HARMONIC INC
Form 10-K
March 01, 2019
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2018 Annual Report

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Form 10-K

(Mark One)
ý ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Fiscal Year Ended December 31, 2018
¨ TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
Commission File No. 000-25826

HARMONIC INC.
(Exact name of Registrant as specified in its charter)

Delaware	77-0201147
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification Number)

4300 North First Street
San Jose, CA 95134
(408) 542-2500
(Address, including zip code, and telephone number, including area code, of Registrant's principal executive offices)
Securities registered pursuant to section 12(b) of the Act:

Title of Each Class	Name of Each Exchange on Which Registered
Common Stock, par value $.001 per share	The NASDAQ Stock Market LLC

Securities registered pursuant to Section 12(g) of the 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 ý
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 ý
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 ý 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 during the preceding 12 months (or for such shorter period that the Registrant was required to submit and post such files). Yes ý No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of the Registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ý
Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting 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. (Check one):

Large accelerated filer	¨	Accelerated filer	ý
Non-accelerated filer	¨	Smaller reporting company	¨
Emerging growth company	¨		

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 ý

Based on the reported closing sale price of the Common Stock on The NASDAQ Global Select Market on June 29, 2018, the aggregate market value of the voting Common Stock held by non-affiliates of the Registrant was approximately $106,193,000. Shares of Common Stock held by each executive officer and director and by each person who owns 5% or more of the outstanding Common Stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

The number of shares outstanding of the Registrant's Common Stock, $.001 par value, was 88,678,700 on February 22, 2019.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for the Registrant's 2018 Annual Meeting of Stockholders (which will be filed with the Securities and Exchange Commission within 120 days of the end of the fiscal year ended December 31, 2018) are incorporated by reference in Part III of this Annual Report on Form 10-K.

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Forward Looking Statements

Some of the statements contained in this Annual Report on Form 10-K are forward-looking statements that involve risk and uncertainties. The statements contained in this Annual Report on Form 10-K that are not purely historical are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the "Securities Act"), and Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), including, without limitation, statements regarding our expectations, beliefs, intentions or strategies regarding the future. In some cases, you can identify forward-looking statements by terminology such as, "may," "will," "should," "expects," "plans," "anticipates," "believes," "intends," "estimates," "predicts," "potential," or "continue" or the negative of these terms or other comparable terminology. These forward-looking statements include, but are not limited to, statements regarding:

- developing trends and demands in the markets we address, particularly emerging markets;
- economic conditions, particularly in certain geographies, and in financial markets;
- new and future products and services;
- spending of our customers;
- our strategic direction, future business plans and growth strategy;
- industry and customer consolidation;
- expected demand for and benefits of our products and services;
- concentration of revenue sources;
- expectations regarding our CableOS solutions;
- expectations regarding the impact of warrants issued to Comcast on our business;
- potential future acquisitions and dispositions;
- anticipated results of potential or actual litigation;
- our competitive environment;
- the impact of our restructuring plans;
- the impact of governmental regulations, including with respect to tariffs and economic sanctions;
- anticipated revenue and expenses, including the sources of such revenue and expenses;
- expected impacts of changes in accounting rules;
- expectations regarding the usability of our inventory and the risk that inventory will exceed forecasted demand;
- expectations and estimates related to goodwill and intangible assets and their associated carrying value;
- expectations regarding the applicability of tax provisions, including with respect to credits related to our acquisition of Thomson Video Networks ("TVN"); and
- use of cash, cash needs and ability to raise capital, including repaying or refinancing our convertible notes.

These statements are subject to known and unknown risks, uncertainties and other factors, which may cause our actual results to differ materially from those implied by the forward-looking statements. Important factors that may cause actual results to differ from expectations include those discussed in "Risk Factors" beginning on page 14 in this Annual Report on Form 10-K. All forward-looking statements included in this Annual Report on Form 10-K are based on information available to us on the date thereof, and we assume no obligation to update any such forward-looking statements. The terms "Harmonic," "Company," "we," "us," "its," and "our", as used in this Annual Report on Form 10-K, refe Harmonic Inc. and its subsidiaries and its predecessors as a combined entity, except where the context requires otherwise.

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PART I

Item 1. BUSINESS

We are a leading global provider of (i) versatile and high performance video delivery software, products, system solutions and services that enable our customers to efficiently create, prepare, store, playout and deliver a full range of high-quality broadcast and "over-the-top" (OTT) video services to consumer devices, including televisions, personal computers, laptops, tablets and smart phones and (ii) cable access solutions that enable cable operators to more efficiently and effectively deploy high-speed internet, for data, voice and video services to consumers.

We operate in two segments, Video and Cable Access. Our Video business provides video processing and production and playout solutions and services worldwide to cable operators and satellite and telecommunications (telco) pay-TV service providers, which we refer to collectively as "service providers," and to broadcast and media companies, including streaming media companies. Our Video business infrastructure solutions are delivered either through shipment of our products, software licenses or as software-as-a-service ("SaaS") subscriptions. Our Cable Access business provides cable access solutions and related services, including our CableOS software-based cable access solution, primarily to cable operators globally.

Across our two business segments, we derived approximately 54% of our revenue from the Americas in 2018. The Europe, Middle East and Africa (EMEA) and Asia Pacific (APAC) regions accounted for 27% and 19% of our 2018 revenue, respectively.

Harmonic was initially incorporated in California in June 1988, and was reincorporated in Delaware in May 1995. Our principal executive offices are located at 4300 North First Street, San Jose, California 95134. Our telephone number is (408) 542-2500. Our Internet website is http://www.harmonicinc.com. Other than the information expressly set forth in this Annual Report on Form 10-K, the information contained or referred to on our website is not part of this report.

Industry Overview and Market Trends

Video Business

We believe our customers must continue to employ innovative technologies and services to address key trends in the dynamic video industry.

Demand for Video Services Anytime, Anywhere, on any Device. In our ubiquitous multiscreen video environment, video programming and content needs to be transformed into multiple formats, bit rates and resolutions for display on a broad range of devices.

Demand for High Quality Video. Consumer demand for high quality video anytime, anywhere and on any device requires ever-increasing bandwidth capacity in service providers' networks, as well as technology that maximizes network bandwidth efficiency. With the advent of Ultra High Definition (Ultra HD) televisions and OTT services increasingly being rendered in "4K" high resolution and consuming approximately four times the bandwidth of traditional HD channels, we believe next generation compression technologies, such as High Efficiency Video Compression (HEVC) or advances in H.264/AVC codecs, as well as increasing requirements for HDR encoding, will continue to remain a high priority for distributors of video.

Streaming Video Service. Consumer demand for video download and streaming services from streaming media companies such as Netflix, Hulu, Google (YouTube), Amazon (Prime Video) and Apple (iTunes) continue to experience significant global growth. These and other similar services aggregate third-party and original content and stream video "over-the-top" (OTT) to any Internet-connected device utilizing Internet service providers' networks at no incremental infrastructure cost to the consumer.

Time-Shifted Viewing. "Time-shifting" technologies include digital video recorders (DVRs), cloud and network DVRs (cDVR and nDVR) that allow a subscriber to store programming on the service provider's servers or in the cloud, and video-on-demand (VOD) services.

In response to these trends and the success of OTT streaming media companies, as well as the growing trend of "cord-cutters" (i.e., consumers who cancel traditional pay-TV subscriptions in favor of streaming services), "cord-shavers" (i.e., consumers who switch to smaller bundles of pay-TV subscriptions) and "cord-nevers" (i.e., consumers who have never had a pay-TV subscription):

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- service providers and broadcast and media companies continue to provide more of their own OTT streaming video services, including OTT streaming of live (or "linear") television programming;
- we believe providers of these OTT services will continue to expand monetization opportunities with personalized and dynamic ad insertion, thereby expanding technological and infrastructure requirements;
- service providers are competing to offer higher quality video signals in HD, including evolving initiatives to deliver video in 4K Ultra HD resolution;
- service providers are developing and expanding their content delivery and Internet Protocol (IP) networks, and increasing the capacity and efficiency of their networks with investments in various delivery infrastructure technologies to, among other things, maximize video quality and minimize bandwidth utilization;
- service providers continue to consolidate to achieve greater economies of scale and subscriber concentration, and acquire media companies to expand their content libraries and capabilities to develop original content;
- service providers continue to enhance and differentiate their content offerings, either through in-house development of new content or through acquisitions of existing content brands; and
- service providers have an ongoing need, despite the migration of traffic to OTT, to provide services over their existing broadcast distribution infrastructures.

We believe that the delivery of video over IP will continue to change traditional video viewing habits and distribution methods and alter the traditional advertising and subscription business models of major service providers.

Our Video Markets

Service Providers

- Cable Operators. Cable operators continue to focus on various initiatives to improve and differentiate their service offerings from competing service providers, including: bundled digital video, voice and high speed data services; expansion of VOD libraries and on-demand and streaming service offerings; upgraded consumer-facing applications; video delivery over IP to broadband enabled consumer devices; and capacity enhancement of high-speed data services.
- Satellite Operators. Satellite operators around the world have established digital television services that serve tens of millions of subscribers, with the ability to provide tens of thousands of linear channels. We believe these linear services will continue to grow, particularly in emerging markets, while, in parallel, satellite operators launch new streaming services, such as Sling TV and DirecTV Now, to address younger generation viewers and new consumption habits.
- Telcos. Telcos have established video offerings to successfully compete in the video marketplace, including high-quality HD content, larger VOD libraries, time-shifting television services, bundled voice, data and video packages and, more recently, streaming services. In many cases, telcos are making significant infrastructure investments to expand their video offerings into IP services and gain market share, while certain telcos are also acquiring satellite and/or cable companies to achieve market reach and scale.

Broadcast and Media Companies

- Network broadcasters, programmers and content owners require video contribution and distribution solutions to transmit live programming of news and sports to their studios for subsequent broadcast, and deliver the same programming and content to service providers for distribution to their subscribers. Broadcasters generally produce their own news and sports highlight content, along with hundreds of channels of network programming that is played-to-air under strict reliability requirements using playout servers and software.
- With broadcast and media companies continuing to expand their offerings to support a wide range of live and linear content and making content available in higher quality video formats and on-demand, we believe these trends are accelerating demand for functionally collapsed playout systems with integrated media orchestration software, as well as increasing demand for media servers and video-optimized storage solutions equipped to support higher resolution formats. In addition, in order to achieve faster time-to-market and reduce operational costs, we believe content providers are adopting cloud-based technologies and transitioning portions of their operations into public cloud environments, thereby enabling expanded services at a more rapid pace, the distribution of video directly to consumers or to distributors over IP and public networks, and more efficient and scalable global operations.

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- In the terrestrial broadcasting market, while broadcasters in various countries that have not yet completed converting from analog to digital transmission continue with change-over efforts, operators in numerous other countries around the world are adopting the next generation of digital transmission technologies, such as the DVB-T2 standard and ATSC 3.0 standards. The ongoing conversion from analog to digital transmission and the adoption of next-generation transmission standards provides the opportunity to deliver new channels, HD and Ultra HD services, premium content, and interactive services.

