>
Property, plant and equipment, net	6,769	5,518
Right-of-use assets from operating leases	20,469	—
Goodwill	3,977	3,977
Intangible assets, net	12,381	5,649
Deferred tax assets, net	1,622	2,752
Long-term restricted cash	242	936
Other assets	6,001	2,424
Total assets	<u>\$ 246,147</u>	<u>\$ 190,007</u>
Liabilities, Stockholders' Equity and Non-controlling Interest		
Current liabilities:		
Accounts payable - trade		
Third parties	38,331	36,865
Related parties	96	1,743
Short-term debt - Bank and trade facilities	17,484	31,762
Other payables		
Third parties	1,748	1,792
Related parties	1,530	1,281
Contract liabilities - current	3,567	8,511
Operating lease liabilities - current	4,201	—
Accrued and other liabilities	12,844	11,517
Total current liabilities	<u>79,801</u>	<u>93,471</u>
Long-term debts		
Bank and trade facilities	9,937	—
Related party	9,096	14,142
Contract liabilities - non-current	3,230	1,801
Operating lease liabilities - non-current	18,154	—
Pension liabilities	17,671	—
Other long-term liabilities	1,710	2,739
Total liabilities	<u>139,599</u>	<u>112,153</u>
Commitments and contingencies (Note 14)		
Stockholders' equity and non-controlling interest		
Common stock, authorized 36,000 shares, 21,419 and 16,587 shares outstanding as of December 31, 2019 and 2018, respectively, at a \$0.001 par value	21	16
Additional paid-in capital	139,700	93,192
Accumulated other comprehensive loss	(3,939)	(192)
Accumulated deficit	(29,234)	(15,777)
Total stockholders' equity	<u>106,548</u>	<u>77,239</u>
Non-controlling interest	—	615
Total stockholders' equity and non-controlling interest	<u>106,548</u>	<u>77,854</u>
Total liabilities, stockholders' equity and non-controlling interest	<u>\$ 246,147</u>	<u>\$ 190,007</u>

See accompanying notes to consolidated financial statements.

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES

Consolidated Statements of Comprehensive Income (Loss)

(In thousands, except per share data)

	Years Ended December 31,	
	2019	2018
Net revenue:		
Third parties	\$ 304,369	\$ 276,718
Related parties	2,513	5,630
Total net revenue	306,882	282,348
Cost of revenue:		
Products and services - third parties	203,269	185,709
Products and services - related parties	1,906	4,696
Amortization of intangible assets	1,596	612
Total cost of revenue	206,771	191,017
Gross profit	100,111	91,331
Operating expenses:		
Research and product development	38,516	35,306
Selling, marketing, general and administrative	61,206	48,321
Restructuring and other charges	4,908	—
Amortization of intangible assets	1,507	524
Goodwill impairment charge	1,003	—
Total operating expenses	107,140	84,151
Operating income (loss)	(7,029)	7,180
Interest income	456	264
Interest expense	(3,981)	(1,738)
Other income (expense), net	876	(1,146)
Income (loss) before income taxes	(9,678)	4,560
Income tax provision (benefit)	3,585	1,724
Net income (loss)	(13,263)	2,836
Net income (loss) attributable to non-controlling interest	194	69
Net income (loss) attributable to DASAN Zhone Solutions, Inc.	(13,457)	2,767
Foreign currency translation adjustments	(1,939)	(2,051)
Actuarial gain (loss) for pension plan	(1,793)	—
Comprehensive income (loss)	(16,995)	785
Comprehensive income attributable to non-controlling interest	209	81
Comprehensive income (loss) attributable to DASAN Zhone Solutions, Inc.	\$ (17,204)	\$ 704
Basic earnings (loss) per share attributable to DASAN Zhone Solutions, Inc.	\$ (0.69)	\$ 0.17
Diluted earnings (loss) per share attributable to DASAN Zhone Solutions, Inc.	\$ (0.69)	\$ 0.17
Weighted average shares outstanding used to compute basic net income (loss) per share	19,403	16,482
Weighted average shares outstanding used to compute diluted net income (loss) per share	19,403	16,746

See accompanying notes to consolidated financial statements.

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES
Consolidated Statements of Stockholders' Equity and Non-Controlling Interest
Years ended December 31, 2019 and 2018
(In thousands)

	Common stock		Additional paid-in capital	Accumulated other comprehensive income (loss)	Accumulated deficit	Total stockholders equity	Non-controlling interest	Total stockholders' equity and non-controlling interest
	Shares	Amount						
Balances as of December 31, 2017	16,410	\$ 16	\$ 90,198	\$ 1,871	\$ (18,852)	\$ 73,233	\$ 534	\$ 73,767
ASC 606 opening balance adjustment	—	—	—	—	308	308	—	308
Exercise of stock options and restricted stock grant	177	—	914	—	—	914	—	914
Stock-based compensation	—	—	2,080	—	—	2,080	—	2,080
Net income	—	—	—	—	2,767	2,767	69	2,836
Other comprehensive loss	—	—	—	(2,063)	—	(2,063)	12	(2,051)
Balance as of December 31, 2018	16,587	16	93,192	(192)	(15,777)	77,239	615	77,854
Issuance of common stock in public offering, net of issuance costs	4,718	5	42,504	—	—	42,509	—	42,509
Purchase of non-controlling interest in subsidiary	—	—	(127)	—	—	(127)	(824)	(951)
Exercise of stock options and restricted stock grant	75	—	256	—	—	256	—	256
Employee stock plan purchase program (ESPP)	39	—	367	—	—	367	—	367
Stock-based compensation	—	—	3,508	—	—	3,508	—	3,508
Net loss	—	—	—	—	(13,457)	(13,457)	194	(13,263)
Other comprehensive loss	—	—	—	(3,747)	—	(3,747)	15	(3,732)
Balance as of December 31, 2019	<u>21,419</u>	<u>\$ 21</u>	<u>\$ 139,700</u>	<u>\$ (3,939)</u>	<u>\$ (29,234)</u>	<u>\$ 106,548</u>	<u>\$ —</u>	<u>\$ 106,548</u>

See accompanying notes to consolidated financial statements.

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES

Consolidated Statements of Cash Flows
(In thousands)

	Years Ended December 31,	
	2019	2018
Cash flows from operating activities:		
Net income (loss)	\$ (13,263)	\$ 2,836
Adjustments to reconcile net income (loss) to net cash provided by (used in) operating activities:		
Depreciation and amortization	5,115	2,702
Goodwill impairment charge	1,003	—
Amortization of deferred financing cost	664	—
Stock-based compensation	3,508	2,080
Provision for inventory reserves	2,984	835
Provision for doubtful accounts	155	20
Provision for sales returns	370	1,343
Unrealized loss (gain) on foreign currency transactions	158	(1,229)
Provision for deferred income taxes	1,130	202
Changes in operating assets and liabilities, net of acquisitions:		
Accounts receivable	(23,072)	(10,287)
Inventories	4,802	(9,359)
Contract assets	(5,962)	(12,175)
Prepaid expenses and other assets	(7,688)	3,381
Accounts payable	10,340	5,702
Accrued and other liabilities	854	(3,727)
Contract liabilities	(3,800)	5,458
Net cash used in operating activities	(22,702)	(12,218)
Cash flows from investing activities:		
Proceeds from disposal of property, plant and equipment and other assets	—	2
Purchases of property, plant and equipment	(2,314)	(1,182)
Acquisition of business, net of cash acquired	(4,660)	—
Net cash used in investing activities	(6,974)	(1,180)
Cash flows from financing activities:		
Proceeds from issuance of common stock in public offerings, net of issuance costs	42,509	—
Proceeds from short-term borrowings and line of credit	49,243	55,518
Repayments of short-term borrowings and line of credit	(69,357)	(45,033)
Proceeds from long-term borrowings	25,000	—
Repayments of long-term borrowings	(11,875)	—
Proceeds from related party term loan	—	12,064
Repayments of related party term loan	(5,000)	(4,460)
Financing cost - debt issuance	(2,148)	—
Purchase of non-controlling interest	(951)	—
Proceeds from exercise of stock options	623	914
Net cash provided by financing activities	28,044	19,003
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	(381)	(1,369)
Net increase (decrease) in cash, cash equivalents and restricted cash	(2,013)	4,236
Cash, cash equivalents and restricted cash at beginning of period	35,648	31,412
Cash, cash equivalents and restricted cash at end of period	\$ 33,635	\$ 35,648
Reconciliation of cash, cash equivalents and restricted cash to statement of financial position		
Cash and cash equivalents	\$ 28,747	\$ 27,709
Restricted cash	4,646	7,003
Long-term restricted cash	242	936
	\$ 33,635	\$ 35,648
Supplemental disclosure of cash flow information:		
Shares of the Company's common stock held in escrow	—	—
Cash paid during the period for:		
Interest - bank and trade facilities	\$ 2,786	\$ 1,332
Interest - related party	\$ 509	\$ 611
Income taxes	\$ 2,017	\$ 1,260

See accompanying notes to consolidated financial statements.

DASAN ZHONE SOLUTIONS, INC. AND SUBSIDIARIES

Notes to Consolidated Financial Statements

(1) Organization and Summary of Significant Accounting Policies

(a) Description of Business

DASAN Zhone Solutions, Inc. (referred to, collectively with its subsidiaries, as “DZS” or the “Company”) is a global provider of ultra-broadband network access solutions and communications platforms deployed by advanced Tier 1, 2 and 3 service providers and enterprise customers. The Company provides a wide array of reliable, cost-effective networking technologies, including broadband access, Ethernet switching, mobile backhaul, Passive Optical LAN and software-defined networks, to a diverse customer base that includes more than 1200 customers in more than 120 countries worldwide.

DZS was incorporated under the laws of the state of Delaware in June 1999. The Company is headquartered in Oakland, California with flexible in-house production facilities in Seminole, Florida and Hannover, Germany, and contract manufacturers located in China, India, Korea and Vietnam. The Company also maintains offices to provide sales and customer support at global locations. On March 2, 2020, the Company announced its plans to relocate its corporate headquarters from Oakland, California to Plano, Texas and to establish a new U.S.-based Engineering Center of Excellence in Plano.

(b) Basis of Presentation

The consolidated financial statements are prepared in accordance with U.S. GAAP and include the accounts of the Company, its wholly owned subsidiaries and a subsidiary in which it had a controlling interest. All inter-company transactions and balances have been eliminated in consolidation.

(c) DNI Ownership

As of December 31, 2019, DNI owned approximately 44.4% of the outstanding shares of the Company's common stock. As a result, DNI is able to significantly influence corporate and management policies and the outcome of any corporate transaction or other matter submitted to the Company's stockholders for approval. Such transactions may include mergers and acquisitions, sales of all or some of the Company's assets or purchases of assets, and other significant corporate transactions. The interests of DNI may not coincide with the interests of the Company's other stockholders or with holders of the Company's indebtedness. See Note 7 and Note 12 to the consolidated financial statements for additional information.

(d) Risks and Uncertainties

The accompanying consolidated financial statements have been prepared in conformity with U.S. GAAP, assuming the Company will continue as a going concern.

The Company had net loss of \$13.3 million for the year ended December 31, 2019 and net income of \$2.8 million for the year ended December 31, 2018. Additionally, the Company incurred significant losses in prior years. As of December 31, 2019, the Company had an accumulated deficit of \$29.2 million and working capital of \$114.9 million. As of December 31, 2019, the Company had \$28.7 million in cash and cash equivalents, which included \$14.2 million in cash balances held by its international subsidiaries, and \$38.0 million in aggregate principal debt of which \$18.3 million was reflected in current liabilities. In addition, as of December 31, 2019, the Company had \$4.5 million committed as security for letters of credit under its revolving credit facilities.

The Company's liquidity could be impacted by:

- its vulnerability to adverse economic conditions in its industry or the economy in general;
- debt servicing requiring substantial amounts of cash, rather than being available for other purposes, including operations;
- its ability to plan for, or react to, changes in its business and industry; and
- investor and customer perceptions about its financial stability and limiting its ability to obtain financing or acquire customers.

The Company's ability to meet its obligations as they become due in the ordinary course of business for the next twelve (12) months will depend on its ability (i) to achieve forecasted results of operations, (ii) access funds approved under existing or new credit facilities and/or raise additional capital through sale of the Company's common stock to the public, and (iii) effectively manage working capital requirements. If the Company cannot raise additional funds when it needs or wants them, its operations and prospects could be negatively affected. Management's belief that it will achieve forecasted results of operations assumes that, among other things, the Company will continue to be successful in implementing its business strategy. If one or more of these factors do not occur as expected, it could cause the Company to fail to meet its obligations as they come due.

At September 30, 2019, the Company was not in compliance with the maximum leverage ratio financial covenant under the PNC Credit Facilities, which represented an event of default thereunder. On November 8, 2019, the Company obtained a waiver of the foregoing event of default. The Company would have been in further breach of this financial covenant as of December 31, 2019. As discussed further in Note 7 to the consolidated financial statements, in March 2020, the Company entered into a term loan with DNI in the amount of KRW 22.4 billion (\$18.5 million). The Company plans to use the proceeds of such loan to repay in full the PNC Credit Facilities, and terminate the facility. Covenants under the March 2020 DNI loan are less restrictive than under the PNC Credit Facilities.

In December 2019, a strain of coronavirus, now known as COVID-19, was reported to have surfaced in Wuhan, China. Since that time, other countries including the United States, South Korea, Italy and Japan have experienced widespread or sustained transmission of the virus, and there is a risk that the virus will continue to spread to additional countries. The Company relies on suppliers and contract manufacturers located in China and has significant business operations in South Korea and Japan. If the virus continues to spread, the effects of the virus could continue to materially and adversely affect our financial condition, results of operations, and cash flows. Given the ongoing and dynamic nature of the virus and the worldwide response related thereto, it is difficult to predict the full impact of the COVID-19 outbreak on our business. The impact of a continued COVID-19 outbreak could have a material adverse effect on our business, financial condition, results of operations, and cash flows.

Based on the Company's current plans and current business conditions, the Company believes that its existing cash, cash equivalents and available credit facilities will be sufficient to satisfy its anticipated cash requirements for at least the next twelve (12) months from the date of this Annual Report on Form 10-K.

Concentration of Risk

Financial instruments, which potentially subject the Company to concentrations of credit risk, consist primarily of cash and cash equivalents, accounts receivable and contract assets. Cash and cash equivalents consist principally of financial deposits and money market accounts. Cash and cash equivalents are principally held with various domestic financial institutions with high credit standing.

The Company's customers include competitive and incumbent local exchange carriers, competitive access providers, internet service providers, wireless carriers and resellers serving these markets. The Company performs ongoing credit evaluations of its customers and generally does not require collateral. Allowances are maintained for potential doubtful accounts.

For the year ended December 31, 2019, no customer represented 10% or more of net revenue. For the year ended December 31, 2018, one (1) customer represented 11% of net revenue.

As of December 31, 2019, two (2) customers represented 18% and 11% of net accounts receivable, respectively. As of December 31, 2018, two (2) customers represented 11% and 10% of net accounts receivable, respectively. As of December 31, 2019 and December 31, 2018, receivables from customers in countries other than the United States represented 94% and 88% of net accounts receivable, respectively.

(e) Consolidated Subsidiaries

Details of the Company's consolidated operating subsidiaries as of December 31, 2019 and 2018 are as follows:

	Location	Percentage of ownership (%)	
		December 31, 2019	December 31, 2018
Dasan Network Solutions, Inc. (U.S. subsidiary)	US	100%	100%
Dasan Network Solutions, Inc. (Korean subsidiary)	Korea	100%	100%
DZS Japan Inc.	Japan	100%	69.06%
DASAN Vietnam Company Limited	Vietnam	100%	100%
D-Mobile Limited	Taiwan	100%	100%
DASAN India Private Limited	India	99.99%	99.99%
Keymile GmbH	Germany	100%	—%

(f) Use of Estimates

The preparation of the consolidated financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenue and expenses during the reporting period. Actual results could differ materially from those estimates.

(g) Revenue Recognition

Revenue from contracts with customers is recognized when control of the promised goods or services is transferred to the customers, in an amount that reflects the consideration the Company expects to be entitled to in exchange for those goods or services.