Over-the-Top (OTT)

- According to a 2017 Cisco study, IP video traffic accounts for a significant majority of Internet traffic globally, and video traffic will only continue to increase for the foreseeable future. We believe service providers and broadcast and media companies with OTT services and offerings will continue to require high-quality video processing solutions and new technologies in order to process and distribute large amounts of live and VOD content from a wide variety of sources to a broad array of consumer devices, and to optimize adaptive bitrate video streaming quality and bandwidth utilization.
- With the continued proliferation of OTT streaming content and program channels similar to channels currently available from service providers, monetizing this content through the use of national, regionalized and personalized advertising delivered to the varied devices of individual viewers has become a key area of focus for companies with OTT offerings. We believe OTT ad insertion and other related content customization solutions will continue to attract increased investments from OTT companies.

Emerging Markets

- With a growing middle class across emerging markets, we believe the Pay-TV business will continue to grow for the foreseeable future in the Asia Pacific region, South Asia, the Middle East, Africa and Central and South America. We currently derive a meaningful portion of our revenue from countries in emerging markets.
- Many consumers who are entering the middle class are now able to afford a monthly video service to gain access to their favorite programs and movies. We believe some of the leading video service providers serving emerging markets will experience high subscriber growth rates and may become worldwide industry leaders.
- We believe subscribers in these markets will demand increasingly sophisticated video services over time as consumer consumption trends in these markets track to those in more developed markets. A growing number of new regional OTT entrants in emerging markets, where global brands such as Netflix and Amazon's Prime Video are less dominant, are delivering a variety of OTT services and experiencing rapid growth. As a result, we believe that the infrastructure and technology investments of these service providers and new market entrants are likely to grow significantly for the foreseeable future.
- Media companies addressing emerging markets are aggressively investing in the creation of new content, particularly content that is localized and responsive to consumer demands, with the goal of creating strong brands and a growing, loyal customer base. We believe that this growth in content creation will require these media companies to significantly increase their capabilities in video storage, processing and related technologies.

Video Infrastructure Technology Trends

- Network Function Virtualization. We believe the industry will continue to adopt network function virtualization and unified video processing systems, whereby what had been historically discrete hardware video processing functions are integrated into software and run on the latest Intel processors in order to leverage high-performance and scalable appliance-based hardware, and as software-only virtual instances designed to run on private and/or public cloud environments.
- Unified Video Playout & Processing Systems. A unified video processing system requires software-based channel origination and playout capabilities, with integrated functionality such as graphics and branding insertion and media orchestration, and an integrated control system that streamlines playout processes, improves video quality, enables time-shift and cDVR functionality, while reducing server overhead. Also, when playout functionality is deployed to the cloud, the compression and OTT packaging and origin functionality (in addition to the capability to distribute over traditional broadcast distribution networks) associated with the playout will necessarily also need to be deployed in the cloud.
-

By combining historically discrete video chain functions into a unified playout and distribution system where content can be ingested, formatted, stored, played-to-air and compressed, packaged and delivered, we believe functionally collapsed video playout infrastructures with integrated control systems will enable content providers

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to produce more channels in higher resolution formats faster and more cost-effectively, and provide content in the widest possible range of formats.

- Outsourcing of Video Infrastructure Functionality. We believe there is industry momentum for shifting virtualized and unified video processing infrastructure from broadcast center or production facilities to third party SaaS offerings hosted on public cloud infrastructure. We believe this transition enables media companies and new OTT entrants to more rapidly adapt to market dynamics, utilize A/B testing methodologies to optimize service offerings and expand within and beyond core markets.

Cable Access Business

Industry Challenges

Cable operators continue to face challenges from the rapid growth of demand for broadband bandwidth in their networks, driven primarily by:

- more users with more connected devices and applications;
- bundled digital video, voice and high speed data services; and
- bandwidth-intensive VOD and OTT streaming video services, and cloud applications.

In addition, the operation of network infrastructure is space, power and personnel intensive. Hardware-centric networks can also be expensive to update or replace. To remain competitive, especially in the face of heightened competition from non-cable service providers such as telcos to deliver gigabit data rates, cable operators need to significantly upgrade existing equipment and network technologies.

Technology Trends

- DOCSIS 3.1. We believe the cable industry will continue to deploy the DOCSIS 3.1 standard, which enables high bandwidth data transfer over existing broadband infrastructure.
- Virtualization. We believe cable operators are moving toward more software-driven architectures. Virtualized software solutions that are decoupled from underlying hardware and run on commercial off-the-shelf (COTS) servers and/or cloud architectures allow for significantly increased efficiencies, upgradability, configuration flexibility, service agility and scalability not feasible with hardware-centric approaches. We believe a software-based cable access solution can significantly reduce cable headend costs, especially costs related to physical space and power consumption, and increase operational efficiency, and that the deployment of these systems will be an important step in cable operators’ transition to all-IP networks.
- Distributed Access Architecture. In addition to centralized cable access solutions, we believe there is growing interest in distributed Remote PHY solutions, particularly in competitive gigabit service markets where cable operators are competing with fiber-to-the-home (FTTH) services and are extending fiber networks deeper into their access networks. A Remote PHY architecture coupled with a software-based cable access solution running on COTS servers at a headend, and the distribution of Remote PHY nodes closer to end users, alleviates the power and space requirements of centralized systems at headend sites due to the fact that the RF processing is distributed into the field outside of the headend. We believe this distributed architecture will enable service providers to efficiently scale to support data and IP video growth.

Our Products and Solutions

Video Processing and Delivery Solutions

We offer a range of products and solutions that address the demand and market trends shaping our industry, including next-generation software-based media processing platforms. Our video processing solutions, which include network management software and application software and hardware products, provide our customers with the ability to acquire a variety of signals from different sources and in different protocols in order to deliver a variety of real-time and stored content to their subscribers for viewing on a broad range of devices.

Cloud media processing. An increasing number of service providers and media professionals are looking to cloud-based architectures for their media processing workflows, which is a fundamental shift from traditional, hardware-based approaches. We have addressed, and continue to address, this changing landscape with our VOS Cluster software application, which transforms traditional video processing and delivery architectures into a fully integrated set of cloud-native functions and enables ease of migration between data center computing, public clouds and private clouds, thereby accelerating the time to

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market for new broadcast and OTT services. Our VOS360 offering provides these same capabilities in a public cloud environment, and maintenance operations of the VOS Cluster are the responsibility of Harmonic.

Broadcast and OTT encoders. Our high-performance encoders compress video, audio and data channels to low bit rates while maintaining high video quality. Our latest software-based Electra encoders can deliver video in multiple formats, including standard, HD and Ultra HD, and in any video compression standard, including MPEG-2, MPEG-4 AVC and HEVC. This capability allows the encoders to converge workflows targeted for all forms of video delivery, whether broadcast, cable, satellite, IPTV or OTT. Today's Electra and VOS solutions all leverage the same Harmonic PURE Compression Engine, a software-based technology that incorporates many of the encoding algorithm and processing techniques developed by Harmonic over the past two decades. The benefits of the PURE Compression Engine include a faster rate of video quality innovation, the ability to dynamically balance workflow efficiency and resource utilization, and improved investment protection. Our EyeQ real-time content-aware encoding solution is an optional enhancement for systems featuring PURE Compression. The EyeQ compression solution leverages the mechanics of the human eye to assess video quality and optimize encoding parameters in real time. Our VOS Cluster software application supports a subset of broadcast and OTT encoding functionality.

Contribution encoders. Our ViBE contribution encoders provide broadcasters with video compression solutions for real-time news gathering, live sports coverage and other remote events, and enable our customers to deliver these feeds to their studios for further processing. Our latest models can encode HD and Ultra HD video signals in HEVC or AVC 4:2:2 10-bit resolution, enabling the transmission of very high-quality video with very low latency.

High-density transcoders and stream processing. We offer high-density, real-time transcoding of video for broadcast and OTT delivery with our Electra XT Xtream transcoder. This modular and scalable platform is designed to cost effectively transcode any incoming audio and video signal at a "good enough" video quality. Our latest ProStream X and ProStream XVM real-time stream processing systems are software-based and provide high-performance, high-throughput processing for mission-critical IP video delivery applications, including multiplexing, scrambling, splicing and blackout switching. Our VOS Software Cluster software application supports stream processing.

Multiscreen delivery. Our VOS Cluster software application enables the packaging and delivery of high-quality OTT services, including live streaming, VOD, catch-up TV, start-over TV, nDVR and cDVR services through hypertext transfer protocol (HTTP) streaming to any device. Capabilities include real-time and file-based transcoding, stream packaging, and multiscreen workflow management, as well as support for digital rights management (DRM) processes with a number of DRM partners. Our VOS Cluster application ingests transcoded, segmented and encrypted output from Electra systems to provide high-volume live adaptive bitrate streaming and the delivery of time-shifted services.

Decoders and descramblers. Our family of ProView integrated receivers-decoder (IRD) products allows service providers to acquire content delivered via satellite, IP or terrestrial networks for distribution to their subscribers. These products, including the ProView 7100 and ProView 8100 series, are used by broadcasters to decode signals backhauled from live news and sporting events in contribution applications, as well as by content owners looking to distribute their content in a controlled manner to a large base of video service providers. Our VOS Cluster software applications support a subset of these decoding and descrambling capabilities.

Video servers. Our video playout solutions, including media orchestration software, are based on scalable video servers used by broadcast and media companies to create and playout television channels. Our Spectrum family of video server systems are used by broadcast and media companies to create play-to-air television channels. Our customers typically use these video server products to record incoming content from either live feeds or from tapes, encoding that content in real-time into standard media files that are then stored in the server's file system until the content is needed for playback as part of a scheduled playlist. Clips stored in the server are decoded in real-time and played-to-air according to a playout schedule in a frame-accurate, back-to-back manner to create a seamless television channel. Our Spectrum servers support SD, HD and Ultra HD programming, as well as many different media formats. Our Polaris media orchestration software solutions work with our Spectrum products and provide our customers with playout management and control tools for channel-in-a-box and integrated channel playout applications. Our VOS Cluster software application supports a subset of these video server functionalities.

Video-optimized Storage

MediaGrid. Our MediaGrid shared storage system is a scale-out, network-attached storage system with a built-in media file system optimized for media production workflows. Architected as a clustered storage system with a distributed file system, MediaGrid provides highly scalable storage capacity and access bandwidth to support demanding media production applications, such as video editing, content transformation and media library management. In addition, MediaGrid systems are increasingly being employed for VOD, time-shifted television services and OTT adaptive bitrate streaming. Our VOS Cluster

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software application relies on external infrastructure for storage, and is compatible with MediaGrid video-optimized storage when deployed into a customer's traditional data center environment.

Unified Video Playout and Processing SaaS

Cloud-native SaaS solutions. Our VOS360 SaaS solution provides the functionality of our VOS Cluster in public cloud environments and is designed to be deployable in any public cloud infrastructure. With the VOS360 service, the maintenance operations of the VOS Cluster are the responsibility of Harmonic.

Cable Access Products and Solutions

Software-Based Cable Access Solution. As demand continues to rapidly grow for high-speed broadband services such as OTT streaming, VOD, time-shift TV and cloud DVR, we believe we can help cable operators take advantage of this opportunity with our CableOS software-based cable access solution, an end-to-end cable access solution that we believe delivers unprecedented scalability, agility and cost savings. Our CableOS solution enables the migration to multi-gigabit broadband capacity and the fast deployment of DOCSIS 3.1 data, video and voice services. We believe our solution resolves space and power constraints in the headend and hub, eliminates dependence on hardware upgrade cycles, and reduces total cost of ownership. Our CableOS solution can be deployed based on a centralized, distributed Remote PHY or hybrid architecture.

Edge QAM products. Our Narrowcast Services Gateway (NSG) products are fully integrated edge gateway products that integrate routing, multiplexing, scrambling and modulation into a single package for the delivery of narrowcast services to subscribers over cable networks. NSG systems allow cable operators to deliver IP signals from the headend to the edge of the network for subsequent modulation onto a HFC network. Originally developed for VOD applications, the NSG has evolved to support multiple applications, including switched digital video and modular CMTS applications, as well as large-scale VOD deployments.

Since we historically have not addressed the CMTS market and 2018 was our first year of generating revenues in this new market, we believe that our CableOS solution, which includes a software-based CMTS, will have an opportunity to be sold into a significantly larger and growing market, with growth driven by virtualization and the distributed Remote PHY architecture.

Technical Support and Professional Services

We provide maintenance and support services to most of our customers under service level agreements that are generally renewed on an annual basis. We also provide consulting, implementation and integration services to our customers worldwide. We draw upon our expertise in broadcast television, communications networking and compression technology to design, integrate and install complete solutions for our customers, including integration with third-party products and services. We offer a broad range of services, including program management, technical design and planning, building and site preparation, integration and equipment installation, end-to-end system testing and comprehensive training.

Customers

We sell our products to a variety of cable, satellite and telco, and broadcast and media companies. Set forth below is a representative list of our significant end user and integrator/reseller customers, listed alphabetically, based, in part, on revenue during 2018.

United States	International
AT&T	Arquiva
Buckeye Cable	Bell TV
Charter Communications	Groupe Canal+
Comcast	Netorium
Cox Communications	SCSK Corp.
DigitalGlue	Sky Italia
Dish Network	Sky Perfect JSAT Corp.
GatesAir	Sony
Heartland Video Systems	Telecom Argentina
Turner Broadcasting	Vodafone

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Sales to our 10 largest customers in 2018, 2017 and 2016 accounted for approximately 37%, 24% and 28% of our net revenue, respectively. Although we continue to seek to broaden our customer base by penetrating new markets and further expanding internationally, we expect to see continuing industry consolidation and customer concentration. During 2018, Comcast accounted for 15% of our net revenue. During 2017 and 2016, no single customer accounted for more than 10% of our net revenue. The loss of any significant customer, or any material reduction in orders from any significant customer, or our failure to qualify our new products with any significant customer could materially and adversely affect our operating results, financial condition and cash flows. In addition, we are involved in most quarters in one or more relatively large individual transactions. A decrease in the number of relatively larger individual transactions in which we are involved in any quarter could adversely affect our operating results for that quarter.

Sales and Marketing

In the U.S. and internationally, we sell our products through our own direct sales force, as well as through independent resellers and systems integrators. Our direct sales team is organized geographically and by major customers and markets to support customer requirements. Our principal sales offices outside of the U.S. are located in Europe and Asia, and we have a support center in Switzerland to support our international customers and operations. Our international resellers are generally responsible for importing our products and providing certain installation, technical support and other services to customers in their territory after receiving training from us.

Our direct sales force and resellers are supported by a highly trained technical staff, which includes application engineers who work closely with our customers to develop technical proposals and design systems to optimize system performance and economic benefits for our customers. Our technical support teams provide a customized set of services, as required, for ongoing maintenance, support-on-demand and training for our customers and resellers, both in our facilities and on-site.

Our product management organization develops strategies for product lines and markets and, in conjunction with our sales force, identifies the evolving technical and application needs of customers so that our product development resources can be most effectively and efficiently deployed to meet anticipated product requirements. Our product management organization is also responsible for setting price levels, demand forecasting and general support of the sales force, particularly at major accounts.

Our corporate marketing organization is responsible for building awareness of the Harmonic brand in our markets and driving engagement with our strategies, solutions and products. The group develops all of our corporate messaging and manages all customer and industry communication channels, including public relations, Web and social media, events and trade shows, as well as demand generation marketing campaigns in conjunction with our sales force.

Manufacturing and Suppliers

We rely on third-party contract manufacturers to assemble our products and the subassemblies and modules for our products. In 2003, we entered into an agreement with Plexus Services Corp. to act as our primary contract manufacturer. Plexus currently provides us with a majority, of the products we purchase from our contract manufacturers. This agreement has automatic annual renewals, unless prior notice for nonrenewal is given, and has been automatically renewed for a term expiring in October 2019. We do not generally maintain long-term agreements with any of our contract manufacturers.

Many components, subassemblies and modules necessary for the manufacture or integration of our products are obtained from a sole supplier or a limited group of suppliers. While we expend considerable efforts to qualify additional component sources, consolidation of suppliers in the industry and the small number of viable alternatives have limited the results of these efforts. We do not generally maintain long-term agreements with any of our suppliers.

Intellectual Property

As of December 31, 2018, we held 81 issued U.S. patents and 53 issued foreign patents and had 91 patent applications pending. Although we attempt to protect our intellectual property rights through patents, trademarks, copyrights, licensing arrangements, maintaining certain technology as trade secrets and other measures, we cannot assure you that any patent, trademark, copyright or other intellectual property rights owned by us will not be invalidated, circumvented or challenged, that such intellectual property rights will provide competitive advantages to us, or that any of our pending or future patent applications will be issued with the claims, or the scope of the claims, sought by us, if at all. We cannot assure you that others

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will not develop technologies that are similar or superior to our technology, duplicate our technology or design around the patents that we own. In addition, effective patent, copyright and trade secret protection may be unavailable or limited in which we do business or may do business in the future.
We enter into confidentiality or license agreements with our employees, consultants, vendors and customers as needed, and generally limit access to, and distribution of, our proprietary information. However, no assurances can be given that these actions will prevent misappropriation of our technology. In addition, if necessary, we are prepared to take legal action, in the future, to enforce our patents and other intellectual property rights, to protect our trade secrets, to determine the validity and scope of the proprietary rights of others, or to defend against claims of infringement or invalidity. Any such litigation could result in substantial costs and diversion of resources, including management time, and could negatively affect our business, operating results, financial position and cash flows.
In order to successfully develop and market our products, we may be required to enter into technology development or licensing agreements with third parties. Although many companies are often willing to enter into such technology development or licensing agreements, we cannot assure you that such agreements can be negotiated on reasonable terms or at all. The failure to enter into technology development or licensing agreements, when necessary, could limit our ability to develop and market new products and could harm our business.

Backlog

We schedule production of our products and solutions based upon our backlog, open contracts, informal commitments from customers and sales projections. Our backlog consists of unfilled firm purchase orders by our customers which have not been completed. Approximately 82% of our backlog is projected to be converted to revenue within a rolling one-year period. As of December 31, 2018 and 2017, we had backlog, including deferred revenue, of $186.4 million and $224.4 million, respectively. Delivery schedules on such orders may be deferred or canceled for a number of reasons, including reductions in spending by our customers or changes in specific customer requirements. In addition, due to annual budget cycles at many of our customers, the amount of our backlog at any given time is not necessarily indicative of actual revenues for any succeeding period.

Competition

The markets for video infrastructure systems are extremely competitive and have been characterized by rapid technological change and declining average selling prices. The principal competitive factors in these markets include product performance, functionality and features, reliability, pricing, breadth of product offerings, brand recognition and awareness, sales and distribution capabilities, technical support and services, and relationships with end customers. We believe that we compete favorably in each of these categories.
Large integrated system suppliers, such as Arris Group, Cisco Systems and Ericsson, with which we have historically competed in our Video business segment, announced sale and divestiture transactions in the last several months that impacted these companies’ video businesses: Arris announced a definitive agreement to be acquired by CommScope; Cisco Systems sold its video solutions group (now called Synamedia) to Permira, a private equity firm; and Ericsson completed the sale of a majority stake in its MediaKind video technology business to One Equity Partners, a private equity firm. In certain product lines, our competitors include companies such as ATEME and Elemental Technologies (an Amazon Web Services company). With respect to production and playout products, competitors include Evertz Microsystems, EVS, Grass Valley (a Belden brand) and Imagine Communications. In the OTT market, our competitors include end-to-end online video platforms such as Brightcove and Verizon Digital Media Services, who provide comprehensive OTT infrastructure solutions, some of which overlap with our products and services.

Our competitors in our Cable Access business include Arris, Casa Systems, Cisco Systems and Huawei Technologies.

Research and Development

We have historically devoted a significant amount of our resources to research and development. Research and development expenses in 2018, 2017 and 2016 were approximately $89.2 million, $96.0 million and $98.4 million, respectively. Research and development expenses as a percentage of revenue in 2018, 2017 and 2016 were approximately 22.1%, 26.8% and 24.2%, respectively. Our internal research and development activities are conducted primarily in the United States (California, Oregon and New Jersey), France, Israel and Hong Kong. In addition, a portion of our research and development is conducted through third-party partners with engineering resources in Ukraine and in India.

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Our research and development program is primarily focused on developing new products and systems, and adding new features and other improvements to existing products and systems. Our development strategy is to identify features, products and systems, in both software and hardware solutions, that are, or are expected to be, needed by our customers. For our Video business segment, our current research and development efforts are focused on next-generation video processing and delivery across different deployment environments, particularly cloud-native and SaaS delivery models, and enhanced video compression, video quality, and multiscreen solutions. We also devote significant resources to production and playout and distribution solutions. With respect to our Cable Access business segment, our major research and development efforts are focused on cable access solutions for both video and data, particularly the ongoing development of our centralized and distributed CableOS software-based cable access solutions.

Our success in designing, developing, manufacturing and selling new or enhanced products will depend on a variety of factors, including the identification of market demand for new products, product selection, timely product design and development, product performance, effective manufacturing and assembly processes and sales and marketing. Because of the complexity inherent in such research and development efforts, we cannot assure you that we will successfully develop new products, or that new products developed by us will achieve market acceptance. Our failure to successfully develop and introduce new products would materially and adversely affect our business, operating results, financial condition and cash flows.

Employees

As of December 31, 2018, we employed a total of 1,162 full time employees, including 425 in research and development, 190 in sales, 293 in service and support, 57 in operations, 78 in marketing (corporate and product) and 119 in a general and administrative capacity. Of those employees, 375 were located in the U.S. and 787 employees were located in foreign countries in South America, the Middle East, Europe, Asia and Canada. From time to time, we also employ a number of temporary employees and consultants on a contract basis. Our employees in France are represented by labor unions and an employee works council. None of our other employees are represented by a labor union with respect to their employment with us. We have not experienced any work stoppages, and we consider our relations with our employees to be good.

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Available Information

Harmonic makes available free of charge, on the Harmonic web site, the Company's Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K (via link to the SEC website, which itself is available at http://www.sec.gov), and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after Harmonic files such material with, or furnishes such material to, the Securities and Exchange Commission. The address of the Harmonic web site is http://www.harmonicinc.com. Except as expressly set forth in this Form 10-K, the contents of our web site are not incorporated into, or otherwise to be regarded as part of, this report.

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Item 1A. RISK FACTORS

We depend on cable, satellite and telco, and broadcast and media industry spending for our revenue and any material decrease or delay in spending in any of these industries would negatively impact our operating results, financial condition and cash flows.