The Company generates revenue primarily from sales of products and services, including, extended warranty service and customer support. Revenue from product sales is recognized at a point in time when control of the goods is transferred to the customer, generally occurring upon shipment or delivery dependent upon the terms of the underlying contract. Most of the Company's arrangements include customer acceptance provisions. Transfer of control occurs upon obtaining the signed acceptance certificate from the customer, unless the Company can objectively demonstrate that customer acceptance is a formality. In those instances, where transfer of control occurs prior to obtaining the signed acceptance certificate, the Company considers a number of factors, including successful completion of customer testing to demonstrate that the delivered products meet all the acceptance criteria specified in the arrangement, its experience with the customer and its experience with other contracts for similar products.

Revenue from services is generally recognized over time on a ratable basis over the contract term, using an output measure of progress, as the contracts usually provide the customer equal benefit throughout the contract period. The Company typically invoices customers for support contracts in advance, for periods ranging from one (1) to five (5) years.

Transaction price is calculated as selling price net of variable consideration. Sales to certain distributors are made under arrangements which provide the distributors with volume discounts, price adjustments, and other allowances under certain circumstances. These adjustments and allowances are accounted for as variable consideration. To estimate variable consideration, the Company analyzes historical data, channel inventory levels, current economic trends and changes in customer demand for the Company's products, among other factors. Historically, variable consideration has not been a significant component of the Company's contracts with customers.

For contracts with customers that contain multiple performance obligations, the Company accounts for the promised performance obligations separately as individual performance obligations if they are distinct. In determining whether performance obligations meet the criteria for being distinct, the Company considers a number of factors, including the degree of interrelation and interdependence between obligations and whether or not the good or service significantly modifies or transforms another good or service in the contract. After identifying the separate performance obligations, the transaction price is allocated to the separate performance obligations on a relative standalone selling price basis. Standalone selling prices for products are determined using either an adjusted market assessment or expected cost-plus margin. For customer support and extended warranty services, standalone selling price is primarily based on the prices charged to customers, when sold separately. Unsatisfied and partially unsatisfied performance obligations as of the end of the reporting period primarily consist of products and services for which customer purchase orders have been accepted and that are in the process of being delivered.

The Company records contract assets when it has a right to consideration and records accounts receivable when it has an unconditional right to consideration. The Company records contract liabilities when cash payments are received (or unconditional rights to receive cash) in advance of fulfilling its performance obligations.

The Company's payment terms vary by the type and location of its customer and the products or services offered. For certain products or services and customer types, the Company requires payment before the products or services are delivered to the customer.

Other related policies and revenue information

Warranties

Products sold to customers include standard warranties, typically for one year, covering bug fixes and minor updates such that the product continues to function according to published technical specifications. These standard warranties are assurance type warranties and do not offer any services in addition to the assurance that the product will continue working as specified. Therefore, standard warranties are not considered separate performance obligations. Instead, the expected cost of warranty is accrued as expense in accordance with applicable guidance. Optional extended warranties, for up to five years, are sold with certain products and include additional support services. The transaction price for extended warranties is accounted for as service revenue and recognized ratably over the life of the contract.

The Company records estimated costs related to standard warranties upon product shipment or upon identification of a specific product failure. The Company recognizes estimated warranty costs when it is probable that a liability has been incurred and the amount of loss is reasonably estimable. The estimates are based upon historical and projected product failure and claim rates, historical costs incurred in correcting product failures and information available related to any specifically identified product failures. Significant judgment is required in estimating costs associated with warranty activities and the Company's estimates are limited to information available to the Company at the time of such estimates. In some cases, such as when a specific product failure is first identified or a new product is introduced, the Company may initially have limited information and limited historical failure and claim rates upon which to base its estimates, and such estimates may require revision in future periods. The recorded amount is adjusted from time to time for specifically identified warranty exposure.

Contract Costs

Applying a practical expedient, the Company recognizes the incremental costs of obtaining contracts, which primarily consist of sales commissions, as sales and marketing expense, when incurred if the amortization period of the assets that otherwise would have been recognized is one year or less. If the service period, inclusive of any anticipated renewal, is longer than a year, the incremental direct costs are capitalized and amortized over the period of benefit. As of December 31, 2019 and 2018, such capitalized costs were not significant.

Financing

The Company applies the practical expedient not to adjust the promised amount of consideration for the effects of a financing component if the Company expects, at contract inception, that the period between when the Company transfers a good or service to the customer and when the customer pays for the good or service will be one year or less. During the year ended December 31, 2019 and 2018, such financing components were not significant.

Bill-and-hold

The Company recognizes revenue from the sale of products when control has passed to the customer, which is based on the shipping terms of the arrangement, when significant risk and rewards have transferred to the customer. In some instances, the customer agrees to buy product from the Company but requests delivery at a later date, commonly known as bill-and-hold arrangements. For these transactions, the Company deems that control passes to the customer when the product is ready for delivery. The Company views products readiness for delivery when a signed agreement is in place, the transaction is billable, and the customer has significant risk and rewards for the products, the ability to direct the assets, the products have been set aside specifically for the customer, and cannot be redirected to another customer.

Shipping and Handling

The Company has elected to account for shipping and handling activities that occur after the customer has obtained control of a good as a fulfillment cost rather than as an additional promised service. As a result, the Company accrues the costs of shipping and handling when the related revenue is recognized.

Unsatisfied Performance Obligations

The Company does not disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less. The majority of the Company's performance obligations in its contracts with customers relate to contracts with duration of less than one year. The transaction price allocated to unsatisfied performance obligations included in contracts with duration of more than 12 months is reflected in contract liabilities – non-current on the consolidated balance sheet.

Disaggregation of Revenue

The following table presents the revenues by source (in thousands):

	Years ended December 31,	
	2019	2018
Revenue by products and services:		
Products	\$ 286,292	\$ 269,269
Services	20,590	13,079
Total	<u>\$ 306,882</u>	<u>\$ 282,348</u>

Information about the Company's net revenue for North America and international markets for 2019 and 2018 is summarized below (in thousands):

	Years ended December 31,	
	2019	2018
Revenue by geography:		
United States	\$ 36,383	\$ 50,795
Canada	4,690	4,413
Total North America	41,073	55,208
Latin America	23,774	27,596
Europe, Middle East, Africa	78,375	34,741
Korea	79,124	76,006
Other Asia Pacific	84,536	88,797
Total International	265,809	227,140
Total	\$ 306,882	\$ 282,348

(h) Allowances for Sales Returns and Doubtful Accounts

The Company records an allowance for sales returns for estimated future product returns related to current period product revenue. The allowance for sales returns is recorded as a reduction of revenue and an increase to accrued and other liabilities. The Company bases its allowance for sales returns on periodic assessments of historical trends in product return rates and current approved returned products. If the actual future returns were to deviate from the historical data on which the reserve had been established, the Company's future revenue could be adversely affected.

The Company records an allowance for doubtful accounts for estimated losses resulting from the inability of customers to make payments for amounts owed to the Company. The allowance for doubtful accounts is recorded as an expense under general and administrative expenses. The Company bases its allowance on periodic assessments of its customers' liquidity and financial condition through analysis of information obtained from credit rating agencies, financial statement review and historical collection trends. Additional allowances may be required in the future if the liquidity or financial condition of the Company's customers deteriorates, resulting in doubts about their ability to make payments.

Activity under the Company's allowance for doubtful accounts is comprised as follows (in thousands):

	December 31,	
	2019	2018
Balance at beginning of year	\$ 328	\$ 1,246
Charged to expense	155	20
Reversal of expense	—	(11)
Utilization/write offs/exchange rate differences	(90)	(927)
Balance at end of year	\$ 393	\$ 328

Activity under the Company's allowance for sales returns is comprised as follows (in thousands):

	December 31,	
	2019	2018
Balance at beginning of year	\$ 706	\$ 445
Charged to revenue	370	1,343
Utilization/write offs/exchange rate differences	(733)	(1,082)
Balance at end of year	\$ 343	\$ 706

(i) Inventories

Inventories are stated at the lower of cost or net realizable value, with cost being determined using the first-in, first-out method. In assessing the net realizable value of inventories, the Company is required to make judgments as to future demand requirements and compare these with the current or committed inventory levels. Once inventory has been written down to its estimated net realizable value, its carrying value cannot be increased due to subsequent changes in demand. To the extent that a severe decline in forecasted demand occurs, or the Company experiences a higher incidence of inventory obsolescence due to rapidly changing technology and customer requirements, the Company may incur significant expenses for excess and obsolete inventory. The Company also evaluates the terms of its agreements with its suppliers and establishes accruals for estimated losses on adverse purchase commitments as necessary, applying the same lower of cost or net realizable value approach that is used to value inventory.

(j) Foreign Currency Translation

For operations outside the United States, the Company translates assets and liabilities of foreign subsidiaries, whose functional currency is the applicable local currency, at end of period exchange rates. Revenues and expenses are translated at periodic average rates. The adjustment resulting from translating the financial statements of such foreign subsidiaries, is included in accumulated other comprehensive income (loss,) which is reflected as a separate component of stockholders' equity. Gains and losses on foreign currency transactions are included in other income (expense) in the accompanying consolidated statement of comprehensive income (loss).

(k) Comprehensive Income (Loss)

There have been no items reclassified out of accumulated other comprehensive income (loss) and into net income (loss). The Company's other comprehensive income (loss) for the years ended December 31, 2019 and 2018 is comprised of foreign currency translation gains and losses and actuarial gains and losses from pension liability.

(l) Property, Plant and Equipment

Property, plant, and equipment are stated at cost, less accumulated depreciation, and are depreciated using the straight-line method over the estimated useful life of each asset. The useful life of each asset category is as follows:

<u>Asset Category</u>	<u>Useful Life</u>
Furniture and fixtures	3 to 4 years
Machinery and equipment	3 to 10 years
Computers and software	3 years
Leasehold improvements	Shorter of remaining lease term or estimated useful lives

Upon retirement or sale, the cost and related accumulated depreciation of the asset are removed from the balance sheet and the resulting gain or loss is reflected in operating expenses.

(m) Long-Lived Assets

The Company reviews long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying value of an asset or asset group may not be recoverable. Recoverability of assets to be held and used is measured by comparing the carrying amount of an asset to the future net undiscounted cash flows expected to be generated by the asset. If the carrying amount of an asset exceeds its estimated future net undiscounted cash flows, an impairment expense is recognized in the amount by which the carrying amount of the asset exceeds the fair value of the asset. Any assets to be disposed of would be separately presented in the balance sheet and reported at the lower of the carrying amount or fair value less costs to sell, and would no longer be depreciated. The assets and liabilities of a disposed group classified as held for sale would be presented separately in the appropriate asset and liability sections of the balance sheet.

The Company estimates the fair value of its long-lived assets based on a combination of market information primarily obtained from third-party quotes and online markets. In the application of impairment testing, the Company is required to make estimates of future operating trends and resulting cash flows and judgments on discount rates and other variables. Actual future results and other assumed variables could differ from these estimates.

(n) Goodwill and Other Acquisition-Related Intangible Assets

Goodwill and other acquisition-related intangible assets not subject to amortization are tested annually for impairment and are tested for impairment more frequently if events and circumstances indicate that the asset might be impaired.

Factors the Company considers important which could trigger an impairment review, include, but are not limited to, significant changes in the manner of use of its acquired assets, significant changes in the strategy for the Company's overall business or significant negative economic trends. If this evaluation indicates that the value of an intangible asset may be impaired, an assessment of the recoverability of the net carrying value of the asset over its remaining useful life is made. If this assessment indicates that the cost of an intangible asset is not recoverable, based on the estimated undiscounted future cash flows or other comparable market valuations of the entity or technology acquired over the remaining amortization period, the net carrying value of the related intangible asset will be reduced to fair value and the remaining amortization period may be adjusted. An impairment loss is recognized to the extent that the carrying amount exceeds the asset's fair value.

In the application of impairment testing, the Company is required to make estimates of future operating trends and resulting cash flows and judgments on discount rates and other variables. Actual future results and other assumed variables could differ from these estimates.

During 2019, the Company recorded Goodwill of \$1.0 million related to the acquisition of Keymile. In performing the annual impairment evaluation, utilizing a present value cash flow model to determine the fair value of the reporting unit, the Company determined that the goodwill related to Keymile was impaired, due to the financial performance on the reporting unit. The Company recognized an impairment loss of \$1.0 million of this goodwill for the year ended December 31, 2019.

(o) Business Combination

The Company allocates the fair value of purchase consideration to the tangible assets acquired, liabilities assumed and intangible assets acquired based on their estimated fair values. The excess of the fair value of purchase consideration over the fair values of these identifiable assets and liabilities is recorded as goodwill. When determining the fair values of assets acquired and liabilities assumed, management makes significant estimates and assumptions, especially with respect to intangible assets and certain tangible assets such as inventory.

Critical estimates in valuing certain tangible and intangible assets include but are not limited to future expected cash flows from the underlying assets and discount rates. Management's estimates of fair value are based upon assumptions believed to be reasonable, but which are inherently uncertain and unpredictable and, as a result, actual results may differ from estimates.

(p) Stock-Based Compensation

The Company amortizes the values of the stock-based compensation to expense using the straight-line method. The value of the award is recognized as expense over the requisite service periods in the Company's consolidated statement of comprehensive income (loss). The Company accounts for forfeitures as they occur.

The Company uses the Black Scholes model to estimate the fair value of options, which is affected by the Company's stock price as well as assumptions regarding a number of complex and subjective variables. These variables include the Company's expected stock price volatility over the expected term of the awards, risk-free interest rates and expected dividends. The expected stock price volatility is based on the weighted average of the historical volatility of the Company's common stock over the most recent period commensurate with the estimated expected life of the Company's stock options. The Company based its expected life assumption on its historical experience and on the terms and conditions of the stock awards granted. Risk-free interest rates reflect the yield on zero-coupon United States Treasury securities.

(q) Income Taxes

The Company uses the asset and liability method to account for income taxes. Under this method, deferred tax assets and liabilities are determined based on differences between the financial reporting and the income tax bases of assets and liabilities. Deferred tax assets and liabilities are measured using enacted tax rates and laws that will be in effect when the differences are expected to reverse. Valuation allowances are established, when necessary, to reduce deferred tax assets to the amount expected to be realized.

(r) Net Income (Loss) per Share Attributable to DASAN Zhone Solutions, Inc.

Basic net income (loss) per share attributable to DASAN Zhone Solutions, Inc. is computed by dividing the net income (loss) attributable to DASAN Zhone Solutions, Inc. for the period by the weighted average number of shares of common stock outstanding during the period. The calculation of diluted net income (loss) per share attributable to DASAN Zhone Solutions, Inc. gives effect to common stock equivalents; however, potential common equivalent shares are excluded if their effect is antidilutive. Potential common stock equivalent shares are composed of restricted stock units, unvested restricted shares and incremental shares of common stock issuable upon the exercise of stock options.

(s) Research and Development Cost

Costs related to research and development, which primarily consists of labor and benefits, supplies, facilities, consulting, and outside service fees, are expensed as incurred.

(t) Cash and Cash Equivalents

Cash and cash equivalents consist of cash and short-term investments (if any) with original maturities of less than three months.

(u) Recent Accounting Pronouncements

Recent Accounting Pronouncements Adopted

Lease Accounting

In February 2016, the Financial Accounting Standards Board (“FASB”) issued Accounting Standards Codification 842, *Leases* (“ASC 842”), which introduces the recognition of lease assets and lease liabilities by lessees for those leases classified as operating leases under previous guidance. ASC 842 requires that lease arrangements longer than 12 months’ result in an entity recognizing an asset and liability, with respect to such lease arrangement, among other changes.

The Company adopted the new standard on January 1, 2019, using the modified retrospective approach whereby the cumulative effect of adoption was recognized on the adoption date and prior periods were not restated. There was no net cumulative effect adjustment to retained earnings as of January 1, 2019 as a result of this adoption. ASC 842 sets out the principles for the recognition, measurement, presentation and disclosure of leases.

The Company has elected to use a certain package of practical expedients permitted under the transition guidance within ASC 842. Those practical expedients are as follows:

- The Company did not reassess (i) whether expired or existing contracts contain leases under the new definition of a lease; (ii) lease classification for expired or existing leases; and (iii) whether previously capitalized initial direct costs would qualify for capitalization under ASC 842.
- The Company did not reassess a lease whose term is 12 months or less and does not include a purchase option that the lessee is reasonably certain to exercise.
- The Company did not elect to use hindsight for transition when considering judgments and estimates such as assessments of lessee options to extend or terminate a lease or purchase the underlying asset.
- For all asset classes, the Company elected to not recognize a right-of-use asset and lease liability for leases with a term of 12 months or less.
- For all asset classes, the Company elected to not separate non-lease components from lease components to which they relate and has accounted for the combined lease and non-lease components as a single lease component.