Our revenue has been derived from worldwide sales to service providers and broadcast and media companies, as well as, in recent years, streaming media companies. We expect that these markets will provide our revenue for the foreseeable future. Demand for our products will depend on the magnitude and timing of spending by customers in each of these markets for the purpose of creating, expanding or upgrading their systems. These spending patterns are dependent on a variety of factors, including:

• the impact of general economic conditions, actual and projected;

• access to financing;

• annual budget cycles of customers in each of the industries we serve;

• the impact of industry consolidation;

• customers suspending or reducing spending in anticipation of: (i) new video or cable industry standards; (ii) industry trends and technology shifts, such as virtualization and cloud-based solutions, and (iii) new products, such as products and services based on our VOS software platform or our CableOS software-based cable access solution;

• delayed or reduced spending as customers transition to or contemplate adopting new business and operating models enabled by software- and cloud-based solutions, including software-as-a-service (SaaS) unified video processing solutions;

• federal, state, local and foreign government regulation of telecommunications, television broadcasting and streaming media;

• overall demand for communication services and consumer acceptance of new video and data technologies and services;

• competitive pressures, including pricing pressures;

• the impact of fluctuations in currency exchange rates; and

• discretionary end-user customer spending patterns.

In the past, specific factors contributing to reduced spending have included:

• weak or uncertain economic and financial conditions in the U.S. or one or more international markets;

• uncertainty related to development of digital video industry standards;

• delays in evaluations of new services, new standards and systems architectures by many operators;

• emphasis by operators on generating revenue from existing customers, rather than from new customers, through construction, expansion or upgrades;

• a reduction in the amount of capital available to finance projects of our customers and potential customers;

• proposed and completed business combinations and divestitures by our customers and the length of regulatory review of each;

• completion of a new system or significant expansion or upgrade to a system; and

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• bankruptcies and financial restructuring of major customers.

In the past, adverse economic conditions in one or more of the geographies in which we offer our products have adversely affected our customers' spending in those geographies and, as a result, our business. During challenging economic times, and in tight credit markets, many customers may delay or reduce capital expenditures. This could result in reductions in revenue from our products, longer sales cycles, difficulties in collection of accounts receivable, slower adoption of new technologies and increased price competition. If global economic and market conditions, or economic conditions in the U.S., Europe or other key markets, deteriorate, we could experience a material and adverse effect on our business, results of operations, financial condition and cash flows. Additionally, since most of our international revenue is denominated in U.S. dollars, global economic and market conditions may impact currency exchange rates and cause our products to become relatively more expensive to customers in a particular country or region, which could lead to delayed or reduced spending in those countries or regions, thereby negatively impacting our business and financial condition.

In addition, industry consolidation has in the past constrained, and may in the future constrain or delay, spending by our customers. Further, if our product portfolio and product development plans do not position us well to capture an increased portion of the spending of customers in the markets on which we focus, our revenue may decline.

As a result of these various factors and potential issues related to customer spending, we may not be able to maintain or increase our revenue in the future, and our operating results, financial condition and cash flows could be materially and adversely affected.

The markets in which we operate are intensely competitive.

The markets for our products are extremely competitive and have been characterized by rapid technological change and declining average sales prices in the past.

Large integrated system suppliers, such as Arris Group, Cisco Systems and Ericsson, with which we have historically competed in our Video business segment, announced sale and divestiture transactions in the last several months that impacted these companies' video businesses: Arris announced a definitive agreement to be acquired by CommScope; Cisco Systems sold its video solutions group (now called Synamedia) to Permira, a private equity firm; and Ericsson completed the sale of a majority stake in its MediaKind video technology business to One Equity Partners, a private equity firm. In certain product lines, our competitors include companies such as ATEME and Elemental Technologies (an Amazon Web Services company). With respect to production and playout products, competitors include Evertz Microsystems, EVS, Grass Valley (a Belden brand) and Imagine Communications. In the OTT market, our competitors include end-to-end online video platforms such as Brightcove and Verizon Digital Media Services, who provide comprehensive OTT infrastructure solutions, some of which overlap with our products and services. Our competitors in our Cable Access business include Arris, Casa Systems, Cisco Systems and Huawei Technologies.

A number of our principal business competitors in both of our business segments are substantially larger and/or may have access to greater financial, technical, marketing and other resources than we have. Consolidation in the Video industry has led to the acquisition of a number of our historic competitors over the last several years by substantially larger companies and private equity firms. With respect to our Cable Access business, our competitors are also substantially larger than us, and the pending acquisition of Arris by CommScope will create a significantly larger combined business.

In addition, some of our larger competitors have more long-standing and established relationships with domestic and foreign customers. Many of these large enterprises are in a better position to withstand any significant reduction in spending by customers in our markets. They often have broader product lines and market focus, and may not be as susceptible to downturns in a particular market. These competitors may also be able to bundle their products together to meet the needs of a particular customer, and may be capable of delivering more complete solutions than we are able to provide. To the extent large enterprises that currently do not compete directly with us choose to enter our markets by acquisition or otherwise, competition would likely intensify.

Further, some of our competitors that have greater financial resources have offered, and in the future may offer, their products at lower prices than we offer for our competing products or on more attractive financing or payment terms, which has in the past caused, and may in the future cause, us to lose sales opportunities and the resulting revenue or to reduce our prices in response to that competition. Also, some competitors that are smaller than we are have engaged in, and may continue to engage in, aggressive price competition in order to gain customer traction and market share. Reductions in prices for any of our products could materially and adversely affect our operating margins and revenue.

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Additionally, certain customers and potential customers have developed, and may continue to develop, their own solutions that may cause such customers or potential customers to not consider our product offerings or to displace our installed products with their own solutions. The growing availability of open source codecs and related software, as well as new server chipsets that incorporate encoding technology, has, in certain respects, lowered the barriers to entry for the video processing industry. The development of solutions by potential and existing customers and the reduction of the barriers to entry to enter the video processing industry could result in increased competition and adversely affect our results of operations and business.

If any of our competitors' products or technologies were to become the industry standard, our business could be seriously harmed. If our competitors are successful in bringing their products to market earlier than us, or if these products are more technologically capable than ours, our revenue could be materially and adversely affected.

We need to develop and introduce new and enhanced products in a timely manner to meet the needs of our customers and to remain competitive.

All of the markets we address are characterized by continuing technological advancement, changes in customer requirements and evolving industry standards. To compete successfully, we must continually design, develop, manufacture and sell new or enhanced products that provide increasingly higher levels of performance and reliability and meet our customers changing needs. However, we may not be successful in those efforts if, among other things, our products:

• are not cost effective;

• are not brought to market in a timely manner;

• are not in accordance with evolving industry standards;

• fail to meet market acceptance or customer requirements; or

• are ahead of the needs of their markets.

We are currently developing and marketing products based on the latest video compression standards, such as HEVC, which provides significantly greater compression efficiency, thereby making more bandwidth available to operators. At the same time, we continue to devote development resources to enhance the existing AVC/H.264 compression of our products, which many of our customers continue to require. There can be no assurance that these efforts will be successful in the near future, or at all, or that our competitors will not take significant market share in encoding or transcoding.

We continue to focus our development efforts on key product solutions in our Video and Cable Access businesses. Our VOS solution is a software-based, cloud-enabled platform that unifies the entire media processing chain, from ingest to delivery. We have launched a number of VOS-based product solutions and services, including our VOS Cluster and VOS360 SaaS solutions, and continue to develop and expand the capabilities of our VOS software platform. In our Cable Access business, we have launched and continue to develop our CableOS software-based cable access solutions.

Many of these products and initiatives are intended to integrate existing and new features and functions in response to shifts in customer demands in the relevant market, as well as to general technology trends that we believe will significantly impact our industry. The success of these significant and costly development efforts will be predicated, for certain products and initiatives, on the timing of market adoption of the new standards on which the resulting products are based, and for other products, the timing of customer adoption of our products and solutions, as well as our ability to timely develop the features and capabilities of our products and solutions. If new standards or some of our new products are adopted later than we predict or not adopted at all, or if adoption occurs earlier than we are able to deliver the applicable products or functionality, we risk spending significant research and development time and dollars on products or features that may never achieve market acceptance or that miss the customer demand window and thus do not produce the revenue that a timely introduction would have likely produced.

If we fail to develop and market new and enhanced products on a timely basis, our operating results, financial condition and cash flows could be materially and adversely affected.

Our software-based cable access product initiatives expose us to certain technology transition risks that may adversely impact our operating results, financial condition and cash flows.

We believe our CableOS software-based cable access solutions, supporting centralized, distributed Remote PHY or

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hybrid configurations, will significantly reduce cable headend costs and increase operational efficiency, and are an important step in cable operators' transition to all-IP networks. If we are unsuccessful in developing and deploying our cable access solutions in a timely manner, or are otherwise delayed in making our solutions available to our customers, our business may be adversely impacted, particularly if our competitors develop and market similar products and solutions before we do.

We believe software-based cable access solutions will, over time, replace and make obsolete current CMTS solutions, which is a market our products have historically not addressed, as well as cable edge-QAM products. If demand for our software-based cable access solutions is weaker than expected, , our near and long-term operating results, financial condition and cash flows could be adversely impacted. Further, in September 2016 we granted Comcast a warrant (the "Warrant") to purchase shares of our common stock to further incentivize them to purchase our products and adopt our technologies, particularly our CableOS software-based cable access solution. If Comcast deploys our CableOS solution in its networks more slowly than we anticipate or at a scale below our expectations, we may be unable to fully realize the anticipated benefits of our relationship with Comcast and our business and operating results, financial condition and cash flows could be materially and adversely affected. Moreover, if competitors adapt new cable industry technology standards into competing cable access solutions faster than we do, or promulgate a new or competitive architecture for next-generation cable access solutions that renders our CableOS solution obsolete, our business may be adversely impacted.

The sales cycle for our CableOS solutions tends to be long. For cable operators, upgrading or expanding network infrastructure is complex and expensive, and investing in a CableOS solution is a significant strategic decision that may require considerable time to evaluate, test and qualify. Potential customers need to ensure our CableOS solution will interoperate with the various components of its existing network infrastructure, including third-party equipment, servers and software. In addition, since we are a relatively new entrant into the CMTS market, we need to demonstrate significant performance, functionality and/or cost advantages with our CableOS solutions that outweigh customer switching costs. If sales cycles are significantly longer than anticipated or we are otherwise unsuccessful in growing our CableOS sales, our operating results, financial condition and cash flows could be materially and adversely affected.

Our future growth depends on market acceptance of several broadband services, on the adoption of new broadband technologies, and on several other broadband industry trends.

Future demand for many of our products will depend significantly on the growing market acceptance of emerging broadband services, including digital video, VOD, Ultra HD, IP video services (particularly streaming to tablet computers, connected TVs and mobile devices) and very high-speed data services. The market demand for such emerging services is rapidly growing, with many custom or proprietary systems in use, which increases the challenge of delivering interoperable products intended to address the requirements of such services.

The effective delivery of these services will depend, in part, on a variety of new network architectures, standards and devices, such as:

• the adoption of cloud-native media processing architectures;

• the adoption of advanced video compression standards, such as next generation H.264 compression and HEVC;

• the adoption of our cable access solutions;

• fiber to the premises, or FTTP, networks designed to facilitate the delivery of video services by telcos;

• the greater use of protocols such as IP;

• the further adoption of bandwidth-optimization techniques, such as DOCSIS 3.0 and DOCSIS 3.1 and associated specifications; and

• the introduction of new consumer devices, such as advanced set-top boxes, cloud DVRs, connected TVs, tablet computers, and a variety of smart phone mobile devices.

If adoption of these emerging services and/or technologies is not as widespread or as rapid as we expect, or if we are unable to develop new products based on these technologies on a timely basis, our operating results, financial condition and cash flows could be materially and adversely affected.

Furthermore, other technological, industry and regulatory trends and requirements may affect the growth of our business.

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These trends and requirements include the following:

- convergence, whereby network operators bundle video, voice and data services to consumers, including mobile delivery options;

- the increasing availability of traditional broadcast video content and video-on-demand on the Internet;

- adoption of high-bandwidth technology, such as DOCSIS 3.x, next generation LTE and FTTP;

- the use of digital video by businesses, governments and educational institutions;

- efforts by regulators and governments in the U.S. and internationally to encourage the adoption of broadband and digital technologies, as well as to regulate broadband access and delivery;

- consumer interest in higher resolution video such as Ultra HD or retina-display technologies on mobile devices;

- the need to develop partnerships with other companies involved in video infrastructure workflow and broadband services;

- the continued adoption of the television viewing behaviors of consumers in developed economies by the growing middle class across emerging economies;

- the extent and nature of regulatory attitudes towards issues such as network neutrality, competition between operators, access by third parties to networks of other operators, local franchising requirements for telcos to offer video, and other new services, such as mobile video; and

- the outcome of disputes and negotiations between content owners and service providers regarding rights of service providers to store and distribute recorded broadcast content, which outcomes may drive adoption of one technology over another in some cases.

If we fail to recognize and respond to these trends, by timely developing products, features and services required by these trends, we are likely to lose revenue opportunities and our operating results, financial condition and cash flows could be materially and adversely affected.

We depend significantly on our international revenue and are subject to the risks associated with international operations, including those of our resellers, contract manufacturers and outsourcing partners, which may negatively affect our operating results.

Revenue derived from customers outside of the U.S. in the fiscal years ended December 31, 2018, 2017 and 2016 represented approximately 55%, 63% and 58% of our revenue, respectively. Although no assurance can be given with respect to international sales growth in any one or more regions, we expect that international revenue will likely continue to represent, from year to year, a majority, and potentially increasing, percentage of our annual revenue for the foreseeable future. A significant percentage of our revenue is generated from sales to resellers, value-added resellers (“VARs”) and systems integrators, particularly in emerging market countries. Furthermore, the majority of our employees are based in our international offices and locations, and most of our contract manufacturing occurs outside of the U.S. In addition, we outsource a portion of our research and development activities to certain third-party partners with development centers located in different countries, particularly Ukraine and India.

Our international operations, the international operations of our resellers, contract manufacturers and outsourcing partners, and our efforts to maintain and increase revenue in international markets are subject to a number of risks, which are generally greater with respect to emerging market countries, including the following:

• growth and stability of the economy in one or more international regions;

• fluctuations in currency exchange rates;

• changes in foreign government regulations and telecommunications standards;

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• import and export license requirements, tariffs, taxes, economic sanctions, contractual limitations and other trade barriers;

• our significant reliance on resellers and others to purchase and resell our products and solutions, particularly in emerging market countries;

• availability of credit, particularly in emerging market countries;

• longer collection periods and greater difficulty in enforcing contracts and collecting accounts receivable, especially from smaller customers and resellers, particularly in emerging market countries;

• compliance with the U.S. Foreign Corrupt Practices Act (the "FCPA"), the U.K. Bribery Act and/or similar anti-corruption and anti-bribery laws, particularly in emerging market countries;

• the burden of complying with a wide variety of foreign laws, treaties and technical standards;

• fulfilling "country of origin" requirements for our products for certain customers;

• difficulty in staffing and managing foreign operations;

• business and operational disruptions or delays caused by political, social and economic instability and unrest, including risks related to terrorist activity, particularly in emerging market countries (e.g., recent significant civil, political and economic disturbances in Ukraine);

• changes in economic policies by foreign governments, including the imposition and potential continued expansion of economic sanctions by the U.S. and the European Union on the Russian Federation;

• changes in diplomatic and trade relationships, including the imposition of new trade restrictions, trade protection measures, import or export requirements, trade embargoes and other trade barriers, including those imposed by the U.S. against China;

• any negative economic impacts resulting from the political environment in the U.S. or the U.K.'s referendum to exit the European Union; and

• business and economic disruptions and delays caused by outbreaks of disease, epidemics and potential pandemics.

We have certain international customers who are billed in their local currency, primarily the Euro, British pound and Japanese yen, which subjects us to foreign currency risk. In addition, a portion of our operating expenses relating to the cost of certain international employees, are denominated in foreign currencies, primarily the Euro, Israeli shekel, British pound, Singapore dollar, Chinese yuan and Indian rupee. Although we do hedge against the Euro, British pound, Israeli shekel and Japanese yen, gains and losses on the conversion to U.S. dollars of accounts receivable, accounts payable and other monetary assets and liabilities arising from international operations may contribute to fluctuations in our operating results. Furthermore, payment cycles for international customers are typically longer than those for customers in the U.S. Unpredictable payment cycles could cause us to fail to meet or exceed the expectations of security analysts and investors for any given period.

Most of our international revenue is denominated in U.S. dollars, and fluctuations in currency exchange rates could cause our products to become relatively more expensive to customers in a particular country or region, leading to a reduction in revenue or profitability from sales in that country or region. The potential negative impact of a strong

U.S. dollar on our business may be exacerbated by the significant devaluation of a number of foreign currencies. Also, if the U.S. dollar were to weaken against many foreign currencies, there can be no assurance that a weaker dollar would lead to growth in customer spending in foreign markets.

Our operations outside the U.S. also require us to comply with a number of U.S. and international regulations that prohibit improper payments or offers of payments to foreign governments and their officials and political parties for corrupt purposes. For example, our operations in countries outside the U.S. are subject to the FCPA and similar laws, including the U.K. Bribery Act. Our activities in certain emerging countries create the risk of unauthorized payments or offers of payments by one of our employees, consultants, sales agents or channel partners that could be in violation of various anti-corruption laws, even though these parties may not be under our control. Under the FCPA and U.K. Bribery Act, companies may be held liable for the corrupt actions taken by their directors, officers, employees, channel partners, sales agents, consultants, or other strategic or local partners or representatives. We have internal control policies and procedures with respect to FCPA compliance, have implemented FCPA training and compliance programs for our employees, and include in our agreements with resellers a requirement that those parties comply with the FCPA. However, we cannot provide assurances that our policies, procedures and programs will prevent violations of the FCPA or similar laws by our employees or agents, particularly in emerging market countries, and as we expand our international operations. Any such violation, even if prohibited by our policies, could result in criminal or civil sanctions against us.

The effect of one or more of these international risks could have a material and adverse effect on our business, financial condition, operating results and cash flows.

We purchase several key components, subassemblies and modules used in the manufacture or integration of our products from sole or limited sources, and we rely on contract manufacturers and other subcontractors.

Many components, subassemblies and modules necessary for the manufacture or integration of our products are obtained from a sole supplier or a limited group of suppliers. For example, we depend on two suppliers for certain video encoding chips which are incorporated into several products. Our reliance on sole or limited suppliers, particularly foreign suppliers, and our reliance on contractors for manufacturing and installation of our products, involves several risks, including a potential inability to obtain an adequate supply of required components, subassemblies or modules; reduced control over costs, quality and timely delivery of components, subassemblies or modules; supplier discontinuation of components, subassemblies or modules we require; and timely installation of products. In addition, our financial results may be impacted by tariffs imposed by the U.S. on goods from other countries and tariffs imposed by other countries on U.S. goods, including the tariffs proposed by the U.S. government on various imports from China and by the Chinese government on certain U.S. goods, the scope and duration of which, if implemented, remain uncertain. If any such tariffs are imposed on products or components that we import, including those obtained from a sole supplier or a limited group of suppliers, we could experience reduced revenues or may have to raise our prices, either of which could have an adverse effect on our business, financial condition and operating results.

These risks could be heightened during a substantial economic slowdown, because our suppliers and subcontractors are more likely to experience adverse changes in their financial condition and operations during such a period. Further, these risks could materially and adversely affect our business if one of our sole sources, or a sole source of one of our suppliers or contract manufacturers, is adversely affected by a natural disaster. While we expend resources to qualify additional component sources, consolidation of suppliers and the small number of viable alternatives have limited the results of these efforts. Managing our supplier and contractor relationships is particularly difficult during time periods in which we introduce new products and during time periods in which demand for our products is increasing, especially if demand increases more quickly than we expect.

Plexus Services Corp., which manufactures our products at its facilities in Malaysia, currently serves as our primary contract manufacturer, and currently provides us with a majority, by dollar amount, of the products that we purchase from our contract manufacturers. Most of the products manufactured by our French and Israeli operations are outsourced to another third-party manufacturer in France and Israel, respectively. From time to time we assess our relationship with our contract manufacturers, and we do not generally maintain long-term agreements with any of our suppliers or contract manufacturers. Our agreement with Plexus has automatic annual renewals, unless prior notice is given by either party, and has been automatically renewed for a term expiring in October 2019.

Difficulties in managing relationships with any of our current contract manufacturers, particularly Plexus, that manufacture our products off-shore, or any of our suppliers of key components, subassemblies and modules used in our products, could impede our ability to meet our customers' requirements and adversely affect our operating results. An inability to obtain adequate and timely deliveries of our products or any materials used in our products, or the inability of any of our contract manufacturers to scale their production to meet demand, or any other circumstance that would require us to seek alternative sources of supply, could negatively affect our ability to ship our products on a timely basis, which could damage relationships with current and prospective customers and harm our business and materially and adversely affect our revenue and other operating results. Furthermore, if we fail to meet customers' supply expectations, our revenue would be adversely affected and we may lose sales opportunities, both short and long term, which could materially and adversely affect our business and our operating results, financial condition and cash flows. Increases, from time to time, in demand on our suppliers and subcontractors from our customers or from other parties have, on occasion, caused delays in the availability of certain components and products. In response, we may increase our inventories of certain components and products and expedite shipments of our products when necessary. These actions could increase our costs and could also increase our risk of holding obsolete or excess inventory, which, despite our use of a demand order fulfillment model, could materially and adversely affect our business, operating results, financial condition and cash flows.

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The loss of one or more of our key customers, a failure to continue diversifying our customer base, or a decrease in the number of larger transactions could harm our business and our operating results.

Historically, a significant portion of our revenue has been derived from relatively few customers, due in part to the consolidation of media customers. Sales to our top 10 customers in the fiscal years ended December 31, 2018, 2017 and 2016 accounted for approximately 37%, 24% and 28% of revenue, respectively. Although we have broadened our customer base by further penetrating new markets and expanding internationally, we expect to see continuing industry consolidation and customer concentration.