The Company applies significant judgment in considering all relevant factors that create an economic benefit (e.g., contract-based, asset-based, entity-based, and market-based, among others) as of the commencement date in determining the initial lease term and future lease payments. For example, the Company exercises judgment in determining whether renewal periods will be exercised during the initial measurement process. If the Company believes it will exercise the renewal option, and the lease payments associated with the renewal periods are known or calculable, such renewal lease payments would be included in the initial measurement of the lease liability. If the Company believes that it will exercise the renewal period and the renewal

payments are unknown or not calculable, the renewal term will not be included until they become known or calculable at which time the Company would remeasure the remaining lease payments similar to a lease modification.

Adoption of ASC 842 resulted in the balance sheet recognition of right of use assets and lease liabilities of approximately \$22.5 million as of January 1, 2019. Adoption of ASC 842 did not materially impact the Company's consolidated statements of comprehensive income (loss), stockholders' equity and non-controlling interest, and cash flows. See Note 13 in the notes to consolidated financial statements.

Income Tax Effects within Accumulated Other Comprehensive Income

In February 2018, the FASB issued ASU 2018-02, *Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income*. The amendments in this update allow a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the Tax Cuts and Jobs Act (the "Tax Act"). The adoption of this standard on January 1, 2019 did not have an impact on the Company's consolidated financial statements.

Improving the Presentation of Net Periodic Pension Cost and Net Periodic Post-Retirement Benefit Cost

In March 2017, the FASB issued ASU 2017-07, *Improving the Presentation of Net Periodic Pension Cost and Net Periodic Post-Retirement Benefit Cost*. The ASU requires the Company to disaggregate the service cost component from the other components of net periodic benefit costs and requires the Company to present the other components of net periodic benefit cost in other income, net. The standard is effective for annual and interim periods beginning after December 31, 2017, and retrospective application is required. The Company adopted this guidance during the first quarter of 2019 without any retrospective adjustments since the underlying pension obligations were acquired through the Keymile Acquisition in 2019. The interest cost, which is the only component of net periodic post-retirement cost, is recognized in Other income (loss), net in the consolidated statement of comprehensive income (loss).

Other recent accounting pronouncements

In December 2019, the FASB issued ASU No. 2019-12, *Simplifying the Accounting for Income Taxes*, as part of its initiative to reduce complexity in accounting standards. The amendments in the ASU are effective for fiscal years beginning after December 15, 2020, including interim periods therein. Early adoption of the standard is permitted, including adoption in interim or annual periods for which financial statements have not yet been issued. We have not early adopted this ASU for 2019. The ASU is currently not expected to have a material impact on the Company's consolidated financial statements.

In November 2019, the FASB issued ASU No. 2019-11, *Codification Improvements to Topic 326, Financial Instruments-Credit Losses*, which clarifies or addresses specific issues about certain aspects of ASU 2016-13. ASU 2019-11 clarifies that to use the practical expedient, entities must reasonably expect the borrower "to continue to replenish the collateral to meet the requirements of the contract." In addition, if entities have elected the practical expedient (i.e., they reasonably expect the borrower to continue to replenish the collateral to meet the requirements of the contract) and the fair value of the collateral is less than the amortized cost of the financial asset, they should estimate expected credit losses on the portion of the amortized cost basis that is unsecured (i.e., the amount by which the amortized cost basis of the financial asset exceeds the fair value of the collateral). The expected credit loss is limited to the difference between the amortized cost basis of the financial asset and the fair value of the collateral. Effective Dates for entities that have not yet adopted ASU 2016-13, the amendments in ASU 2019-11 are effective on the same date as those in ASU 2016-13. For entities that have adopted ASU 2016-13, the amendments in ASU 2019-11 are effective for fiscal years beginning after December 15, 2019, and interim periods therein. The Company is currently assessing the potential impact of adopting this new guidance on its consolidated financial statements.

In June 2016, FASB issued ASU 2016-13, *Financial Instruments - Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments*, which requires the Company to measure and recognize expected credit losses for financial assets held and not accounted for at fair value through net income. In November 2018, April 2019 and May 2019, the FASB issued ASU No. 2018-19, *Codification Improvements to Topic 326, Financial Instruments - Credit Losses*, ASU No. 2019-04, *Codification Improvements to Topic 326, Financial Instruments - Credit Losses*, and ASU No. 2019-05, *Financial Instruments - Credit Losses (Topic 326): Targeted Transition Relief*, which provided additional implementation guidance on the previously issued ASU. The updated guidance is effective for the Company on January 1, 2020, and requires a modified retrospective adoption method. Early adoption is permitted. The Company is currently assessing the potential impact of adopting this new guidance on its consolidated financial statements.

In November 2019, the FASB issued ASU 2019-08, *Compensation - Stock Compensation (ASC 718)*. This ASU requires an entity measure and classify share-based payment awards granted to a customer by applying the guidance in ASC 718. The amount of the share-based payment award that is recorded as a reduction of the transaction price is required to be measured at the grant-date fair value in accordance with ASC 718. The amendments in this update are effective for the Company for annual and interim periods beginning in fiscal 2020. The Company does not expect the adoption of this guidance to have a material impact on the consolidated financial statements.

In August 2018, the FASB issued ASU 2018-15, *Intangibles - Goodwill and Other Internal-Use Software - Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement*. The update reduces complexity for the accounting for costs of implementing a cloud computing service arrangement and aligns the requirements for capitalizing implementation costs incurred in a hosting arrangement that is a service contract with the requirements for capitalizing implementation costs incurred to develop or obtain internal-use software. The standard is effective for annual and interim periods beginning after December 15, 2019, and retrospective or prospective application is permitted. The Company is currently evaluating the impact of adoption of this ASU, but it is not expected to have a material effect on its consolidated financial statements.

In January 2017, FASB issued ASU 2017-04, *Simplifying the Test for Goodwill Impairment*, which simplifies the accounting for goodwill impairment. The updated guidance is effective for the Company on January 1, 2020, and will be adopted accordingly. Early adoption is permitted. The Company is currently assessing the potential impact of adopting this new guidance on its consolidated financial statements.

On August 28, 2018, the FASB issued ASU 2018-13, *Fair Value Measurement (Topic 820)*, which removes, modifies, and adds certain disclosure requirements related to fair value measurements in ASC 820. The updated guidance is effective for annual and interim periods beginning after December 15, 2019. Early adoption is permitted. The Company is currently assessing the potential impact of adopting this new guidance on its consolidated financial statements.

In August 2018, the FASB issued ASU 2018-14, *Disclosure Framework-Changes to the Disclosure Requirements for Defined Benefit Plans*, which amends ASC 715 to add, remove, and clarify disclosure requirements related to defined benefit pension and other postretirement plans. The updated guidance is effective for the Company on January 1, 2021, with early adoption permitted. The Company is currently assessing the potential impact of adopting this new guidance on its consolidated financial statements.

(2) Business Combinations

Keymile Acquisition

On January 3, 2019, ZTI Merger Subsidiary III Inc., a Delaware corporation and a wholly owned subsidiary of the Company (“ZTI”), acquired all of the outstanding shares of Keymile GmbH (“Keymile”), a limited liability company organized under the laws of Germany, from Riverside KM Beteiligung GmbH (“Riverside”), a limited liability company organized under the laws of Germany, pursuant to a share purchase agreement (the “Keymile Acquisition”).

Keymile is a leading solution provider and manufacturer of telecommunication systems for broadband access. The Company believes Keymile strengthens its portfolio of broadband access solutions, which now includes a series of multi-service access platforms for FTTx network architectures, including ultra-fast broadband copper access based on VDSL/Vectoring and G. Fast technology.

The aggregate cash purchase price paid for all of the shares of Keymile and certain of its subsidiaries, was €10.25 million (approximately \$11.8 million), prior to adjustment for the lockbox mechanism described below. The Company also assumed pension obligations of approximately \$16.2 million. Following the closing of the Keymile Acquisition, Keymile became the Company’s wholly owned subsidiary. The Keymile Acquisition agreement also provided for a lockbox mechanism such that normal operations were observed by Keymile management and any excess cash flows generated from operating activities for the period from October 1, 2018 to December 31, 2018 remained with Keymile following the closing, with the Company as the beneficiary, as the purchaser of Keymile. At December 31, 2018, cash received from the lockbox mechanism amounted to \$2.5 million, resulting in a final adjusted acquisition price of \$9.3 million.

On October 1, 2018, as a condition for the Keymile Acquisition, Riverside extended a €4.0 million (\$4.4 million, which represents the cash and cash equivalents and short-term debt, in the “Allocation of Purchase Consideration” table below) working capital loan to Keymile. The working capital loan bore interest at a rate of 3.5% per annum and was repaid during 2019.

A summary of the final estimated purchase price allocation to the fair value of assets acquired and liabilities assumed is as follows (in thousands):

Purchase consideration		
Cash consideration	\$	11,776
Working capital adjustment: cash received from lockbox mechanism		<u>(2,497)</u>
Adjusted purchase consideration	<u>\$</u>	<u>9,279</u>

The following summarizes the final estimated fair values of the assets acquired and liabilities assumed at the date of acquisition for the Keymile Acquisition (in thousands):

Allocation of purchase consideration	
Current assets	
Cash and cash equivalents	\$ 4,619
Accounts receivable - trade, net	6,820
Other receivables	798
Inventories	9,943
Property, plant and equipment	983
Other assets	3,698
Right-of-use assets from operating leases	5,011
Intangible assets	10,047
Accounts payable - trade	(3,303)
Short-term debt	(4,582)
Contract liabilities	(364)
Accrued liabilities	(3,651)
Operating lease liabilities - current	(823)
Deferred tax liabilities	(425)
Pension obligations	(16,191)
Operating lease liabilities - non-current	(4,188)
Other long term liabilities	(116)
Goodwill	1,003
Total purchase consideration	\$ 9,279

The purchase price allocation resulted in the recognition of goodwill of approximately \$1.0 million. The goodwill was the result of the purchase price paid for the Keymile Acquisition (adjusted for amounts received under the lockbox mechanism) exceeding the fair value of the identifiable net assets acquired.

The estimated weighted average useful lives of the acquired property, plant and equipment is 5 years. Depreciation is calculated using the straight-line method.

The following table represents the final estimated fair value and useful lives of identifiable intangible assets acquired:

	Estimated Fair Value (in thousands)	Estimated Useful Life
Intangible assets acquired		
Technology - developed core	\$ 5,040	5 years
Customer relationships	3,632	5 years
Trade name	1,375	5 years
Total intangible assets	\$ 10,047	

As of the valuation date, there was value attributable to Keymile's existing customer relationships. Keymile's key customer base is made up of independent telecommunication service providers and network operators, a base of customers that have seen growth since 2012. Keymile is seen as a market leader and historically has had low customer attrition. In addition, switching costs are considered to be high due to the disruption of switching platforms as well as the additional training necessary. The Company valued the customer relationships using the Income Approach, specifically the Multi-Period Excess Earnings Method ("MPEEM").

The Company utilized the Relief from Royalty Method ("RFRM") to value the tradename and developed technology. The RFRM assumes that the value of the asset equals the amount a third party would pay to use the asset and capitalize on the related benefits of the asset. Therefore, a revenue stream for the asset is estimated, and then an appropriate royalty rate is applied to the forecasted revenue to estimate the pre-tax income associated with the asset. The pre-tax income is then tax-effected to estimate the after-tax net income associated with the asset. Finally, the after tax net income is discounted to the present value using an appropriate rate of return that considers both the risk of the asset and the associated cash flow estimates.

Pro Forma Financial Information

The unaudited pro forma information for the period set forth below gives effect to the Keymile Acquisition as if it had occurred as of January 1, 2018. The unaudited pro forma financial information has been prepared by management for illustrative purposes only and does not purport to represent what the results of operations of the Company would have been if the Keymile Acquisition had occurred on January 1, 2018 or what such results will be for any future periods. The unaudited pro forma financial information is based on estimates and assumptions and on the information available at the time of the preparation thereof. These estimates and assumptions may change, be revised or prove to be materially different, and the estimates and assumptions may not be representative of facts existing at the time of the Keymile Acquisition. The pro forma adjustments primarily relate to acquisition related costs, amortization of acquired intangible assets and interest expense related to financing arrangements.

Below is the pro forma financial information (in thousands), unaudited:

	Year Ended December 31, 2018	
Pro forma net revenues	\$	332,571
Pro forma net income attributable to DASAN Zhone Solutions, Inc.		2,480

Below is the financial information for Keymile (in thousands):

	Year Ended December 31, 2019	
Net revenues	\$	36,390
Net loss attributable to DASAN Zhone Solutions, Inc.		(13,072)

Acquisition of the Non-controlling Interest in DZS Japan

On July 31, 2019, the Company acquired the remaining 30.94% non-controlling interest of DZS Japan, Inc. (“DZS Japan”), and DZS Japan became a wholly owned subsidiary of the Company. The Company acquired the remaining interest in DZS Japan for total cash consideration of \$950,000, consisting entirely of payments to the former shareholder (Handysoft). This transaction resulted in a decrease to “Additional paid-in capital” of \$127,000, a decrease to “Non-controlling interest” of \$823,000, and a total impact of \$950,000 in the consolidated statement of stockholders’ equity and non-controlling interests for the year ended December 31, 2019.

(3) Fair Value Measurement

The Company utilizes a fair value hierarchy that is intended to increase consistency and comparability in fair value measurements and related disclosures. The fair value hierarchy is based on inputs to valuation techniques that are used to measure fair value that are either observable or unobservable. Observable inputs reflect assumptions market participants would use in pricing an asset or liability based on market data obtained from independent sources while unobservable inputs reflect a reporting entity’s pricing based upon their own market assumptions. The fair value hierarchy consists of the following three levels:

Level 1 – Inputs are quoted prices in active markets for identical assets or liabilities.

Level 2 – Inputs are quoted prices for similar assets or liabilities in an active market, quoted prices for identical or similar assets or liabilities in markets that are not active, inputs other than quoted prices that are observable and market-corroborated inputs which are derived principally from or corroborated by observable market data.

Level 3 – Inputs are derived from valuation techniques in which one or more significant inputs or value drivers are unobservable.

The following financial instruments were not measured at fair value on the Company’s consolidated balance sheet as of December 31, 2019 and 2018, but require disclosure of their fair values: cash and cash equivalents, restricted cash, accounts and other receivables, accounts payable and debt. The carrying values of financial instruments such as cash and cash equivalents, restricted cash, accounts and other receivables and accounts payable approximate their fair values based on their short-term nature. The carrying value of the Company’s debt approximates their fair values based on the current rates available to the Company for debt of similar terms and maturities.

All derivatives are entered into and exited at the end of the period, thus there is no fair value associated with any outstanding derivatives at December 31, 2018. No such instruments were in place during 2019.

(4) Cash and Cash Equivalents and Restricted Cash

As of December 31, 2019 and 2018, the Company's cash and cash equivalents consisted of financial deposits. Restricted cash consisted primarily of cash restricted for performance bonds, warranty bonds and collateral for borrowings. At December 31, 2018, cash and cash equivalents included \$11.8 million intended for payment for the Keymile acquisition.

(5) Balance Sheet Detail

Balance sheet detail as of December 31, 2019 and 2018 is as follows (in thousands):

Inventories

	As of December 31,	
	2019	2018
Inventories:		
Raw materials	\$ 15,774	\$ 15,688
Work in process	1,458	2,429
Finished goods	18,207	15,751
	<u>\$ 35,439</u>	<u>\$ 33,868</u>

Inventories provided as collateral for borrowings from Export-Import Bank of Korea amounted to \$6.7 million and \$9.5 million as of December 31, 2019 and 2018, respectively.

Property, plant and equipment

	As of December 31,	
	2019	2018
Property, plant and equipment, net:		
Furniture and fixtures	\$ 10,803	\$ 8,029
Machinery and equipment	2,550	3,553
Leasehold improvements	4,267	3,715
Computers and software	1,990	922
Other	660	982
	<u>20,270</u>	<u>17,201</u>
Less: accumulated depreciation and amortization	(13,130)	(11,271)
Less: government grants	(371)	(412)
	<u>\$ 6,769</u>	<u>\$ 5,518</u>

Depreciation expense associated with property, plant and equipment was \$2.0 million and \$1.6 million for the years ended December 31, 2019 and 2018, respectively.

The Company receives grants from various government entities mainly to support capital expenditures. Such grants are deferred and are generally refundable to the extent the Company does not utilize the funds for qualifying expenditures. Once earned, the Company records the grants as a contra amount to the assets and amortizes such amount over the useful lives of the related assets as a reduction to depreciation expense.

Accrued and other liabilities

	As of December 31,	
	2019	2018
Accrued and other liabilities (in thousands):		
Accrued warranty	\$ 1,611	\$ 1,319
Accrued compensation	1,618	2,461
Other accrued expenses	9,615	7,737
	<u>\$ 12,844</u>	<u>\$ 11,517</u>

The Company accrues for warranty costs based on historical trends for the expected material and labor costs to provide warranty services. The Company's standard warranty period is one year from the date of shipment with the ability for customers to purchase an extended warranty of up to five years from the date of shipment. The following table summarizes the activity related to the product warranty liability (in thousands):

	As of December 31,	
	2019	2018
Balance at beginning of the year	\$ 1,319	\$ 931
Charged to cost of revenue	967	1,171
Claims and settlements	(903)	(791)
Warranty liability assumed from Keymile acquisition	230	—
Foreign exchange impact	(2)	8
Balance at end of the year	\$ 1,611	\$ 1,319

Contract Asset

The balance of Contract Assets, current at December 31, 2019 was \$16.7 million, which increased from \$11.4 million as of December 31, 2018. The increase in contract assets by \$5.3 million was primarily due to new customer contracts entered into during the year of \$6.5 million, partially offset by billed products and services during the year of \$1.2 million.

Contract Liability

The balance of Contract Liabilities, current at December 31, 2019 was \$3.6 million, comprising of Products and services contract liability of \$2.7 million and Extended warranty contract liability of \$0.9 million. The balance of Contract Liabilities, current at December 31, 2018 was \$8.5 million.

The balance of Contract Liabilities, long-term at December 31, 2019 was \$3.2 million, comprising of Products and services contract liability of \$1.0 million and Extended warranty contract liability of \$2.2 million. The balance of Contract Liabilities, current at December 31, 2018 was \$1.8 million.

During the year ended December 31, 2019, the Company recorded \$2.5 million in Net Revenue, related to Contract Liabilities as of December 31, 2018.

Accrued Restructuring Costs

The Company established a restructuring plan in September 2019 to further align its business resources based on an analysis of the current business conditions. The Company incurred restructuring and other charges of approximately \$4.9 million for the year ended December 31, 2019, consisting primarily of severance and other termination related benefits of \$3.9 million, and an impairment charge of \$1.0 million related to an Right-of-use asset from an operating lease. Severance and other termination related benefits are as follows (in thousands):

	Severance and Related Benefits	
Balance as of December 31, 2018	\$	—
Restructuring charges for the year		3,930
Cash payments		(3,930)
Balance as of December 31, 2019	\$	—

(6) Goodwill and Intangible Assets

Goodwill as of December 31, 2019 and 2018 was as follows (in thousands):

	As of December 31,	
	2019	2018
Balance at beginning of the year	\$ 3,977	\$ 3,977
Goodwill from Keymile acquisition	1,003	—
Less: Impairment of Keymile acquisition goodwill	(1,003)	—
Balance at end of the year	\$ 3,977	\$ 3,977

During 2019, the Company recorded Goodwill of \$1.0 million related to the acquisition of Keymile. Refer to Note 2 Business Combinations, for further detail. In performing the annual impairment evaluation, utilizing a present value cash flow model to determine the fair value of the reporting unit, the Company determined that the goodwill related to Keymile was impaired, due to the financial performance of the reporting unit. The Company recognized an impairment loss of \$1.0 million on goodwill for the year ended December 31, 2019 and accumulated impairment of goodwill was \$1.0 million as of December 31, 2019.

Intangible assets as of December 31, 2019 and 2018 were as follows (in thousands):

	As of December 31, 2019		
	Gross Carrying Amount	Accumulated Amortization	Net
Developed technology	\$ 7,994	\$ (3,027)	\$ 4,967
Customer relationships	8,795	(2,458)	6,337
Trade name	1,346	(269)	1,077
Total intangible assets, net	<u>\$ 18,135</u>	<u>\$ (5,754)</u>	<u>\$ 12,381</u>

During 2019 the Company recorded \$5.0 million, \$3.6 million and \$1.4 million in Developed technology, Customer relationships and Trade names, respectively, related to the acquisition of Keymile. Refer to Note 2 Business Combinations, for further detail.

	As of December 31, 2018		
	Gross Carrying Amount	Accumulated Amortization	Net
Developed technology	\$ 3,060	\$ (1,428)	\$ 1,632
Customer relationships	5,240	(1,223)	4,017
Backlog	2,179	(2,179)	-
Total intangible assets, net	<u>\$ 10,479</u>	<u>\$ (4,830)</u>	<u>\$ 5,649</u>

Amortization expense associated with intangible assets for the years ended December 31, 2019 and 2018 amounted to \$3.1 million, and \$1.1 million, respectively. As of December 31, 2019, expected future amortization expense for the years indicated was as follows (in thousands):

Period	Expected Amortization Expense
2020	\$ 3,103
2021	2,899
2022	2,491
2023	2,491
2024	524
Thereafter	873
Total	<u>\$ 12,381</u>

(7) Debt

The following tables summarize the Company's debt (in thousands):

	As of December 31, 2019		
	Short-term	Long-term	Total
PNC Credit Facilities	\$ 2,500	\$ 10,625	\$ 13,125
Bank and Trade Facilities - Foreign Operations	15,779	—	15,779
Related party	—	9,096	9,096
	18,279	19,721	38,000
Less: unamortized deferred financing costs on the PNC Bank Facility	(795)	(688)	(1,483)
	<u>\$ 17,484</u>	<u>\$ 19,033</u>	<u>\$ 36,517</u>

	As of December 31, 2018		
	Short-term	Long-term	Total
Former WFB Facility	\$ 7,000	\$ —	\$ 7,000
Bank and Trade Facilities - Foreign Operations	24,762	—	24,762
Related party	—	14,142	14,142
	<u>\$ 31,762</u>	<u>\$ 14,142</u>	<u>\$ 45,904</u>

The future principal maturities of our Secured Term Loans for each of the next five years are as follows (in thousands):

Year ended December 31,		
2020		\$ 18,279
2021		3,438
2022		16,283
2023		—
2024		—
Thereafter		—
Total		<u>\$ 38,000</u>

PNC Credit Facilities

On February 27, 2019, the Company and ZTI (collectively, the “Borrowers”), and certain direct and indirect subsidiaries of the Borrowers, as guarantors, entered into a Revolving Credit, Term Loan, Guaranty and Security Agreement (the “Domestic Credit Agreement”) and an Export-Import Revolving Credit, Guaranty and Security Agreement (the “Ex-Im Credit Agreement,” and together with the Domestic Credit Agreement, the “Credit Agreements”), in each case with PNC Bank, National Association (“PNC”) and Citibank, N.A. as lenders, and PNC as agent for the lenders (the “PNC Credit Facilities”), which replaced the Company’s former senior secured credit facilities with Wells Fargo Bank (the “Former WFB Facility”). We refer to such transactions and the agreements referenced above as the “PNC Credit Facilities.”

The PNC Credit Facilities provided for a \$25 million term loan and a \$15 million revolving line of credit (including subfacilities for Ex-Im transactions, letters of credit and swing loans) with a \$10 million incremental increase option. The amount the Company was able to borrow on the revolving line of credit at any time was based on eligible accounts receivable and other conditions, less certain reserves. Borrowings under the PNC Credit Facilities bore interest at a floating rate equal to either the PNC prime rate or the LIBOR rate for the applicable period, plus a margin that was based on the type of advance.

The Company used a portion of the funds borrowed from the term loan under the PNC Credit Facilities to (i) repay \$5.0 million of existing related party indebtedness with DNI plus accrued interest, (ii) repay \$1.5 million revolving line of credit outstanding balance plus accrued interest and fees and cash collateralize \$3.6 million in outstanding letters of credit under the Wells Fargo Credit Facility (described below), and (iii) repay \$5.6 million in short-term debt in Korea and Japan. The Company’s obligations under the PNC Credit Facilities were secured by substantially all of the personal property assets of the Company and its subsidiaries that were co-borrowers or guarantors under the PNC Credit Facilities, including their intellectual property.

The PNC Credit Facilities had a three-year term and were scheduled to mature on February 27, 2022. The PNC Credit Facilities contemplated repayment of the term loan in quarterly installments over the term of the loan, with the balance of the term loan and revolving line of credit due at maturity.

The PNC Credit Facilities contained certain covenants, limitations, and conditions with respect to the Company, including a maximum leverage ratio, a minimum fixed charge coverage ratio, and a minimum liquidity covenant, as well as financial reporting obligations, and usual and customary events of default. At September 30, 2019, the Company was not in compliance with the maximum leverage ratio financial covenant in the PNC Credit Facilities, which represented an event of default thereunder. On November 8, 2019, the Company obtained a waiver of the foregoing event of default from PNC Bank. As a condition for the issuance of such waiver, the Company voluntarily prepaid \$10.0 million of the outstanding term loan and paid a one-time fee of \$150,000.

The interest rate on the term loan was 8.12% at December 31, 2019. Deferred financing costs of \$1.5 million has been netted against the aggregate principal amount of the PNC term loan in the consolidated balance sheet as of December 31, 2019. On July 2, 2019, \$4.4 million in outstanding borrowings under the revolving line of credit (which represented all outstanding borrowings under the revolving line of credit) was repaid in full.

As of December 31, 2019, the Company had \$13.1 million in outstanding term loan borrowings under the PNC Facilities, and no outstanding borrowings under the revolving line of credit.

Former WFB Facility

As of December 31, 2018, the Company had a \$25.0 million revolving line of credit facility (including up to \$5.0 million in letter of credit) with Wells Fargo (the "Former WFB Facility"). Under the Former WFB Facility, the Company has the option of borrowing funds at agreed upon interest rates. The amount that the Company was able to borrow under the Wells Fargo Facility varied based on eligible accounts receivable and inventory less amount committed as cash collateral for letter of credit.

As of December 31, 2018, the Company had \$7.0 million outstanding borrowings under its Former WFB Facility and \$1.3 million committed as security for letters of credit outstanding. The amounts borrowed under the Wells Fargo Facility bore interest, payable monthly, at a floating rate equal to the three-month LIBOR plus a margin based on the Company's average excess availability as calculated under the Former WFB Facility. The interest rate on the Wells Fargo Facility was 5.1% at December 31, 2018. Subsequently, on January 8, 2019, the Company fully repaid the \$7.0 million outstanding borrowings under the revolving line of credit.

The Company's obligations under the Former WFB Facility were secured by substantially all of its assets and those of its subsidiaries that guarantee the Wells Fargo Facility, including their intellectual property. The Former WFB Facility contained certain financial covenants, and customary affirmative and negative covenants. As of December 31, 2018, the Company was in compliance with the covenants under the Former WFB Facility.

On February 27, 2019, the Company repaid \$1.5 million in principal amount of outstanding borrowings on the revolving line of credit plus accrued interest and fees and cash collateralized \$3.6 million in outstanding letters of credit under the Former WFB Facility with some of the proceeds of the PNC Credit Facilities. On February 27, 2019, the Company also terminated the Former WFB Facility.

Working Capital Loan

On October 1, 2018, as a condition for the Keymile Acquisition, Riverside, the former stockholder of Keymile, extended a €4.0 million (\$4.4 million) working capital loan to Keymile. The working capital loan bore interest at a rate of 3.5% per annum and was repaid during 2019.

Bank and Trade Facilities - Foreign Operations

Certain of the Company's foreign subsidiaries have entered into various financing arrangements with foreign banks and other lending institutions consisting primarily of revolving lines of credit, trade facilities, term loans and export development loans. These facilities are renewed as they mature and are generally secured by a security interest in certain assets of the applicable foreign subsidiaries and supported by guarantees given by DNI or third parties. Payments under such facilities are made in accordance with the given lender's amortization schedules.

As of December 31, 2019 and 2018, the Company had an aggregate outstanding balance of \$15.8 million and \$24.8 million, respectively, under such financing arrangements. The weighted average borrowing rate as of December 31, 2019 was 2.7%. The maturity date and interest rates per annum applicable to outstanding borrowings under these financing arrangements were as listed in the tables below (amounts in thousands).

		As of December 31, 2019			
		Maturity Date	Denomination	Interest rate (%)	Amount
NongHyup Bank	Credit facility	09/30/2020	USD	3.50 ~ 4.50	\$ 2,091
The Export-Import Bank of Korea	Export development loan	07/01/2020	KRW	2.75	5,182
Korea Development Bank	General loan	08/08/2020	KRW	3	4,319
Korea Development Bank	Credit facility	08/07/2020	USD	3.00 ~ 3.15	2,460
LGUPlus	General loan	06/17/2020	KRW	0	1,727
					\$ 15,779

		As of December 31, 2018			
		Maturity Date	Denomination	Interest rate (%)	Amount
Industrial Bank of Korea	Credit facility	01/02/2019 ~ 05/15/2019	USD	3.96 ~ 4.36	\$ 1,982
Industrial Bank of Korea	Trade finance	02/18/2019 ~ 02/25/2019	USD	5.31 ~ 6.08	1,920
Shinhan Bank	General loan	3/30/2019	KRW	6.06	2,862
NongHyup Bank	Credit facility	01/07/2019 ~ 04/29/2019	USD	3.71 ~ 4.50	2,053
The Export-Import Bank of Korea	Export development loan	07/01/2019	KRW	3.44	6,439
The Export-Import Bank of Korea	Import development loan	02/14/2019	USD	4.31	850
Korea Development Bank	General loan	08/08/2019	KRW	3.48	4,472
Korea Development Bank	Credit facility	02/07/2019 ~ 03/06/2019	USD	3.64 ~ 3.91	1,489
LGUPlus	General loan	06/17/2019	KRW	0	1,789
Shoko Chukin Bank	General loan	06/28/2019	JPY	1.33	906
					\$ 24,762

As of December 31, 2019 and December 31, 2018, the Company had \$4.6 million and \$5.5 million in outstanding borrowings, respectively, and \$0.8 million and \$2.6 million committed as security for letters of credit under the Company's \$19.0 million credit facility with certain foreign banks.

Related Party Debt

In February 2016, DNS California borrowed \$1.8 million from DNI for capital investment, which amount was outstanding as of December 31, 2019. This loan was due to mature in March 2018 with an option of renewal by mutual agreement, and bore interest at a rate of 4.6% per annum, payable annually. Effective January 31, 2018, we amended the terms of this loan to extend the repayment date from March 2018 to July 2019 and maintain an interest rate of 4.6%. On February 27, 2019, we amended the terms of this loan to extend the repayment date until May 27, 2022.

In September 2016, we entered into a loan agreement with DNI for a \$5.0 million unsecured subordinated term loan facility. Under the loan agreement, we were permitted to request drawdowns of one or more term loans in an aggregate principal amount not to exceed \$5.0 million. As of December 31, 2019, the loan was repaid in full. As of December 31, 2018, \$5.0 million in term loans was outstanding under the facility. The interest rate as of December 31, 2019 under this facility was 4.6% per annum. On or about February 27, 2019, the entire outstanding balance on this term loan was repaid with some of the proceeds of the PNC Credit Facilities.

In March 2018, DNS Korea borrowed \$5.8 million from DNI of which \$4.5 million was repaid on August 8, 2018. As of December 31, 2018, \$1.3 million remained outstanding. The loan bears interest at a rate of 4.6%, and is secured by certain accounts receivable of DNS Korea. On February 27, 2019, the Company amended the terms of this loan to extend the repayment date until May 27, 2022.

In December 2018, we entered into a Loan Agreement with DNI for a \$6.0 million term loan with an interest rate of 4.6% per annum. On February 27, 2019, we amended the terms of the term loan to extend the repayment date until May 27, 2022.

The modifications resulting from the amendments described in the four preceding paragraphs were limited to the extension of the maturity dates and removal of the collateral on the outstanding term loans with DNI. There were no fees paid to DNI or external costs otherwise incurred in connection with these modifications.

Interest expense on these related party borrowings was \$0.4 million in 2019 and 2018, respectively.

On March 5, 2020, DNS Korea entered into a loan transaction with DNI in the amount of KRW 22.4 billion (\$18.5 million USD), which loan matures on March 11, 2022, bears interest at a rate of 4.6% per annum and is pre-payable without premium or penalty. See Note 18 to the consolidated financial statements for additional information.

As of December 31, 2019, we had an aggregate of \$9.1 million in outstanding borrowings from DNI, which consisted of a \$6.0 million unsecured subordinated term loan facility which matures in May 2022, a \$1.8 million loan for capital investment which matures in May 2022, and KRW 1.5 billion (\$1.3 million) outstanding under a secured loan from DNS Korea which matures in May 2022. All three loans bear interest at a rate of 4.6% per annum.