In the fiscal year ended December 31, 2018, Comcast accounted for 15% of our net revenue. In the fiscal year ended December 31, 2017 and 2016, no single customer accounted for more than 10% of our net revenue. Further consolidation in the cable industry could lead to additional revenue concentration for us. The loss of any significant customer, or any material reduction in orders from any other significant customer, or our failure to qualify our new products with any significant customer could materially and adversely affect, either long term or in a particular quarter, our operating results, financial condition and cash flows. Further, if Comcast Cable does not continue to increase its deployment of our products and solutions in connection with the Warrant we issued to them in September 2016, or does so more slowly or at a scale that is lower than we anticipate, we may be unable to realize the anticipated benefits of the Warrant and our operating results, financial condition and cash flows could be materially and adversely effected.

In addition, we are involved in most quarters in one or more relatively large individual transactions. A decrease in the number of the relatively larger individual transactions in which we are involved in any quarter could materially and adversely affect our operating results for that quarter.

As a result of these and other factors, we may be unable to increase our revenues from some or all of the markets we address, or to do so profitably, and any failure to increase revenues and profits from these customers could materially and adversely affect our operating results, financial condition and cash flows.

We rely on resellers, value-added resellers and systems integrators for a significant portion of our revenue, and disruptions to, or our failure to develop and manage our relationships with these customers or the processes and procedures that support them could adversely affect our business.

We generate a significant percentage of our revenue through sales to resellers, VARs and systems integrators that assist us with fulfillment or installation obligations. We expect that these sales will continue to generate a significant percentage of our revenue in the future. Accordingly, our future success is highly dependent upon establishing and maintaining successful relationships with a variety of channel partners.

We generally have no long-term contracts or minimum purchase commitments with any of our reseller, VAR or system integrator customers, and our contracts with these parties do not prohibit them from purchasing or offering products or services that compete with ours. Our competitors may provide incentives to any of our reseller, VAR or systems integrator customers to favor their products or, in effect, to prevent or reduce sales of our products. Any of our reseller, VAR or systems integrator customers may independently choose not to purchase or offer our products. Many of our resellers, and some of our VARs and system integrators are small, are based in a variety of international locations, and may have relatively unsophisticated processes and limited financial resources to conduct their business. Any significant disruption of our sales to these customers, including as a result of the inability or unwillingness of these customers to continue purchasing our products, or their failure to properly manage their business with respect to the purchase of, and payment for, our products, or their ability to comply with our policies and procedures as well as applicable laws, could materially and adversely affect our business, operating results, financial condition and cash flows. In addition, our failure to continue to establish or maintain successful relationships with reseller, VAR and systems integrator customers could likewise materially and adversely affect our business, operating results, financial condition and cash flows.

We have made, and may continue to make, acquisitions, and any acquisition could disrupt our operations, cause dilution to our stockholders and materially and adversely affect our business, operating results, cash flows and financial condition.

As part of our business strategy, from time to time we have acquired, and we may continue to acquire, businesses, technologies, assets and product lines that we believe complement or expand our existing business. For example, in February 2016, we announced the closing of our acquisition of TVN, which is headquartered in Rennes, France. Acquisitions involve numerous risks, including the following:

• unanticipated costs or delays associated with an acquisition;

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• difficulties in the assimilation and integration of acquired operations, technologies and/or products;

• potential disruption of our business and the diversion of management’s attention from the regular operations of the business during the acquisition process;

• the challenges of managing a larger and more geographically widespread operation and product portfolio after the closing of the acquisition;

• potential adverse effects on new and existing business relationships with suppliers, contract manufacturers, resellers, partners and customers;

• compliance with regulatory requirements, such as local employment regulations and organized labor in France;

• risks associated with entering markets in which we may have no or limited prior experience;

• the potential loss of key employees of acquired businesses and our own business as a result of integration;

• difficulties in bringing acquired products and businesses into compliance with applicable legal requirements in jurisdictions in which we operate and sell products;

• impact of known potential liabilities or unknown liabilities, including litigation and infringement claims, associated with companies we acquire;

• substantial charges for acquisition costs or for the amortization of certain purchased intangible assets, deferred stock compensation or similar items;

• substantial impairments to goodwill or intangible assets in the event that an acquisition proves to be less valuable than the price we paid for it;

• difficulties in establishing and maintaining uniform financial and other standards, controls, procedures and policies;

• delays in realizing, or failure to realize, the anticipated benefits of an acquisition; and

• the possibility that any acquisition may be viewed negatively by our customers or investors or the financial markets.

Competition within our industry for acquisitions of businesses, technologies, assets and product lines has been, and is likely to continue to be, intense. As such, even if we are able to identify an acquisition that we would like to consummate, we may not be able to complete the acquisition on commercially reasonable terms or because the target chooses to be acquired by another company. Furthermore, in the event that we are able to identify and consummate any future acquisitions, we may, in each of those acquisitions:

• issue equity securities which would dilute current stockholders’ percentage ownership;

• incur substantial debt to finance the acquisition or assume substantial debt in the acquisition;

• incur significant acquisition-related expenses;

• assume substantial liabilities, contingent or otherwise; or

• expend significant cash.

These financing activities or expenditures could materially and adversely affect our operating results, cash flows and financial condition or the price of our common stock. Alternatively, due to difficulties in the capital or credit markets at the time, we may be unable to secure capital necessary to complete an acquisition on reasonable terms, or at all. Moreover, even if we were to obtain benefits from acquisitions in the form of increased revenue and earnings per share, there may be a delay between the time the expenses associated with an acquisition are incurred and the time we recognize such benefits.

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In addition to the risks outlined above, if we are unable to successfully receive payment of any significant portion of TVN's existing French R&D tax credit receivables from the French tax authority as expected, or are unable to successfully apply for or otherwise obtain the financial benefit of new French R&D tax credits in future years, our ability to achieve the anticipated benefits of the acquisition as well as our business, operating results and financial condition could be adversely affected.

As of December 31, 2018, we had approximately $241 million of goodwill recorded on our balance sheet associated with prior acquisitions. In the event we determine that our goodwill is impaired, we would be required to write down all or a portion of such goodwill, which could result in a material non-cash charge to our results of operations in the period in which such write-down occurs.

If we are unable to successfully address one or more of these risks, our business, operating results, financial condition and cash flows could be materially and adversely affected.

We may not be able to effectively manage our operations.

In recent years, we have expanded our international operations significantly. For example, upon the closing of our acquisition of TVN on February 29, 2016, we added 438 employees, most of whom are based in France.

As of December 31, 2018, we had 787 employees in our international operations, representing approximately 68% of our worldwide workforce. Our ability to manage our business effectively in the future, including with respect to any future growth, our operation as both a hardware and increasingly software-centric business, the integration of any acquisition efforts such as our recent acquisition of TVN, and the breadth of our international operations, will require us to train, motivate and manage our employees successfully, to attract and integrate new employees into our overall operations, to retain key employees and to continue to improve and evolve our operational, financial and management systems. There can be no assurance that we will be successful in any of these efforts, and our failure to effectively manage our operations could have a material and adverse effect on our business, operating results, cash flows and financial condition.

We face risks associated with having outsourced engineering resources located in Ukraine.

We outsource a portion of our research and development activities for both our Video and Cable Access business segments to a third-party partner with engineering resources located in Ukraine. Political, social and economic instability and unrest or violence in Ukraine, including the ongoing conflict with Russian-backed separatists or conflict with the Russian Federation directly, could cause disruptions to the business and operations of our outsourcing partner, which could slow or delay the development work our partner is undertaking for us. Instability, unrest or conflict could limit or prevent our employees from traveling to, from, or within Ukraine to direct and coordinate our outsourced engineering teams, or cause us to shift all or portions of the development work occurring in Ukraine to other locations or countries. The resulting delays could negatively impact our product development efforts, operating results and our business.

In order to manage our growth, we must be successful in addressing management succession issues and attracting and retaining qualified personnel.

Our future success will depend, to a significant extent, on the ability of our management to operate effectively, both individually and as a group. We must successfully manage transition and replacement issues that may result from the departure or retirement of members of our executive management. We cannot provide assurances that changes of management personnel in the future would not cause disruption to operations or customer relationships or a decline in our operating results.

We are also dependent on our ability to retain and motivate our existing highly qualified personnel, in addition to attracting new highly qualified personnel. Competition for qualified management, technical and other personnel is often intense, particularly in Silicon Valley, Israel and Hong Kong where we have significant research and development activities, and we may not be successful in attracting and retaining such personnel. Competitors and others have in the past attempted, and are likely in the future to attempt, to recruit our employees. While our employees are required to sign standard agreements concerning confidentiality, non-solicitation and ownership of inventions, we generally do not have non-competition agreements with our personnel. The loss of the services of any of our key personnel, the inability to attract or retain highly qualified personnel in the future or delays in hiring such personnel, particularly senior management and engineers and other technical personnel, could negatively affect our business and operating results. Furthermore, a certain portion of our personnel in the U.S. is comprised of foreign nationals whose ability to work for us depends on obtaining the necessary visas. Our ability to hire and retain foreign nationals in the U.S., and their ability to remain and work in the U.S., is affected by various laws and regulations,

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including limitations on the availability of visas. Changes in U.S. laws or regulations affecting the availability of visas may adversely affect our ability to hire or retain key personnel and as a result may impair our operations.

We face risks associated with having facilities and employees located in Israel.

As of December 31, 2018, we maintained facilities in Israel with a total of 168 employees, or approximately 14% of our worldwide workforce. Our employees in Israel engage in a number of activities, for both our Video and Cable Access business segments, including research and development, product development, and supply chain management for certain product lines and sales activities.

As such, we are directly affected by the political, economic and military conditions affecting Israel. Any significant conflict involving Israel could have a direct effect on our business or that of our Israeli contract manufacturers, in the form of physical damage or injury, restrictions from traveling or reluctance to travel to from or within Israel by our Israeli and other employees or those of our subcontractors, or the loss of Israeli employees to active military duty. Most of our employees in Israel are currently obligated to perform annual reserve duty in the Israel Defense Forces, and approximately 11% of those employees were called for active military duty in 2018. In the event that more of our employees are called to active duty, certain of our research and development activities may be significantly delayed and adversely affected. Further, the interruption or curtailment of trade between Israel and its trading partners, as a result of terrorist attacks or hostilities, conflicts between Israel and any other Middle Eastern country or organization, or any other cause, could significantly harm our business. Additionally, current or future tensions or conflicts in the Middle East could materially and adversely affect our business, operating results, financial condition and cash flows.

Our operating results are likely to fluctuate significantly and, as a result, may fail to meet or exceed the expectations of securities analysts or investors, causing our stock price to decline.