(8) Stockholders' Equity

Changes in Accumulated Other Comprehensive Income (Loss)

The table below summarizes the changes in accumulated other comprehensive income (loss) by component, net of tax (in thousands):

	As of December 31,	
	2019	2018
Beginning accumulated other comprehensive income	\$ (192)	1,871
Actuarial loss for pension plan	(1,793)	—
Foreign currency translation adjustments, net	(1,939)	(2,051)
Non-controlling interest	(15)	(12)
Ending accumulated other comprehensive income	<u>\$ (3,939)</u>	<u>\$ (192)</u>

Stock-based Compensation

As of December 31, 2019, the Company has one (1) stock-based compensation plan related to equity compensation (including equity compensation in the form of stock options, restricted stock and restricted stock units) and one (1) plan related to employee stock purchases.

The following table summarizes stock-based compensation expense (in thousands):

	Years ended December 31,	
	2019	2018
Cost of revenue	\$ 41	\$ 18
Research and product development	267	134
Selling, marketing, general and administrative	3,200	1,928
	<u>\$ 3,508</u>	<u>\$ 2,080</u>

2017 Stock Incentive Plans

The Company's stock-based compensation plans are designed to attract, motivate, retain and reward employees, directors and consultants and align stockholder and employee interests.

On January 4, 2017, the Board of Directors approved, and at the 2017 Annual Meeting of Stockholders, the Company's stockholders approved, the DASAN Zhone Solutions, Inc. 2017 Incentive Award Plan. On February 12, 2018, the Board of Directors approved an amendment to the 2017 Incentive Award Plan, which is referred to herein as the "2017 Plan Amendment". The Company's stockholders approved the 2017 Plan Amendment at the 2018 Annual Meeting of the Stockholders. The 2017 Incentive Award Plan, as amended by the 2017 Plan Amendment, is referred to herein as the "2017 Plan."

The 2017 Plan authorizes the issuance of stock options, restricted stock, restricted stock units, dividend equivalents, stock payment awards, stock appreciation rights, performance bonus awards and other incentive awards. The 2017 Plan authorizes the grant of awards to employees, non-employee directors and consultants of the Company and its subsidiaries. Under the 2017 Plan, stock options may be granted at an exercise price less than, equal to or greater than the fair market value on the date of grant, except that any stock options granted to a 10% stockholder must have an exercise price equal to at least 110% of the fair market value of the Company's common stock on the date of grant. The Board of Directors determine the term of each stock option, the option exercise price and the vesting terms. Stock options are generally granted at an exercise price equal to the fair

market value on the date of grant, expiring seven (7) to ten (10) years from the date of grant and vesting over a period of four years.

The maximum number of shares of the Company's common stock which may be granted under the 2017 Plan is the sum of (i) 600,000 shares, plus (ii) any shares subject to awards granted under the prior plan to the extent such shares become available for issuance under the 2017 Plan pursuant to its terms, plus (iii) any shares subject to an annual increase on each January 1 during the 10 year term of the 2017 Plan equal to the lesser of (x) 4% of the total shares of the Company's common stock outstanding (on an as-converted basis) and (y) such smaller amount as may be determined by the Board of Directors in its sole discretion. The annual increase on January 1, 2019 was 663,473 shares. In addition, the following annual limitations apply: (i) the maximum aggregate number of shares of the Company's common stock that may be subject to awards granted to any one participant during a calendar year is 4,000,000 shares; and (ii) the maximum aggregate amount of cash that may be paid to any one participant during any calendar year with respect to awards initially payable in cash is \$10 million. The number of shares of the Company's common stock that may be issued or transferred pursuant to awards granted under the 2017 Plan shall not exceed an aggregate of 8,000,000 shares.

The Company has estimated the fair value of stock-based payment awards on the date of grant using the Black Scholes pricing model, which is affected by the Company's stock price as well as assumptions regarding a number of complex and subjective variables. These variables include the Company's expected stock price volatility over the term of the awards, actual and projected employee option exercise behaviors, risk-free interest rate and expected dividends. The estimated expected term of options granted was determined based on historical option exercises. Estimated volatility was based on the historical volatility of the Company and the risk-free interest rate was based on the U.S. Treasury yield in effect at the time of grant for the expected life of the options. The Company does not anticipate paying any cash dividends in the foreseeable future, and therefore used an expected dividend yield of zero in the option valuation model. Forfeitures are recognized as they occur.

Stock Options

The weighted average assumptions used to value option grants for the year ended December 31, 2019 and 2018 are as follows:

	Years ended December 31,	
	2019	2018
Expected term (years)	5.85	4.88
Volatility	65.72%	81.87%
Risk free interest rate	1.99%	2.74%

The weighted average grant date fair value of options granted during the years ended December 31, 2019 and 2018 were \$7.22 and \$6.49, respectively.

The following table sets forth the summary of option activity under the stock option program for the year ended December 31, 2019 (in thousands, except per share data):

	Options Outstanding	Weighted Average Exercise Price	Weighted Average Remaining Contractual Term	Aggregate Intrinsic Value
Outstanding as of December 31, 2018	1,744	\$ 8.00		
Granted	470	10.36		
Canceled/Forfeited	(128)	9.83		
Expired	(39)	8.32		
Exercised	(35)	6.22		
Outstanding as of December 31, 2019	2,012	8.47	7.36	2,418
Vested and expected to vest at December 31, 2019	2,012	8.47	7.36	2,418
Vested and exercisable at December 31, 2019	946	7.47	5.74	1,684

The aggregate intrinsic value represents the total pretax intrinsic value, based on the Company's closing stock price as of December 31, 2019 of \$8.86 per share which would have been received by the option holders had the option holders exercised their options as of that date.

The aggregate intrinsic value of awards exercised during the years ended December 31, 2019 and 2018 were \$0.2 million and \$0.6 million, respectively.

As of December 31, 2019, there was \$6.3 million of unrecognized compensation costs which are recognized over a weighted average period of three (3) years.

The following table sets forth the summary of option activity under the stock option program for the year ended December 31, 2018 (in thousands, except per share data):

	Options Outstanding	Weighted Average Exercise Price	Weighted Average Remaining Contractual Term	Aggregate Intrinsic Value
Outstanding as of December 31, 2017	1,213	\$ 6.50		
Granted	836	9.86		
Canceled/Forfeited	(155)	8.00		
Exercised	(150)	6.08		
Outstanding as of December 31, 2018	<u>1,744</u>	8.00	8.65	10,378
Vested and expected to vest at December 31, 2018	<u>1,744</u>	8.00	8.65	10,378
Vested and exercisable at December 31, 2018	<u>488</u>	6.77	7.51	3,497

Restricted Stock Units

The following table sets forth the summary of restricted stock unit awards activity under the stock award program for the year ended December 31, 2019 (in thousands, except per share data):

	RSU Outstanding	Weighted Average Grant Date Fair Value
Non-vested as of December 31, 2018	4	\$ 7.50
Granted	40	12.77
Canceled/Forfeited	—	—
Vested	(33)	13.11
Non-vested as of December 31, 2019	<u>11</u>	10.05

The following table sets forth the summary of restricted stock unit awards activity under the stock award program for the year ended December 31, 2018 (in thousands, except per share data):

	RSU Outstanding	Weighted Average Grant Date Fair Value
Non-vested as of December 31, 2017	5	\$ 7.43
Granted	35	9.66
Canceled/Forfeited	—	—
Vested	(36)	9.56
Non-vested as of December 31, 2018	<u>4</u>	7.50

Total grant-date fair value of awards granted during the years ended December 31, 2019 and 2018 was \$0.5 million and \$0.3 million, respectively. Total fair value of awards vested was \$0.4 million during both years ended December 31, 2019 and 2018.

2018 Employee Stock Purchase Plan

On May 22, 2018, the stockholders of the Company approved the adoption of the DASAN Zhone Solutions, Inc. 2018 Employee Stock Purchase Plan (the "ESPP"). The ESPP replaced the DASAN Zhone Solutions, Inc. 2002 Employee Stock Purchase Plan.

The ESPP authorizes the issuance of up to 250,000 shares of the Company's common stock. In addition, the ESPP provides for an annual increase on the first day of each calendar year beginning on January 1, 2019, and ending on and including January 1, 2028, equal to the lesser of (i) 1% of the shares outstanding on the last day of the immediately preceding calendar year and (ii) such smaller number of shares as may be determined by the Board of Directors in its sole discretion. Notwithstanding the foregoing, the number of shares of stock that may be issued or transferred pursuant to awards under the ESPP may not exceed an aggregate of 2,000,000 shares. These 2,000,000 shares have been registered pursuant to a registration statement on Form S-8 filed with the SEC on November 8, 2018. The purchase price of the shares will be 85% of the lower of the fair market value of our common stock on (a) the first trading day of the offering period or (b) the final trading day of the offering period, which would be the applicable purchase date.

The weighted average assumptions used to value option grants for the year ended December 31, 2019 included an Expected term of 0.5 years, Volatility of 66.04% and a Risk free interest rate of 2.31%. The Company recorded \$149,000 and \$14,000 of expense related to the ESPP for the year ended December 31, 2019 and 2018, respectively.

(9) Net Income (Loss) Per Share

The following table sets forth the computation of basic and diluted net income (loss) per share (in thousands, except per share data):

	Years ended December 31,	
	2019	2018
Numerator:		
Net income (loss) attributable to DASAN Zhone Solutions, Inc.	\$ (13,457)	\$ 2,767
Denominator:		
Weighted average number of shares outstanding:		
Basic	19,403	16,482
Effect of dilutive securities:		
Stock options, restricted stock units and share awards	—	264
Diluted	19,403	16,746
Net income (loss) per share attributable to DASAN Zhone Solutions Inc.:		
Basic	\$ (0.69)	\$ 0.17
Diluted	\$ (0.69)	\$ 0.17

The following tables set forth potential common stock that is not included in the diluted net income (loss) per share calculation above because their effect would be anti-dilutive for the periods indicated (in thousands, except exercise price per share data):

	2019	Weighted average option exercise price	2018	Weighted average option exercise price
Outstanding stock options, restricted stock units and unvested restricted shares	2,023	\$ 8.42	1,747	\$ 7.91

As of December 31, 2019 and 2018, no shares of issued common stock were subject to repurchase.

(10) Income Taxes

The geographical breakdown of income (loss) before income taxes is as follows (in thousands):

	Years ended December 31,	
	2019	2018
Loss before income taxes - Domestic	\$ (11,069)	\$ (3,003)
Income before income taxes - Foreign	1,391	7,563
Income (loss) before income taxes	\$ (9,678)	\$ 4,560

The following is a summary of the components of income tax expense applicable to income (loss) before income taxes (in thousands):

	Years ended December 31,	
	2019	2018
Current:		
Federal	\$ —	\$ —
State	16	13
Foreign	2,439	1,509
Total current tax provision	\$ 2,455	\$ 1,522
Deferred:		
Federal	\$ —	\$ 12
State	—	—
Foreign	1,130	190
Total deferred tax provision (benefit)	\$ 1,130	\$ 202
Total tax provision (benefit)	\$ 3,585	\$ 1,724

A reconciliation of the expected tax provision (benefit) to the actual tax provision (benefit) is as follows (in thousands):

	Years ended December 31,	
	2019	2018
Expected tax provision (benefit) at statutory rate	\$ (2,032)	\$ 953
State taxes, net of Federal effect	13	297
State change in deferreds	1,927	—
Foreign rate differential	2,751	129
Valuation allowance	557	(906)
Permanent differences	544	297
Other permanent items	—	1,178
Tax credit carry-forwards	(212)	(280)
Tax expense adjustments after tax return for prior period	37	74
Others	—	(18)
Total tax provision	\$ 3,585	\$ 1,724

Deferred income taxes reflect the net tax effects of temporary differences between the carrying amounts of assets and liabilities for financial reporting and income tax purposes. Significant components of the Company's deferred tax assets and liabilities as of December 31, 2019 and 2018 are as follows (in thousands):

	As of December 31,	
	2019	2018
Deferred tax assets:		
Net operating loss, capital loss, and tax credit carryforwards	\$ 23,195	\$ 12,621
Fixed assets and intangible assets	1,057	1,451
Inventory and other reserves	1,368	1,998
Operating lease liability	1,684	—
Other (mainly accrued expenses)	2,552	2,042
Gross deferred tax assets	29,856	18,112
Less valuation allowance	(26,827)	(15,360)
Deferred tax liabilities:		
Operating lease right-of-use-asset	(1,407)	—
Gross deferred tax liabilities	(1,407)	—
Total net deferred tax assets	\$ 1,622	\$ 2,752

For the years ended December 31, 2019 and 2018, the net changes in the valuation allowance were an increase of \$11.5 million, and a decrease of \$0.9 million, respectively. The increase during the current year is mainly due to the increase of U.S. net deferred tax assets and recognition of the Germany deferred tax assets. The decrease during 2018 is mainly due to the decrease of U.S. net deferred tax assets. The Company maintains a valuation allowance on its U.S. and Germany net deferred tax assets since it is more likely than not that the net deferred tax assets will not be realized due to the lack of previously paid taxes and anticipated taxable income.

As of December 31, 2019, the Company had net operating loss carryforwards for federal and state income tax purposes of approximately \$38.0 million and \$29.4 million, respectively. The federal losses begin to expire in various years beginning in 2030. The state losses begin to expire in various years beginning in 2021. The Federal net operating loss carryforward includes \$12.6 million that has an indefinite carryforward period.

Pursuant to Sections 382 and 383 of the Internal Revenue Code, or IRC, annual use of the Company's net operating losses and tax credit carryforwards may be limited in the event a cumulative change in ownership of more than 50% occurs within a three-year period. The Company had an ownership change in September 2016, which has resulted in an annual limitation on the amount of net operating loss and tax credit carry forward which arose prior to that date that the Company can utilize in a future year. In addition, some of the pre-acquisition NOLs have written off due to the limitation.

As of December 31, 2019, the Company had research credit carryforwards of approximately \$1.2 million and \$1.6 million for federal and state purposes, respectively. If not utilized, the federal carryforwards will expire beginning in 2036. The California credit carryforwards do not expire and the Georgia credit carryforwards will expire beginning in 2026.

In accordance with ASC 740 the Company is required to inventory, evaluate, and measure all uncertain tax positions taken or to be taken on tax returns, and to record liabilities for the amount of such positions that may not be sustained, or may only be partially sustained, upon examination by the relevant taxing authorities. At December 31, 2019, the Company had gross unrecognized tax benefits of \$1.0 million, none of which if recognized, would reduce the effective tax rate in a future period, due to the Company's full valuation allowance on U.S. net deferred tax assets.

A reconciliation of the beginning and ending unrecognized tax benefit amounts for 2019 and 2018 are as follows (in thousands):

	<u>As of December 31,</u>	
	<u>2019</u>	<u>2018</u>
Balance at beginning of the year	\$ 807	\$ 380
Increases related to current year tax positions	229	427
Balance at end of the year	<u>\$ 1,036</u>	<u>\$ 807</u>

It is the Company's policy to account for interest and penalties related to uncertain tax positions as interest expense and general administrative expense, respectively in the consolidated statements of comprehensive income (loss).

The Company did not record any interest and penalty (benefit) provision during the years ended December 31, 2019 and 2018.

The Company or one of its subsidiaries files income tax returns in the U.S. federal jurisdiction, and various state and foreign jurisdictions. The open tax years for the major jurisdictions are as follows:

Federal	2016 - 2019
California and Canada	2015 - 2019
Brazil	2014 - 2019
Germany	2015 - 2019
Japan	2014 - 2019
Korea	2017 - 2019
United Kingdom	2016 - 2019
Vietnam	2017 - 2019

However, due to the fact the Company had net operating losses and credits carried forward in most jurisdictions, certain items attributable to technically closed years are still subject to adjustment by the relevant taxing authority through an adjustment to tax attributes carried forward to open years. The Company is not currently under examination for income taxes in any material jurisdiction.

(11) Non-Controlling Interests

Non-controlling interests were as follows (in thousands):

	As of December 31,	
	2019	2018
Beginning non-controlling interests	\$ 615	534
Net income attributable to non-controlling interests	194	69
Foreign currency translation adjustments (Other Comprehensive Income)	15	12
Purchase of non-controlling interests	(824)	—
Ending non-controlling interests	\$ —	\$ 615

Acquisition of the Non-Controlling Interest in DNS Japan

On July 31, 2019, the Company acquired the remaining 30.94% non-controlling interest of Dasan Network Solutions JAPAN, Inc. (“DNS Japan”), and DNS Japan became a wholly owned subsidiary of the Company. The Company acquired the remaining interest in DNS Japan for total cash consideration of \$950,000, consisting entirely of payments to the former shareholder (Handysoft).