Our operating results have fluctuated in the past and are likely to continue to fluctuate in the future, on an annual and a quarterly basis, as a result of several factors, many of which are outside of our control. Some of the factors that may cause these fluctuations include:

• the level and timing of spending of our customers in the U.S., Europe and in other markets;

• economic and financial conditions specific to each of the cable, satellite and telco, and broadcast and media industries, as well as general economic and financial market conditions, including any stemming from an unstable political environment in the United States or abroad as well as those resulting from regulatory, trade or tax policy changes from the Tax Cuts and Jobs Act that was enacted in December 2017 (the “TCJA”);

• changes in market acceptance of and demand for our products or our customers’ services or products;

• the timing and amount of orders, especially from large individual transactions and transactions with our significant customers;

• the mix of our products sold and the effect it has on gross margins;

• the timing of revenue recognition, including revenue recognition on sales arrangements and from transactions with significant service and support components, which may span several quarters;

• our transition to a SaaS subscription model for our Video business, which may cause near-term declines in revenue;

• the timing of completion of our customers’ projects;

• the length of each customer product upgrade cycle and the volume of purchases during the cycle;

• competitive market conditions, including pricing actions by our competitors;

• the level and mix of our domestic and international revenue;

• new product introductions by our competitors or by us;

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• uncertainty in both the U.K. and the European Union due to the U.K.'s referendum to exit the European Union, which could adversely affect our results, financial condition and prospects;

• changes in domestic and international regulatory environments affecting our business;

• the evaluation of new services, new standards and system architectures by our customers;

• the cost and timely availability to us of components, subassemblies and modules;

• the mix of our customer base, by industry and size, and sales channels;

• changes in our operating and extraordinary expenses;

• the timing of acquisitions and dispositions by us and the financial impact of such transactions;

• impairment of our goodwill and intangibles;

• the impact of litigation, such as related litigation expenses and settlement costs;

• write-downs of inventory and investments;

• changes in our effective federal tax rate, including as a result of changes in our valuation allowance against our deferred tax assets, and changes in our effective state tax rates, including as a result of apportionment;

• changes to tax rules related to the deferral of foreign earnings and compliance with foreign tax rules;

• the impact of applicable accounting guidance on accounting for uncertainty in income taxes that requires us to establish reserves for uncertain tax positions and accrue potential tax penalties and interest; and

• the impact of applicable accounting guidance on business combinations that requires us to record charges for certain acquisition related costs and expenses and generally to expense restructuring costs associated with a business combination subsequent to the acquisition date.

The timing of deployment of our products by our customers can be subject to a number of other risks, including the availability of skilled engineering and technical personnel, the availability of third-party equipment and services, our customers' ability to negotiate and enter into rights agreements with video content owners that provide our customers with the right to deliver certain video content, and our customers' need for local franchise and licensing approvals.

We often recognize a substantial portion of our quarterly revenue in the last month of the quarter. We establish our expenditure levels for product development and other operating expenses based on projected revenue levels for a specified period, and expenses are relatively fixed in the short term. Accordingly, even small variations in the timing of revenue, particularly from relatively large individual transactions, can cause significant fluctuations in operating results in a particular quarter.

As a result of these factors and other factors, our operating results in one or more future periods may fail to meet or exceed the expectations of securities analysts or investors. In that event, the trading price of our common stock would likely decline.

Fluctuations in our future effective tax rates could affect our future operating results, financial condition and cash flows.

We are required to periodically review our deferred tax assets and determine whether, based on available evidence, a valuation allowance is necessary. The realization of our deferred tax assets, which are predominantly in the U.S., is dependent upon the generation of sufficient U.S. and foreign taxable income in the future to offset these assets. Based on our evaluation, a history of operating losses in recent years has led to uncertainty with respect to our ability to realize certain of our net deferred tax assets, and as a result we recorded a net increase in valuation allowance of $0.9 million and $9.0 million in 2018 and 2017, respectively, against our U.S. net deferred tax assets. The increases in valuation allowance in 2018 and 2017 were offset partially by the valuation allowance release of $1.5 million and $5.8 million, respectively. The releases of valuation allowance were associated with our foreign subsidiaries and a one-time benefit in 2017 of $2.6 million relating to the refund of alternative minimum tax credit carryforwards related to the TCJA.

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The calculation of tax liabilities involves dealing with uncertainties in the application of complex global tax regulations. We recognize potential liabilities for anticipated tax audit issues in the U.S. and other tax jurisdictions based on our estimate of whether, and the extent to which, additional taxes will be due. In the event we determine that it is appropriate to create a reserve or increase an existing reserve for any such potential liabilities, the amount of the additional reserve is charged as an expense in the period in which it is determined. If payment of these amounts ultimately proves to be unnecessary, the reversal of the liabilities would result in tax benefits being recognized in the period when we determine the liabilities are no longer necessary. If the estimate of tax liabilities proves to be less than the ultimate tax assessment for the applicable period, a further charge to expense in the period such short fall is determined would result. Either such charge to expense could have a material and adverse effect on our operating results for the applicable period.

Our future effective income tax rates could be adversely affected if tax authorities challenge our international tax structure or if the relative mix of U.S. and international income changes for any reason. Accordingly, there can be no assurance that our income tax rate will be less than the U.S. federal statutory rate in future periods.

The United States recently passed a comprehensive tax reform bill that could adversely affect our financial performance.

On December 22, 2017, the U.S. government enacted comprehensive tax legislation commonly referred to as the Tax Cuts and Jobs Act of 2017, or the Tax Act. The Tax Act makes broad and complex changes to the U.S. tax code. The changes include, but are not limited to, reducing the U.S. federal corporate tax rate from 35% to 21%, imposing a mandatory one-time transition tax on certain unrepatriated earnings of foreign subsidiaries, eliminating the corporate alternative minimum tax, or AMT, and a requirement to pay a minimum tax on foreign earnings for tax years beginning after December 31, 2017. Notwithstanding the reduction in the corporate income tax rate, the overall impact of the new federal tax law is uncertain, and our financial performance could be adversely affected. In addition, it is uncertain if, and to what extent, various states will conform to the new tax law and foreign countries will react by adopting tax legislation or taking other actions that could adversely affect our business.

We or our customers may face intellectual property infringement claims from third parties.

Our industry is characterized by the existence of a large number of patents and frequent claims and related litigation regarding patent and other intellectual property rights. In particular, leading companies in the telecommunications industry have extensive patent portfolios. Also, patent infringement claims and litigation by entities that purchase or control patents, but do not produce goods or services covered by the claims of such patents (so-called "non-practicing entities" or "NPEs"), have increased rapidly over the last decade or so. From time to time, third parties, including NPEs, have asserted, and may assert in the future, patent, copyright, trademark and other intellectual property rights against us or our customers. Our suppliers and their customers, including us, may have similar claims asserted against them. A number of third parties, including companies with greater financial and other resources than us, have asserted patent rights to technologies that are important to us.

Any intellectual property litigation, regardless of its outcome, could result in substantial expense and significant diversion of the efforts of our management and technical personnel. An adverse determination in any such proceeding could subject us to significant liabilities and temporary or permanent injunctions and require us to seek licenses from third parties or pay royalties that may be substantial. Furthermore, necessary licenses may not be available on terms satisfactory to us, or at all. An unfavorable outcome on any such litigation matter could require that we pay substantial damages, could require that we pay ongoing royalty payments, or could prohibit us from selling certain of our products. Any such outcome could have a material and adverse effect on our business, operating results, financial condition and cash flows.

Our suppliers and customers may have intellectual property claims relating to our products asserted against them. We have agreed to indemnify some of our suppliers and most of our customers for patent infringement relating to our products. The scope of this indemnity varies, but, in some instances, includes indemnification for damages and expenses (including reasonable attorney's fees) incurred by the supplier or customer in connection with such claims. If a supplier or a customer seeks to enforce a claim for indemnification against us, we could incur significant costs defending such claim, the underlying claim or both. An adverse determination in either such proceeding could subject us to significant liabilities and have a material and adverse effect on our operating results, cash flows and financial condition.

We may be the subject of litigation which, if adversely determined, could harm our business and operating results.

We may be subject to claims arising in the normal course of business. The costs of defending any litigation, whether in cash expenses or in management time, could harm our business and materially and adversely affect our operating results and cash flows. An unfavorable outcome on any litigation matter could require that we pay substantial damages, or, in connection with any intellectual property infringement claims, could require that we pay ongoing royalty payments or prohibit us from

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selling certain of our products. In addition, we may decide to settle any litigation, which could cause us to incur significant settlement costs. A settlement or an unfavorable outcome on any litigation matter could have a material and adverse effect on our business, operating results, financial condition and cash flows.

We may sell one or more of our product lines, from time to time, as a result of our evaluation of our products and markets, and any such divestiture could adversely affect our continuing business and our expenses, revenues, results of operation, cash flows and financial position.

We periodically evaluate our various product lines and may, as a result, consider the divestiture of one or more of those product lines. We have sold product lines in the past, and any prior or future divestiture could adversely affect our continuing business and expenses, revenues, results of operations, cash flows and financial position.

Divestitures of product lines have inherent risks, including the expense of selling the product line, the possibility that any anticipated sale will not occur, delays in closing any sale, the risk of lower-than-expected proceeds from the sale of the divested business, unexpected costs associated with the separation of the business to be sold from the seller's information technology and other operating systems, and potential post-closing claims for indemnification or breach of transition services obligations of the seller. Expected cost savings, which are offset by revenue losses from divested businesses, may also be difficult to achieve or maximize due to the seller's fixed cost structure, and a seller may experience varying success in reducing fixed costs or transferring liabilities previously associated with the divested business.

We could be negatively affected as a result of a future proxy contest and the actions of activist stockholders.

If a proxy contest with respect to election of our directors is initiated in the future, or if other activist stockholder activities occur, our business could be adversely affected because:

• responding to a proxy contest and other actions by activist stockholders can be costly and time-consuming, disrupting our operations and diverting the attention of management and our employees;

• perceived uncertainties as to our future direction caused by activist activities may result in the loss of potential business opportunities, and may make it more difficult to attract and retain qualified personnel and business partners; and

• if individuals are elected to our Board with a specific agenda, it may adversely affect our ability to effectively and timely implement our strategic plans.

Our failure to adequately protect our proprietary rights and data may adversely affect us.

At December 31, 2018, we held 81 issued U.S. patents and 53 issued foreign patents, and had 91 patent applications pending. Although we attempt to protect our intellectual property rights through patents, trademarks, copyrights, licensing arrangements, maintaining certain technology as trade secrets and other measures, we can give no assurances that any patent, trademark, copyright or other intellectual property rights owned by us will not be invalidated, circumvented or challenged, that such intellectual property rights will provide competitive advantages to us, or that any of our pending or future patent applications will be issued with the scope of the claims sought by us, if at all. We can give no assurances that others will not develop technologies that are similar or superior to our technologies, duplicate our technologies or design around the patents that we own. In addition, effective patent, copyright and trade secret protection may be unavailable or limited in certain foreign countries in which we do business or may do business in the future.

We may enter into confidentiality or license agreements with our employees, consultants, and vendors and our customers, as needed, and generally limit access to, and distribution of, our proprietary information. Nevertheless, we cannot provide assurances that the steps taken by us will prevent misappropriation of our technology. In addition, we have taken in the past, and may take in the future, legal action to enforce our patents and other intellectual property rights, to protect our trade secrets, to determine the validity and scope of the proprietary rights of others, or to defend against claims of infringement or invalidity. Such litigation could result in substantial costs and diversion of management time and other resources, and could materially and adversely affect our business, operating results, financial condition and cash flows.

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Our products include third-party technology and intellectual property, and our inability to acquire new technologies or use third-party technology in the future could harm our business.

In order to successfully develop and market certain of our planned products, we may be required to enter into technology development or licensing agreements with third parties. Although companies with technology useful to us are often willing to enter into technology development or licensing agreements with respect to such technology, we cannot provide assurances that such agreements may be negotiated on commercially reasonable terms, or at all. The failure to enter, or a delay in entering, into such technology development or licensing agreements, when necessary or desirable, could limit our ability to develop and market new products and could materially and adversely affect our business.