This transaction resulted in a decrease to Additional paid-in capital of \$127,000, a decrease to Non-controlling interest of \$823,000, and a total impact of \$950,000 in the Consolidated Statements of Stockholders' Equity and Non-Controlling Interest.

(12) Related Party Transactions

Related Party Debt

As of December 31, 2019 and 2018, the Company had \$9.1 million and \$14.1 million, respectively, outstanding from related party borrowings from DNI.

See Note 7 Debt – Related Party Debt for further information about the Company’s related party debt.

Other Related Party Transactions

Sales and Purchases to and from Related Parties

Sales and purchases, cost of revenue, research and product development, selling, marketing, general and administrative and other income and expenses to and from related parties for the years ended December 31, 2019 and 2018 were as follows (in thousands):

Counterparty	DNI direct ownership interest	For the year ended December 31, 2019						
		Sales	Cost of revenue	Manufacturing (Cost of revenue)	Research and product development	Selling, marketing, general and administrative	Interest expense	Other Expenses
DNI	N/A	\$ 2,471	\$ 1,825	—	—	\$ 3,768	\$ 459	\$ 341
Tomato Soft Ltd.	100%	—	—	117	—	—	—	—
Tomato Soft (Xi'an) Ltd.	100%	—	—	—	526	—	—	—
CHASAN Networks Co., Ltd.	100%	—	—	1,103	71	—	—	—
J-Mobile Corporation	91.50%	42	81	—	—	—	—	—
		<u>\$ 2,513</u>	<u>\$ 1,906</u>	<u>\$ 1,220</u>	<u>\$ 597</u>	<u>\$ 3,768</u>	<u>\$ 459</u>	<u>\$ 341</u>

For the year ended December 31, 2018								
Counterparty	DNI direct ownership interest	Sales	Cost of revenue	Manufacturing (Cost of revenue)	Research and product development	Selling, marketing, general and administrative	Interest expense	Other Expenses
DNI	N/A	\$ 4,633	\$ 3,892	—	—	\$ 4,262	\$ 435	\$ 343
Tomato Soft Ltd.	100%	—	—	121	—	—	—	—
Tomato Soft (Xi'an) Ltd.	100%	—	—	—	520	—	—	—
Chasan Networks Co., Ltd.	100%	—	—	1,119	72	—	—	—
Dasan France	100%	203	177	—	—	—	—	—
Handysoft, Inc.	17.63%	794	627	—	—	6	—	—
		<u>\$ 5,630</u>	<u>\$ 4,696</u>	<u>\$ 1,240</u>	<u>\$ 592</u>	<u>\$ 4,268</u>	<u>\$ 435</u>	<u>\$ 343</u>

The Company has entered into sales agreements with DNI and certain of its subsidiaries. Sales and cost of revenue to DNI, DASAN France, DASAN INDIA Private Limited, and D-Mobile represent finished goods produced by the Company that are sold to these related parties who sell the Company's products in Korea, France, India and Taiwan, respectively.

The Company has entered into an agreement with CHASAN Networks Co., Ltd. to provide manufacturing and research and development services for the Company. Under the agreement with CHASAN Networks., Ltd., the Company is charged a cost plus 7% fee for the manufacturing and development of certain deliverables.

The Company has entered into an agreement with Tomato Soft Ltd., a wholly owned subsidiary of DNI, to provide manufacturing and research and development services for the Company.

The Company has entered into an agreement with Tomato Soft (Xi'an) Ltd. to provide research and development services for the Company. Under the agreement with Tomato Soft (Xi'an) Ltd., the Company is charged an expected annual fee of \$0.7 million for the development of certain deliverables.

Prior to the Merger, as DNS was then a wholly owned subsidiary of DNI, DNI had sales agreements with certain customers on DNS' behalf. Since the Merger, due to these prior sales agreements, the Company has entered into an agreement with DNI in which DNI acts as a sales channel to these customers. Sales to DNI necessary for DNI to fulfill agreements with its customers are recorded net of royalty fees in related party revenue.

The Company shares office space with DNI and certain of DNI's subsidiaries. Prior to the Merger, DNS, then a wholly owned subsidiary of DNI, shared human resources, treasury and other administrative support with DNI. As such, the Company entered into certain service sharing agreements with DNI and certain of its subsidiaries for the shared office space and shared administrative services. Expenses related to rent and administrative services are allocated to the Company based on square footage occupied and headcount, respectively.

Other expenses to related parties represent expenses to DNI for its payment guarantees relating to the Company's borrowings. The Company pays DNI a guarantee fee which is calculated as 0.9% of the guaranteed amount.

Balances of Receivables and Payables with Related Parties

Balances of receivables and payables arising from sales and purchases of goods and services with related parties as of December 31, 2019 and 2018 were as follows (in thousands):

As of December 31, 2019							
Counterparty	DNI Ownership Interest	Other receivables	Deposits for lease*	Loans payable	Accounts payable	Other payables	Accrued and other liabilities**
DNI (parent company)	N/A	\$ 32	\$ 709	\$ 9,096	\$ —	\$ 1,475	\$ 119
Tomato Soft Ltd.	100%	—	—	—	—	10	—
Tomato Soft (Xi'an) Ltd.	100%	—	—	—	—	45	—
Dasan France	100%	—	—	—	—	—	—
Chasan Networks Co., Ltd.	100%	—	—	—	96	—	—
		<u>\$ 32</u>	<u>\$ 709</u>	<u>\$ 9,096</u>	<u>\$ 96</u>	<u>\$ 1,530</u>	<u>\$ 119</u>

Counterparty	DNI Ownership Interest	As of December 31, 2018						
		Account receivables	Other receivables	Deposits for lease*	Loan Payable	Accounts payable	Other payables	Accrued and other liabilities**
DNI (parent company)	N/A	\$ —	\$ —	\$ 735	\$ 14,142	\$ 1,000	\$ 1,231	\$ 169
Tomato Soft Ltd.	100%	—	—	—	—	—	9	—
Tomato Soft (Xi'an) Ltd.	100%	—	—	—	—	—	41	—
Dasan France	100%	280	65	—	—	—	—	—
Handysoft, Inc.	14.77%	303	—	—	—	654	—	—
Chasan Networks Co., Ltd.	100%	—	—	—	—	89	—	—
		<u>\$ 583</u>	<u>\$ 65</u>	<u>\$ 735</u>	<u>\$ 14,142</u>	<u>\$ 1,743</u>	<u>\$ 1,281</u>	<u>\$ 169</u>

* Included in other assets related to deposits for lease in the consolidated balance sheets as of December 31, 2019 and 2018.

** Included in accrued and other liabilities in the consolidated balance sheet as of December 31, 2019 and 2018.

(13) Leases

The Company leases certain properties and buildings (including manufacturing facilities, warehouses, and office spaces) and equipment under various arrangements which provide the right to use the underlying asset and require lease payments for the lease term. The Company's lease portfolio consists of operating leases which expire at various dates through 2027.

The Company determines if an arrangement contains a lease at inception. The Company evaluates each service contract upon inception to determine whether it is, or contains, a lease. Such determination is made by applying judgment in evaluating each service contract within the context of the 5-step decision making process under ASC 842. The key concepts of the 5-step decision making process that the Company evaluated can be summarized as: (1) is there an identified physical asset; (2) does the Company have the right to substantially all the economic benefits from the asset throughout the contract period; (3) does the Company control how and for what purpose the asset is used; (4) does the Company operate the asset; and (5) did the Company design the asset in a way that predetermines how it will be used.

Assets and liabilities related to operating leases are included in the condensed consolidated balance sheet as right-of-use assets from operating leases, operating lease liabilities - current and operating lease liabilities - non-current.

Operating lease right-of-use assets and liabilities are recognized at commencement date based on the present value of lease payments over the lease term. Many of the Company's lease agreements contain renewal options; however, the Company does not recognize right-of-use assets or lease liabilities for renewal periods unless it is determined that the Company is reasonably certain of renewing the lease at inception or when a triggering event occurs. Some of the Company's lease agreements contain rent escalation clauses, rent holidays, capital improvement funding or other lease concessions.

The Company recognizes minimum rental expense on a straight-line basis based on the fixed components of a lease arrangement. The Company amortizes this expense over the term of the lease beginning with the date of initial possession, which is the date lessor makes an underlying asset available for use. Variable lease components represent amounts that are not fixed in nature, are not tied to an index or rate, and are recognized as incurred.

In determining its right-of-use assets and lease liabilities, the Company applies a discount rate to the minimum lease payments within each lease agreement. ASC 842 requires the Company to use the rate of interest that a lessee would have to pay to borrow on a collateralized basis over a similar term an amount equal to the lease payments in a similar economic environment. The Company determines the incremental borrowing rate for each lease based primarily on its lease term and the economic environment of the applicable country or region.

For the measurement and classification of its lease agreements, the Company groups lease and non-lease components into a single lease component for all underlying asset classes. Variable lease payments include payments for non-lease components of maintenance costs. The components of lease expense were as follows for the year ended December 31, 2019:

	Year ended December 31, 2019 (in thousands)	
Operating lease cost	\$	5,212
Variable lease cost		644
Short-term lease cost		404
Total net lease cost	<u>\$</u>	<u>6,260</u>

Lease expense was approximately \$4.3 million for the year ended December 31, 2018.

Supplemental cash flow information related to the Company's operating leases was as follows for the year ended December 31, 2019:

	Year ended December 31, 2019 (in thousands)	
Operating cash flows from operating leases	\$	4,932
ROU assets obtained in exchange for operating lease obligations	\$	3,812

The following table presents the lease balances within the Company's consolidated balance sheet, weighted average remaining lease term, and weighted average discount rates related to the Company's operating leases as of December 31, 2019 (in thousands):

Lease Assets and Liabilities		
Assets:		
Right-of-use assets from operating leases	\$	20,469
Liabilities:		
Operating lease liabilities - current	\$	4,201
Operating lease liabilities - non-current		18,154
Total operating lease liabilities	\$	22,355
Weighted average remaining lease term		2.22 years
Weighted average discount rate		4.8%

During the year ended December 31, 2019, the Company reviewed assets designated for its Keymile business. As a result of the Company's restructuring activities, it determined that the carrying value of a right-to-use asset for an operating lease building was impaired. As a result, the Company recorded a non-cash asset impairment charge of \$0.7 million to reduce the carrying value of these assets, as reflected within Restructuring charges, on the Company's Consolidated Statements of Comprehensive Income (Loss) for the year ended December 31, 2019.

The following table presents the maturity of the Company's operating lease liabilities as of December 31, 2019 (in thousands):

Year ending December 31:	Minimum Future Lease Payments	
2020	\$	5,287
2021		4,655
2022		4,211
2023		3,795
2024		3,320
Thereafter		3,457
Total operating lease payments		24,725
Less: imputed interest		(2,370)
Total minimum lease payments	\$	22,355

(14) Commitments and Contingencies

Performance Bonds

In the normal course of operations, from time to time, the Company arranges for the issuance of various types of surety bonds, such as bid and performance bonds, which are agreements under which the surety company guarantees that the Company will perform in accordance with contractual or legal obligations. As of December 31, 2019, the Company had \$9.2 million of surety bonds guaranteed by third parties.

Purchase Commitments

The Company's inventory purchase commitments typically allow for cancellation of orders 30 days in advance of the required inventory availability date as set by the Company at time of order. However, the Company has agreements with various contract

manufacturers which include non-cancellable inventory purchase commitments. The amount of non-cancellable purchase commitments outstanding was \$4.3 million as of December 31, 2019.

Payment Guarantees Provided by Third Parties and DNI

The following table sets forth payment guarantees of the Company's indebtedness and other obligations as of December 31, 2019 that have been provided by third parties and DNI. DNI owns approximately 44.3% of the outstanding shares of our common stock. The amount guaranteed exceeds the principal amounts of outstanding obligations due to collateral requirements by the banks.

Guarantor	Amount Guaranteed (in thousands)	Description of Obligations Guaranteed
DNI	\$ 8,400	Credit facility from Industrial Bank of Korea
DNI	\$ 2,073	Purchasing Card from Industrial Bank of Korea
DNI	\$ 8,400	Credit facility from Korea Development Bank
DNI	\$ 5,182	Borrowings from Korea Development Bank
DNI	\$ 6,000	Credit facility from NongHyup Bank
DNI	\$ 3,700	Borrowings from Export-Import Bank of Korea
DNI	\$ 3,000	Payment Guarantee from Shinhan Bank
DNI	\$ 1,658	Backed Loan from Shinhan Bank
PNC Bank N.A.	\$ 4,649	Performance Bond
Citi Bank	\$ 253	Performance Bond
Seoul Guarantee Insurance Co.	\$ 6,009	Performance Bond, Warranty Bond, etc. (*)
Industrial Bank of Korea	\$ 836	Bank Guarantee
Korea Development Bank	\$ 3,124	Letter of Credit
NongHyup Bank	\$ 2,266	Letter of Credit
Woori Bank	\$ 1,626	Bank Guarantee
Shinhan Bank	\$ 583	Purchasing Card
Shinhan Bank	\$ 683	Payment Guarantee
AXA Insurance Company	\$ 179	Guarantee for flexible retirement program
	\$ 58,621	

* The Company is responsible for the warranty liabilities generally for the period of two (2) years regarding major product sales and have contracted surety insurance to cover part of the warranty liabilities.

Royalties

The Company has certain royalty commitments associated with the shipment and licensing of certain products. Royalty expense is generally based on a dollar amount per unit shipped or a percentage of the underlying revenue and is recorded in cost of revenue.

Litigation

From time to time, the Company is subject to various legal proceedings, claims and litigation arising in the ordinary course of business. While the outcome of these matters is currently not determinable, the Company records an accrual for legal contingencies that it has determined to be probable to the extent that the amount of the loss can be reasonably estimated. The Company does not expect that the ultimate costs to resolve these matters will have a material adverse effect on its consolidated financial position, results of operations or cash flows. However, litigation is subject to inherent uncertainties, and unfavorable rulings could occur. If an unfavorable ruling were to occur, there exists the possibility of a material adverse impact on the results of operations and cash flows of the reporting period in which the ruling occurs, or future periods.

(15) Employee Benefit Plans

The Company maintains a 401(k) plan for its employees whereby eligible employees may contribute up to a specified percentage of their earnings, on a pretax basis, subject to the maximum amount permitted by the Internal Revenue Code. Under the 401(k) plan, the Company may make discretionary contributions. The Company made no discretionary contributions to the plan in 2019 or 2018.

The Company maintains a defined contribution plan for its employees in Korea. Under the defined contribution plan, the Company contributes 8.33% of an employee's gross salary into the plan. For the year ended December 31, 2019, the Company recorded an expense of \$1.3 million for the plan.

Pension Plans

The Company sponsors defined benefit plans for its employees in Keymile and Japan. Defined benefit plans provide pension benefits based on compensation and years of service.

The net periodic benefit cost related to the plans consisted of the following components during the year ended December 31, 2019 (in thousands):

	Year Ended December 31, 2019
Service Cost	\$ 219
Interest Cost	265
Net amortization	—
Net periodic benefit cost	<u>\$ 484</u>

The service cost component of net benefit cost is presented within cost of sales or selling, general and administrative expense on the accompanying statements of operations, in accordance with where compensation cost for the related associate is reported. All other components of net benefit cost, including interest cost and net amortization noted above, are presented within other income/expense, net in the accompanying statements of operations.

The following provides a reconciliation of the changes in plan assets and benefit obligation, and the funded status at the end of the year (in thousands):

	Year Ended December 31, 2019
Benefit obligation, January 1	\$ —
Assumed with acquisition	16,191
Service cost	219
Interest cost	265
Benefits paid	(456)
Plan amendments	—
Actuarial (gains) losses	1,793
Foreign exchange impact	(341)
Benefit obligation, December 31	<u>17,671</u>
Underfunded status, December 31	<u>\$ 17,671</u>

The Company has recorded the 2019 underfunded status as a long-term liability on the consolidated balance sheets. The accumulated benefit obligation for the plans were \$17.7 million as of December 31, 2019. The Company has life insurance contracts, with the Company as beneficiary, in the amount of \$3.3 million as of December 31, 2019, related to individuals under the pension plans. These insurance contracts are classified as other assets on the Company's Consolidated Balance Sheet. The Company intends to use any proceeds from these policies to fund the pension plans. However, since the Company is the beneficiary on these policies, these assets have not been designated pension plan assets.

The estimated net loss and prior service cost for the plans that will be amortized from accumulated other comprehensive loss into net periodic benefit cost over the next fiscal year is \$19,000. The Company expects to make no contributions to the plans in 2020.

The following gross amounts are recognized net of tax in accumulated other comprehensive loss:

The following benefit payments, which reflect expected future service, are expected to be paid (in thousands):

	Years Ending December 31,	
2020	\$	602
2021		647
2022		687
2023		720
2024		699
2025 - 2029		3,496

The following gross amounts are recognized net of tax in accumulated other comprehensive loss:

		Year Ended December 31, 2019
Prior service cost	\$	—
Net loss		1,793
Net periodic benefit cost	\$	1,793

The weighted average assumptions used in determining the periodic net cost and benefit obligation information related to the plans are as follows:

	Year Ended December 31, 2019
Net periodic benefit cost :	
Discount rate	0.9%
Rate of compensation increase	1.7%
Benefit obligation:	
Discount rate	0.9%
Rate of compensation increase	1.7%

(16) Enterprise-Wide Information

The Company is a global provider of ultra-broadband network access solutions and communications platforms deployed by advanced Tier 1, 2 and 3 service providers and enterprise customers. There are no segment managers who are held accountable for operations, operating results and plans for levels or components below the Company unit level. Accordingly, the Company is considered to be in a single reporting segment and operating unit structure. The Company's chief operating decision maker is the Company's Chief Executive Officer, who reviews financial information presented on a consolidated basis accompanied by disaggregated information about revenues by geographic region for purposes of making operating decisions and assessing financial performance. The Company attributes revenue from customers to individual countries based on location shipped. The following summarizes required disclosures about geographical concentrations and revenue by products and services (in thousands):

	Years ended December 31,	
	2019	2018
Revenue by geography:		
United States	\$ 36,383	\$ 50,795
Canada	4,690	4,413
Total North America	41,073	55,208
Latin America	23,774	27,596
Europe, Middle East, Africa	78,375	34,741
Korea	79,124	76,006
Other Asia Pacific	84,536	88,797
Total International	265,809	227,140
Total	\$ 306,882	\$ 282,348

	Years ended December 31,	
	2019	2018
Revenue by products and services:		
Products	\$ 286,292	\$ 269,269
Services	20,590	13,079
Total	\$ 306,882	\$ 282,348

The Company's property, plant and equipment, net of accumulated depreciation, were located in the following geographical areas as of December 31, 2019 and 2018 (in thousands):

	As of December 31,	
	2019	2018
United States	\$ 2,809	\$ 3,036
Korea	2,020	1,543
Japan and Vietnam	1,074	910
Taiwan and India	24	29
Germany	842	—
	\$ 6,769	\$ 5,518

(17) Subsequent Events

Relocation of Corporation Headquarters and New Facilities in Alameda, California

On March 2, 2020, the Company announced its plans to relocate its corporate headquarters from Oakland, California to Plano, Texas and establish a new U.S.-based Engineering Center of Excellence in Plano.

On February 24, 2020, in connection with the planned relocation, the Company entered into two separate Agreements of Sublease (the "Subleases") with Huawei Technologies USA Inc. ("Huawei") and Futurewei Technologies, Inc. ("Futurewei," together with Huawei, the "Sublessors"), respectively, for two suites at Legacy Place, 5700 Tennyson Parkway, Plano, Texas (the "Premises"). The Subleases are subject to that certain Office Lease dated October 7, 2009 by and between Equus Investment Partnership XI, L.P., as successor-in-interest to Legacy Acquisition, L.P., and Huawei, as amended, and that certain Office Lease dated December 14, 2017 by and between Equus Investment Partnership XI, L.P., as successor-in-interest to L&B CIP Legacy Place I & II, LLC, and Futurewei, respectively.

The Subleases cover premises which, together, consist of 16,333 rentable square feet. Both Subleases are expected to commence in March, 2020 and terminate on November 30, 2025. The Company does not have any option to extend the term of either of the Subleases. The Subleases provide that the base rent will be abated until July 1, 2020. Beginning on July 1, 2020, the aggregate base monthly rent payments due under the Subleases will be \$21,777, subject to an annual increase of \$0.50 per rentable square foot per annum thereafter. The Company is also responsible for certain other costs under the Subleases including operating expenses, insurance and utilities.

DNI Loan

On March 5, 2020, DNS Korea, the Company's wholly-owned, indirect subsidiary entered into a Loan Agreement with DNI (the "March 2020 DNI Loan"). The March 2020 DNI Loan was negotiated and approved on behalf of the Company and its subsidiaries by a special committee of the Board of Directors of the Company (the "Special Committee") consisting of directors, each of whom was determined to be independent from DNI. The March 2020 DNI Loan consists of a term loan in the amount of KRW 22.4 billion (\$18.5 million USD) with interest payable semi-annually at an annual rate of 4.6% and maturing on March 11, 2022. No principal payments are due on the March 2020 DNI Loan until the maturity date, but DNS Korea may prepay the loan, or a portion thereof, without penalty.

As security for the March 2020 DNI Loan (and other existing loans between DNI and DNS Korea and/or DNS California), (i) DNS California, a wholly-owned, direct subsidiary of the Company and the sole stockholder of DNS Korea, agreed to pledge the outstanding shares of DNS Korea to DNI and (ii) DNS Korea granted a security interest in its personal property assets, accounts receivable and intellectual property assets to DNI. The March 2020 DNI Loan includes certain covenants consisting of financial reporting obligations, a maintenance covenant whereby DNS Korea agreed to maintain a minimum stockholders' equity value in an amount equal to or greater than KRW 43.3 billion (\$35.8 million USD), and customary events of default. If an event of default occurs and is not remedied within the applicable cure period, DNI will be entitled to take various actions, including requiring the immediate repayment of all outstanding amounts under the March 2020 DNI Loan and selling the shares or assets of DNS Korea.

DNS Korea loaned the funds borrowed under the March 2020 DNI Loan to the Company, and the Company intends to utilize a portion of such funds to repay in full and terminate the PNC Credit Facilities.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

We maintain disclosure controls and procedures designed to provide reasonable assurance that information required to be disclosed in our reports filed or submitted pursuant to the Securities Exchange Act of 1934 (the “Exchange Act”) is recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms, and that such information is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, as appropriate to allow for timely decisions regarding required disclosures. In designing and evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures.

As required by Rule 13a-15(b) of the Exchange Act, we conducted an evaluation of the effectiveness of the design and operation of our disclosure controls and procedures as of December 31, 2019, the end of the period covered by this Annual Report on Form 10-K. Our management, including our Chief Executive Officer and our Chief Financial Officer, supervised and participated in the evaluation. They concluded that our disclosure controls and procedures were not effective as of December 31, 2019 because of the material weaknesses in our internal control over financial reporting described below under “Management’s Annual Report on Internal Control over Financial Reporting.” The effectiveness of our internal control over financial reporting as of December 31, 2019 has been audited by Grant Thornton LLP, an independent registered public accounting firm, and Grant Thornton LLP has issued a report on our internal control over financial reporting, which is included herein.

Management’s Annual Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Management assessed the effectiveness of our internal control over financial reporting as of December 31, 2019, the end of the period covered by this Annual Report on Form 10-K. In making this assessment, management used the criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Management concluded that, as of December 31, 2019, our internal control over financial reporting was not effective, because of the unremediated material weaknesses in our internal control over financial reporting described below.

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of the registrant’s annual or interim financial statements will not be prevented or detected on a timely basis. Management determined that the Company did not maintain a sufficient complement of personnel with appropriate accounting knowledge, experience and training in the application of US GAAP, including accounting for significant unusual transactions. In addition, the Company did not maintain an effective control environment as it did not appropriately identify internal controls over inventory valuation and revenue. Also, Management determined that the Company did not design and maintain effective controls over the financial closing process, including controls surrounding monitoring and review of the activity of its foreign subsidiaries.

These material weaknesses could result in a misstatement in the financial statements that would result in a material misstatement in the annual or interim consolidated financial statements that would not be prevented or detected.

Remediation Plan for Material Weaknesses in Internal Control over Financial Reporting

As of the date of this Annual Report on Form 10-K, we are re-assessing the design of our controls and modifying processes related to the accounting for significant unusual transactions as well as enhancing monitoring and oversight controls in the application of accounting guidance related to such transactions. In connection therewith, in December of 2019, we hired a new Chief Financial Officer and Chief Accounting Officer, and we anticipate that we will hire additional accounting personnel with relevant skills, training and experience, and conduct further training of our accounting and finance personnel.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting that occurred during the fourth quarter of our latest fiscal year that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Inherent Limitations on Effectiveness of Controls

Our management, including our Chief Executive Officer and Chief Financial Officer, does not expect that our disclosure controls and procedures or our internal control over financial reporting will prevent or detect all error and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system's objectives will be met. The design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Further, because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud, if any, within the Company have been detected. These inherent limitations include the realities that judgments in decision-making can be faulty and that breakdowns can occur because of simple error or mistake. Controls can also be circumvented by the individual acts of some persons, by collusion of two or more people, or by management override of the controls. The design of any system of controls is based in part on certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Projections of any evaluation of controls effectiveness to future periods are subject to risks. Over time, controls may become inadequate because of changes in conditions or deterioration in the degree of compliance with policies or procedures.

ITEM 9B. OTHER INFORMATION

None.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information required in this item relating to our corporate governance, directors and nominees, and the compliance with Section 16(a) of the Securities Exchange Act of 1934 is incorporated herein by reference to the sections of our definitive proxy statement for our 2020 Annual Meeting of Stockholders to be filed with SEC within 120 days of the end of our fiscal year (the “Proxy Statement”) entitled “Corporate Governance Principles and Board Matters,” “Ownership of Securities” and “Proposal 1: Election of Directors.” Since our last Annual Report on Form 10-K, we have not made any material changes to the procedures by which our stockholders may recommend nominees to the Board of Directors.

Information relating to our executive officers is included under the caption “Information About our Executive Officers” in Part I of this Annual Report on Form 10-K, pursuant to General Instruction G(3) of Form 10-K.

We have adopted a Code of Conduct and Ethics applicable to all of our employees, directors and officers (including our principal executive officer, principal financial officer, principal accounting officer and controller). The Code of Conduct and Ethics is designed to deter wrongdoing and to promote honest and ethical conduct and compliance with applicable laws and regulations. The full text of our Code of Conduct and Ethics is published on our website at <https://dasanzhone.com/about/investor-relations/corporate-governance>. We intend to disclose any future amendments to certain provisions of our Code of Conduct and Ethics, or waivers of such provisions granted to executive officers and directors, on our website within four business days following the date of such amendment or waiver.

ITEM 11. EXECUTIVE COMPENSATION

The information required by this item is incorporated herein by reference to the sections of the Proxy Statement entitled “Executive Compensation” and “Director Compensation.”

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required by this item relating to security ownership of certain beneficial owners and management, and securities authorized for issuance under equity compensation plans is incorporated herein by reference to the sections of the Proxy Statement entitled “Ownership of Securities” and “Executive Compensation.”

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The information required by this item is incorporated herein by reference to the section of the Proxy Statement entitled “Certain Relationships and Related Transactions.”

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The information required by this item is incorporated herein by reference to the section of the Proxy Statement entitled “Proposal 2: Ratification of Appointment of Independent Registered Public Accounting Firm.”

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

1. Financial Statements

The Index to Consolidated Financial Statements on page 42 is incorporated herein by reference as the list of financial statements required as part of this Annual Report on Form 10-K.

2. Exhibits

The exhibits required to be filed by Item 601 of Regulation S-K are listed in the “Index to Exhibits” immediately preceding the exhibits hereto and such listing is incorporated herein by reference.

ITEM 16. FORM 10-K SUMMARY

None.

INDEX TO EXHIBITS

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed or Furnished Herewith
		Form	Exhibit	Filing Date	
2.1	Share Purchase Agreement dated as of October 5, 2018, by and between ZTI Acquisition Subsidiary III Inc. and Riverside KM Beteiligung GmbH	8-K	10.1	January 1, 2019	
2.2	Agreement, dated as of December 31, 2018, by and between ZTI Acquisition Subsidiary III Inc. and Riverside KM Beteiligung GmbH	8-K	10.3	January 1, 2019	
2.3	Share Transfer Agreement dated as of July 31, 2019 by and between Handysoft, Inc., as Transferor, and DASAN Zhone Solutions, Inc., as Transferee	8-K	2.1	August 5, 2019	
3.1	Restated Certificate of Incorporation of DASAN Zhone Solutions, Inc., as amended through February 28, 2017	10-K	3.1	September 27, 2017	
3.2	Amended and Restated Bylaws of DASAN Zhone Solutions, Inc.	8-K	3.2	September 12, 2016	
4.1	Description of Capital Stock				X
10.1#	DASAN Zhone Solutions, Inc. 2017 Incentive Award Plan	8-K	10.1	January 10, 2017	
10.1.1#	Amendment to DASAN Zhone Solutions, Inc. 2017 Incentive Award Plan	10-K	10.1.1	March 12, 2019	
10.1.2#	Form of Stock Option Agreement for the DASAN Zhone Solutions, Inc. 2017 Incentive Award Plan	8-K	10.2	January 10, 2017	
10.1.3#	Form of Restricted Stock Unit Award Agreement for the DASAN Zhone Solutions, Inc. 2017 Incentive Award Plan	10-K	10.1	September 27, 2017	
10.2#	DASAN Zhone Solutions, Inc. Amended and Restated 2001 Stock Incentive Plan, as amended	8-K	10.6	September 13, 2016	
10.2.1#	Form of Stock Option Agreement for the DASAN Zhone Solutions, Inc. Amended and Restated 2001 Stock Incentive Plan, as amended	8-K	10.7	September 13, 2016	
10.2.2#	Form of Restricted Stock Award Agreement for the DASAN Zhone Solutions, Inc. Amended and Restated 2001 Stock Incentive Plan, as amended	8-K	10.2	May 17, 2007	
10.2.3#	Form of Restricted Stock Unit Award Agreement for the DASAN Zhone Solutions, Inc. Amended and Restated 2001 Stock Incentive Plan, as amended	10-Q	10.3	November 14, 2016	
10.3#	DASAN Zhone Solutions, Inc. 2018 Employee Stock Purchase Plan	S-8	10.1	November 8, 2018	
10.4#	DASAN Zhone Solutions, Inc. Non-Employee Director Compensation Program	10-K	10.4	April 4, 2018	

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed or Furnished Herewith
		Form	Exhibit	Filing Date	
10.5#	Form of Indemnity Agreement (directors and officers)	10-Q	10.20	May 14, 2004	
10.6#	Amended and Restated Employment Agreement dated as of October 10, 2017 by and between DASAN Zhone Solutions, Inc. and Il Yung Kim	10-K	10.8	April 4, 2018	
10.7#	Employment Agreement, dated as of December 2, 2019, by and between DASAN Zhone Solutions, Inc. and Tom Cancro	8-K	10.1	November 25, 2019	
10.8#	General Release of Claims dated August 30, 2019 by and between DASAN Zhone Solutions, Inc. and Mikhail (Michael) Golomb	10-Q	10.1	November 13, 2019	
10.9	Stockholder Agreement, dated as of September 9, 2016, by and among DASAN Zhone Solutions, Inc. and DASAN Networks, Inc. and the other parties thereto	8-K	10.1	September 12, 2016	
10.10	Lock-Up Agreement, dated as of September 9, 2016, by and among DASAN Zhone Solutions, Inc., DASAN Networks, Inc. and the other parties thereto	8-K	10.2	September 12, 2016	
10.11	Registration Rights Agreement, dated as of September 9, 2016, by and among DASAN Zhone Solutions, Inc., DASAN Networks, Inc. and the other parties thereto	8-K	10.3	September 12, 2016	
10.12	Loan Agreement, dated as of September 9, 2016, by and among DASAN Zhone Solutions, Inc., DASAN Networks, Inc. and the other parties thereto	8-K	10.4	September 12, 2016	
10.13	Loan Agreement, dated as of March 27, 2018, by and between DASAN Networks, Inc. and DASAN Network Solutions, Inc.	8-K	10.1	April 2, 2018	
10.13.1	Amendment No. 1 to Loan Agreement dated as of February 25, 2019 by and between DASAN Network, Inc., as Lender, and DASAN Network Solutions, Inc., as Borrower	10-Q	10.3	May 10, 2019	
10.14	Loan Agreement dated as of December 27, 2018 by and between DASAN Networks, Inc., as Lender, and DASAN Zhone Solutions, Inc., as Borrower	8-K	10.2	January 3, 2019	
10.14.1	Amendment No. 1 to Loan Agreement dated as of February 25, 2019 by and between DASAN Network, Inc., as Lender, and DASAN Network Solutions, Inc., as Borrower	10-Q	10.4	May 10, 2019	
10.15	Revolving Credit, Term Loan, Guaranty and Security Agreement dated as of February 27, 2019 by and among PNC Bank, National Association, Citibank, N.A., DASAN Zhone Solutions, Inc., and the lenders named therein	10-Q	10.1	May 10, 2019	
10.16	Export-Import Revolving Credit, Guaranty and Security Agreement dated as of February 27, 2019 by and among PNC Bank, National Association, Citibank, N.A., DASAN Zhone Solutions, Inc., and the lenders named therein	10-Q	10.2	May 10, 2019	

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed or Furnished Herewith
		Form	Exhibit	Filing Date	
10.17	Letter Agreement dated May 10, 2019 by and among PNC Bank, National Association and Citibank, N.A., as lenders, and DASAN Zhone Solutions, Inc., as borrowing agent	10-Q	10.1	August 14, 2019	
10.18	Letter Agreement dated May 31, 2019 by and among PNC Bank, National Association and Citibank, N.A., as lenders, and DASAN Zhone Solutions, Inc., as borrowing agent	10-Q	10.2	August 14, 2019	
10.19	Letter Agreement dated November 8, 2019 by and among PNC Bank, National Association and Citibank, N.A., as lenders, and DASAN Zhone Solutions, Inc., as borrowing agent	10-Q	10.3	November 13, 2019	
10.20	Office Lease Agreement dated February 9, 2016, between Zhone Technologies, Inc. and BACM 2005-3 Bryan Dairy Industrial, LLC	8-K	10.1	February 23, 2016	
10.20.1	First Amendment to Office Lease Agreement, dated June 7, 2016, between Zhone Technologies, Inc. and BACM 2005-3 Bryan Dairy Industrial, LLC	10-Q	10.1	August 9, 2016	
10.21	Office Lease Agreement dated July 9, 2019, between DASAN Zhone Technologies, Inc. and Family Stations, Inc.	10-Q	10.3	August 14, 2019	
10.22	Loan Agreement dated March 3, 2020 and entered into as of March 4, 2020 by and between DASAN Networks, Inc. and DASAN Network Solutions, Inc. (Korea)	8-K	10.1	March 10, 2020	
10.23	Intellectual Property Pledge Agreement dated March 3, 2020 and entered into as of March 4, 2020 by and between DASAN Networks, Inc. and DASAN Network Solutions, Inc. (Korea)	8-K	10.2	March 10, 2020	
10.24	Share Pledge Agreement dated March 3, 2020 and entered into as of March 4, 2020 by and among DASAN Networks, Inc., DASAN Network Solutions, Inc. (Korea) and DASAN Network Solutions, Inc. (California)	8-K	10.3	March 10, 2020	
10.25	Agreement of Sublease dated February 24, 2020 by and between Huawei Technologies, Inc. and Dasan Zhone Solutions, Inc.	8-K	10.1	March 2, 2020	
10.26	Agreement of Sublease dated February 24, 2020 by and between Huawei Technologies, Inc. and Dasan Zhone Solutions, Inc.	8-K	10.2	March 2, 2020	
16.1	Letter from PricewaterhouseCoopers LLP to the Securities and Exchange Commission dated June 14, 2019	8-K	16.1	June 14, 2019	
21.2	List of Subsidiaries				X
23.1	Consent of Grant Thornton LLP				X
23.2	Consent of PricewaterhouseCoopers LLP				X

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed or Furnished Herewith
		Form	Exhibit	Filing Date	
31.1	Certification of Chief Executive Officer Pursuant to Rule 13a-14(a)/15d-14(a)				X
31.2	Certification of Chief Financial Officer Pursuant to Rule 13a-14(a)/15d-14(a)				X
32.1	Section 1350 Certification of Chief Executive Officer and Chief Financial Officer				X
101.INS	XBRL Instance Document				X
101.SCH	XBRL Taxonomy Extension Schema				X
101.CAL	XBRL Taxonomy Extension Calculation Linkbase				X
101.DEF	XBRL Taxonomy Extension Definition Linkbase				X
101.LAB	XBRL Taxonomy Extension Label Linkbase				X
101.PRE	XBRL Taxonomy Extension Presentation Linkbase				X

Management contract or compensatory plan or arrangement in which one or more executive officers or directors participates.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

DASAN ZHONE SOLUTIONS, INC.

Date: March 24, 2020

By: /s/ IL YUNG KIM
Il Yung Kim
President, Chief Executive Officer and Director

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ IL YUNG KIM</u> Il Yung Kim	President, Chief Executive Officer (Principal Executive Officer) and Director	March 24, 2020
<u>/s/ THOMAS J. CANCRO</u> Thomas J. Cancro	Chief Financial Officer and Corporate Treasurer (Principal Financial Officer and Principal Accounting Officer)	March 24, 2020
<u>/s/ MIN WOO NAM</u> Min Woo Nam	Chairman of the Board of Directors	March 24, 2020
<u>/s/ SEONG GYUN KIM</u> Seong Gyun Kim	Director	March 24, 2020
<u>/s/ DAVID SCHOPP</u> David Schopp	Director	March 24, 2020
<u>/s/ ROLF UNTERBERGER</u> Rolf Unterberger	Director	March 24, 2020
<u>/s/ JOON KYUNG KIM</u> Joon Kyung Kim	Director	March 24, 2020
<u>/s/ CHOON YUL YOO</u> Choon Yul Yoo	Director	March 24, 2020

**DESCRIPTION OF THE REGISTRANT'S SECURITIES
REGISTERED PURSUANT TO SECTION 12 OF THE
SECURITIES EXCHANGE ACT OF 1934**

The following summary of the material terms of the common stock of DASAN Zhone Solutions, Inc. (the "Company") summarizes the material terms of, is subject to and qualified in its entirety by reference to the terms and provisions of our restated certificate of incorporation (the "Charter"), and our amended and restated bylaws (the "Bylaws"). For the complete terms of our common stock, please refer to the Charter and the Bylaws, each as may be amended from time to time. Our common stock is the only class of securities of the Company that is registered pursuant to Section 12 of the Securities Exchange Act of 1934, as amended.

General

We have authorized 61,000,000 shares of capital stock, of which 36,000,000 are shares of common stock, par value \$0.001 per share, and 25,000,000 are shares of preferred stock, par value \$0.001 per share. As of March 11, 2020, there were 21,513,373 shares of common stock issued and outstanding and no shares of preferred stock issued and outstanding. The rights, preferences and privileges of holders of common stock are subject to the rights of the holders of any series of preferred stock that we may designate and issue in the future. Our common stock is listed on the NASDAQ Capital Market under the symbol "DZSI".

Board of Directors

The Board of Directors is divided into three classes of directors that are as nearly equal as possible, with no class having less than one director. Directors are elected for three-year terms with a different classes' term expiring at each annual meeting. Directors continue to hold office until their respective successors are elected and qualified.

Dividends

We have never paid or declared any cash dividends on our common stock and do not anticipate paying cash dividends in the foreseeable future. Any future determination to pay cash dividends will be at the discretion of the Board of Directors, subject to any applicable restrictions under our debt and credit agreements, and will be dependent upon our financial condition, results of operations, capital requirements, general business condition and such other factors as the Board of Directors may deem relevant.

In the event the Board of Directors does issue a dividend, subject to the rights of the holders of any preferred stock, holders of our common stock are entitled to receive equally, on a per share basis, such dividends and other distributions in cash, securities or other property of the Company as may be declared by the Board of Directors.

Voting Rights

Except as otherwise required by law or by the Charter, each holder of common stock is entitled to cast one vote for each share of common stock standing in such holder's name on the stock transfer records of the Company. A quorum of stockholders is necessary to hold a valid meeting of stockholders. The presence, in person or by proxy, of the holders of a majority of the issued and outstanding common stock entitled to vote at such meeting, is necessary to constitute a quorum at such meeting. Directors are elected by a plurality of votes.

For all other matters presented to stockholders, unless otherwise required by applicable law, the Bylaws or the Charter, a majority of the voting power of the issued and outstanding stock of the Company entitled to vote thereon, present and voting, in person or represented by proxy, shall decide the matter. Certain amendments to the Charter require 66-2/3% approval of the voting power of the Company that would be entitled to vote in the election of directors (i.e., Articles V (Board of Directors), VI (Limitation of Liability), VII (Indemnification), VIII (Stockholder Action) and IX (Amendment)). The Bylaws may be amended by a majority vote of the Board of Directors or by 66-2/3% of the voting power of all shares of the Company entitled to vote generally in the election of directors, voting as a single class.

No Preemptive or Similar Rights

Our common stock is not entitled to preemptive rights and is not subject to conversion, redemption or sinking fund provisions. The rights, preferences and privileges of the holders of our common stock are subject to, and may be adversely affected by, the rights of the holders of any series of our preferred stock that we may designate and issue in the future.

Liquidation and Distribution

Upon the liquidation, dissolution or winding up of the Company, the holders of common stock are entitled to ratably receive our net assets remaining for distribution after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock.

Preferred Stock

The Board of Directors is authorized to, subject to any limitations imposed by applicable law, provide for issuances of preferred stock. The Board of Directors is further authorized to fix the voting powers, designations, powers, preferences and other rights of each series of preferred stock. The number of authorized shares of preferred stock may only be increased or decreased by the affirmative vote of the holders of a majority in voting power of the Company entitled to vote, without the separate vote of the holders of preferred stock as a class.

Transfer Agent and Registrar

Our transfer agent and registrar for our capital stock is Computershare Trust Company, N.A. The transfer agent's address is P.O. Box 505000, Louisville, KY 40233, and its telephone number is (800) 942-5909.

ANTI-TAKEOVER PROVISIONS OF THE CHARTER AND THE BYLAWS

General

The Charter and the Bylaws contain certain provisions that could have an effect of delaying, deferring or preventing a change in control of the Company in the event of a merger, reorganization, sale or transfer of substantially all of the Company's assets, or some other extraordinary corporate transaction involving the Company. Set forth below is a description of such provisions. The description is intended as a summary only and is qualified in its entirety by reference to the Delaware General Corporation Law (the "DGCL"), the Charter and the Bylaws.

Advance Notice Requirements for Stockholder Proposals and Director Nominations

The Bylaws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of persons for election to the Board of Directors. Stockholders at an annual meeting may only consider proposals or nominations specified in the notice of meeting or brought before the meeting, by or at the direction of the Board of Directors or by a stockholder of record on the date of a stockholder's notice and on the record date for the determination of stockholders entitled to vote on the annual meeting, who is entitled to vote at the meeting and who has delivered timely written notice in proper form to the Secretary of the Company.

Choice of Forum

The Charter provides that the Court of Chancery of the State of Delaware is the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the Company, (ii) any action asserting a claim of breach of a fiduciary duty owed by any director, officer, employee or agent of the Company to the Company or the Company's stockholders, (iii) any action asserting a claim against the Company arising pursuant to any provision of the DGCL, the Charter or the Bylaws, or (iv) any action asserting a claim against the Company governed by the internal affairs doctrine, in each such case subject to the Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein.

Delaware Anti-takeover Law

The Company is subject to Section 203 of the DGCL ("Section 203"), an anti-takeover law. In general, Section 203 prohibits a publicly held Delaware corporation from engaging in a business combination with an interested stockholder for a period of three years following the date such person became an interested stockholder, unless the business combination or the transaction in which such person became an interested stockholder is approved in a prescribed manner. Generally, a "business combination" includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. Generally, an "interested stockholder" is a person that, together with affiliates and associates, owns, or within three years prior to the determination of interested stockholder status did own, 15% or more of a corporation's voting stock.

DASAN Zhone Solutions, Inc.

List of Subsidiaries

DASAN Zhone Solutions, Inc. had the following subsidiaries at December 31, 2019:

<u>Name</u>	<u>Organized under the laws of</u>
Ark Electronic Products, Inc.	Florida
DASAN Network Solutions, Inc.	California
DASAN Network Solutions, Inc.	Korea
DASAN India Private Limited	India
DASAN Vietnam Company Limited	Vietnam
D-Mobile Limited	Taiwan
DZS Japan Inc.	Japan
Keymile GmbH	Germany
Keymile Ltd.	United Kingdom
Keymile Ltda.	Brazil
Keymile Networks GmbH	Germany
Keymile Sp.z.o.o.	Poland
Paradyne Corporation	Delaware
Paradyne Finance Corp.	Delaware
Paradyne Networks Inc.	Delaware
Paradyne Worldwide Corporation	Delaware
Premisys Communications, Inc.	Delaware
Xybridge Technologies, Inc.	Texas
Zhone AB	Sweden
Zhone Holdings, Inc.	Delaware
Zhone International Ltd.	Cayman Islands
Zhone Technologies B.V.	Netherlands
Zhone Technologies Campus, LLC	California
Zhone Technologies de Argentina SRL	Argentina
Zhone Technologies de Colombia Limitada	Colombia
Zhone Technologies do Brasil LTDA	Brazil
Zhone Technologies GmbH	Germany
Zhone Technologies, Inc.	Canada
Zhone Technologies International, Inc.	Delaware
Zhone Technologies Limited	Hong Kong
Zhone Technologies Ltd.	United Kingdom
Zhone Technologies Pte. Ltd.	Singapore
Zhone Technologies S. de R.L. de C.V.	Mexico
Zhone Technologies S.R.L.	Italy
ZTI Merger Subsidiary III, Inc.	Delaware
Zhone Technologies, SA (PTY) LTD	South Africa

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We have issued our reports dated March 24, 2020, with respect to the consolidated financial statements and internal control over financial reporting included in the Annual Report of DASAN Zhone Solutions, Inc. on Form 10-K for the year ended December 31, 2019. We consent to the incorporation by reference of said reports in the Registration Statements of Dasan Zhone Solutions, Inc. on Forms S-8 (Nos. 333-228276, 333-221568, 333-202580, 333-194334, 333-180148, 333-172876, 333-165510, 333-158009, 333-155321, 333-149598, 333-141153, 333-134217, 333-132336, 333-123369, 333-83422, 333-73352, 333-230236 and 333-61956) and S-3 (333-230476).

/s/ GRANT THORNTON LLP

San Francisco, California

March 24, 2020

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Form S-8 (Nos. 333-228276, 333-221568, 333-202580, 333-194334, 333-180148, 333-172876, 333-165510, 333-158009, 333-155321, 333-149598, 333-141153, 333-134217, 333-132336, 333-123369, 333-83422, 333-73352, 333-230236 and 333-61956) and S-3 (333-230476) of DASAN Zhone Solutions, Inc. of our report dated March 12, 2019, relating to the consolidated financial statements, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP

San Jose, California

March 24, 2020

**CERTIFICATION OF CHIEF EXECUTIVE OFFICER
PURSUANT TO
RULE 13a-14(a)/15d-14(a)**

I, Il Yung Kim, certify that:

1. I have reviewed this Annual Report on Form 10-K of DASAN Zhone Solutions, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 24, 2020

/s/ IL YUNG KIM

Il Yung Kim

President, Chief Executive Officer

**CERTIFICATION OF CHIEF FINANCIAL OFFICER
PURSUANT TO
RULE 13a-14(a)/15d-14(a)**

I, Thomas J. Cancro, certify that:

1. I have reviewed this Annual Report on Form 10-K of DASAN Zhone Solutions, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 24, 2020

/s/ THOMAS J. CANCRO

Thomas J. Cancro
Chief Financial Officer and Corporate Treasurer
(Principal Financial and
Accounting Officer)

SECTION 1350 CERTIFICATIONS

Pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, Il Yung Kim, President and Chief Executive Officer of DASAN Zhone Solutions, Inc. (the "Company"), and Thomas J. Cancro, Chief Financial Officer and Treasurer (Principal Financial and Accounting Officer) of the Company, each hereby certify that, to his knowledge:

1. The Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2019 (the "Report") fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, and
2. The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: March 24, 2020

/s/ IL YUNG KIM

Il Yung Kim
President, Chief Executive Officer

/s/ THOMAS J. CANCRO

Thomas J. Cancro
Chief Financial Officer and Treasurer
(Principal Financial and
Accounting Officer)