We incorporate certain third-party technologies, including software programs, into our products, and, as noted, intend to utilize additional third-party technologies in the future. In addition, the technologies that we license may not operate properly or as specified, and we may not be able to secure alternatives in a timely manner, either of which could harm our business. We could face delays in product releases until alternative technology can be identified, licensed or developed, and integrated into our products, if we are able to do so at all. These delays, or a failure to secure or develop adequate technology, could materially and adversely affect our business, operating results, financial condition and cash flows.

Our use of open source software in some of our products may expose us to certain risks.

Some of our products contain software modules licensed for use from third-party authors under open source licenses. Use and distribution of open source software may entail greater risks than use of third-party commercial software, as open source licensors generally do not provide warranties or other contractual protections regarding infringement claims or the quality of the code. Some open source licenses contain requirements that we make available source code for modifications or derivative works we create based upon the type of open source software we use. If we combine our proprietary software with open source software in a certain manner, we could, under certain of the open source licenses, be required to release the source code of our proprietary software to the public. This could allow our competitors to create similar products with lower development effort and in less time and ultimately could result in a loss of product sales for us.

Although we monitor our use of open source closely, it is possible our past, present or future use of open source has triggered or may trigger the foregoing requirements. Furthermore, the terms of many open source licenses have not been interpreted by U.S. courts, and there is a risk that such licenses could be construed in a manner that could impose unanticipated conditions or restrictions on our ability to commercialize our products. In such event, we could be required to seek licenses from third parties in order to continue offering our products, to re-engineer our products or to discontinue the sale of our products in the event re-engineering cannot be accomplished on a timely basis, any of which could materially and adversely affect our operating results, financial condition and cash flows.

We are subject to import and export control and trade and economic sanction laws and regulations that could subject us to liability or impair our ability to compete in international markets.

Our products are subject to U.S. export control laws, and may be exported outside the U.S. only with the required export license or through an export license exception, in most cases because we incorporate encryption technology into certain of our products. We are also subject to U.S. trade and economic sanction regulations which include prohibitions on the sale or supply of certain products and services to U.S. embargoed or sanctioned countries, governments, persons and entities. In addition, various countries regulate the import of certain technology and have enacted laws that could limit our ability to distribute our products, or could limit our customers' ability to implement our products, in those countries. Although we take precautions and have processes in place to prevent our products and services from being provided in violation of such laws, our products may have been in the past, and could in the future be, provided inadvertently in violation of such laws, despite the precautions we take. If we fail to comply with these laws, we and certain of our employees could be subject to civil or criminal penalties, including the possible loss of export privileges, monetary penalties, and, in extreme cases, imprisonment of responsible employees for knowing and willful violations of these laws. Additionally, our business and operating results be adversely affected through penalties, reputational harm, loss of access to certain markets, or otherwise.

In addition, we may be subject to customs duties that could have a significant adverse impact on our operating results or, if we are able to pass on the related costs in any particular situation, would increase the cost of the related product to our customers. As a result, the future imposition of significant increases in the level of customs duties or the creation of import quotas on our products in Europe or in other jurisdictions, or any of the limitations on international sales described above, could have a material adverse effect on our business, operating results, financial condition and cash flows. Further, some of our customers in Europe have been, or are being, audited by local governmental authorities regarding the tariff classifications used for importation of our products. Import duties and tariffs vary by country and a different tariff classification for any of our

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products may result in higher duties or tariffs, which could have an adverse impact on our operating results and potentially increase the cost of the related products to our customers.

We may need additional capital in the future and may not be able to secure adequate funds at all or on terms acceptable to us.

We engage in the design, development and manufacture and sale of a variety of video and cable access products and system solutions, which has required, and will continue to require, significant research and development expenditures.

We believe that our existing cash of approximately $66 million at December 31, 2018 will satisfy our cash requirements for at least the next 12 months. However, we may need to raise additional funds to take advantage of presently unanticipated strategic opportunities, satisfy our other cash requirements from time to time, or strengthen our financial position. Our ability to raise funds may be adversely affected by a number of factors, including factors beyond our control, such as weakness in the economic conditions in markets in which we sell our products and continued uncertainty in financial, capital and credit markets. There can be no assurance that equity or debt financing will be available to us on reasonable terms, if at all, when and if it is needed.

We may raise additional financing through public or private equity offerings, debt financings, or corporate partnership or licensing arrangements. To the extent we raise additional capital by issuing equity securities or convertible debt, our stockholders may experience dilution. To the extent that we raise additional funds through collaboration and licensing arrangements, it may be necessary to relinquish some rights to our technologies or products, or grant licenses on terms that are not favorable to us. To the extent we raise capital through debt financing arrangements, we may be required to pledge assets or enter into covenants that could restrict our operations or our ability to incur further indebtedness and the interest on such debt may adversely affect our operating results.

If adequate capital is not available, or is not available on reasonable terms, when needed, we may not be able to take advantage of acquisition or other market opportunities, to timely develop new products, or to otherwise respond to competitive pressures.

Cybersecurity incidents, including data security breaches or computer viruses, could harm our business by disrupting our business operations, compromising our products and services, damaging our reputation or exposing us to liability.

Cyber criminals and hackers may attempt to penetrate our network security, misappropriate our proprietary information or cause business interruptions. Because the techniques used by such computer programmers to access or sabotage networks change frequently and may not be recognized until launched against a target, we may be unable to anticipate these techniques or to implement adequate preventative measures. In the past, we have faced compromises to our network security. While we have invested in and continue to update our network security and cybersecurity infrastructure and systems, if our cybersecurity systems fail to protect against unauthorized access, sophisticated cyber-attacks, phishing schemes, data protection breaches, computer viruses, denial-of-service attacks and similar disruptions from unauthorized tampering or human error, our ability to conduct our business effectively could be damaged in a number of ways, including:

• our intellectual property and other proprietary data, or financial assets, could be stolen;

• our ability to manage and conduct our business operations could be seriously disrupted;

• defects and security vulnerabilities could be introduced into our product, software and SaaS offerings, thereby damaging the reputation and perceived reliability and security of our products; and

• personally identifiable data of our customers, employees and business partners could be compromised.

Should any of the above events occur, our reputation, competitive position and business could be significantly harmed, and we could be subject to claims for liability from customers, third parties and governmental authorities. Additionally, we could incur significant costs in order to upgrade our cybersecurity systems and remediate damages. Consequently, our business, operating results, financial condition and cash flows could be materially and adversely affected. In addition, our business operations utilize and rely upon numerous third party vendors, manufacturers, solution providers, partners and consultants, and any failure of such third parties' cybersecurity measures could materially and adversely affect or disrupt our business.

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Our operating results could be adversely affected by natural disasters affecting us or impacting our third-party manufacturers, suppliers, resellers or customers.

Our corporate headquarters is located in California, which is prone to earthquakes. We have employees, consultants and contractors located in regions and countries around the world. In the event that any of our business, sales or research and development centers or offices in the U.S. or internationally are adversely affected by an earthquake or by any other natural disaster, we may sustain damage to our operations and properties, which could cause a sustained interruption or loss of affected operations, and cause us to suffer significant financial losses.

We rely on third-party contract manufacturers for the production of our products. Any significant disruption in the business or operations of such manufacturers or of their or our suppliers could adversely impact our business. Our principal contract manufacturers and several of their and our suppliers and our resellers have operations in locations that are subject to natural disasters, such as severe weather, tsunamis, floods, fires and earthquakes, which could disrupt their operations and, in turn, our operations.

In addition, if there is a natural disaster in any of the locations in which our significant customers are located, we face the risk that our customers may incur losses or sustained business interruption, or both, which may materially impair their ability to continue their purchase of products from us. Accordingly, natural disaster in one of the geographies in which we, or our third-party manufacturers, their or our suppliers or our customers, operate could have a material and adverse effect on our business, operating results, cash flows and financial condition.

Our business and industry are subject to various laws and regulations that could adversely affect our business, operating results, cash flows and financial condition.

Our business and industry are regulated under various federal, state, local and international laws. For example, we are subject to environmental regulations such as the European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directives and similar legislation enacted in other jurisdictions worldwide. Our failure to comply with these laws could result in our being directly or indirectly liable for costs, fines or penalties and third-party claims, and could jeopardize our ability to conduct business in such regions and countries. We expect that our operations will be affected by other new environmental laws and regulations on an ongoing basis. Although we cannot predict the ultimate impact of any such new laws and regulations, they would likely result in additional costs, and could require that we redesign or change how we manufacture our products, any of which could have a material and adverse effect on our operating results, financial condition and cash flows.

We are subject to the Sarbanes-Oxley Act of 2002 which, among other things, requires an annual review and evaluation of our internal control over financial reporting. If we conclude in future periods that our internal control over financial reporting is not effective or if our independent registered public accounting firm is unable to provide an unqualified attestation as of future year-ends, we may incur substantial additional costs in an effort to correct such problems, and investors may lose confidence in our financial statements, and our stock price may decrease in the short term, until we correct such problems, and perhaps in the long term, as well.

We are subject to requirements under the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 that require us to conduct research, disclose, and report whether or not our products contain certain conflict minerals sourced from the Democratic Republic of Congo or its surrounding countries. The implementation of these requirements could adversely affect the sourcing, availability, and pricing of the materials used in the manufacture of components used in our products. In addition, we may incur certain additional costs to comply with the disclosure requirements, including costs related to conducting diligence procedures to determine the sources of conflict minerals that may be used or necessary to the production of our products and, if applicable, potential changes to products, processes or sources of supply as a consequence of such verification activities. It is also possible that we may face reputational harm if we determine that certain of our products contain minerals not determined to be conflict-free and/or we are unable to alter our products, processes or sources of supply to avoid such materials.

Changes in telecommunications legislation and regulations in the U.S. and other countries could affect our sales and the revenue we are able to derive from our products. In particular, on December 14, 2017, the U.S. Federal Communications Commission (FCC) voted to repeal the “net neutrality” rules and return to a “light-touch” regulatory framework. The FCC’s new rules, which took effect in June 2018, granted providers of broadband internet access services greater freedom to make changes to their services, including, potentially, changes that may discriminate against or otherwise harm our business. However, a number of parties have appealed these rules, which appeals are currently being reviewed by the D.C. Circuit Court of Appeals; thus the future impact of the FCC's repeal and any changes thereto remains uncertain. Additionally, on September

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30, 2018, California enacted the California Internet Consumer Protection and Net Neutrality Act of 2018, making California the fourth state to enact a state-level net neutrality law since the FCC repealed its nationwide regulations, mandating that all broadband services in California must be provided in accordance with state net neutrality requirements. The U.S. Department of Justice has sued to block the law going into effect, and California has agreed to delay enforcement until the resolution of the FCC's repeal of the federal rules. A number of other states are considering legislation or executive actions that would regulate the conduct of broadband providers. We cannot predict whether the FCC order or state initiatives will be modified, overturned, or vacated by legal action of the court, federal legislation, or the FCC. The repeal of the net neutrality rules or other regulations dealing with access by competitors to the networks of incumbent operators could slow or stop infrastructure and services investments or expansion by service providers. Increased regulation of our customers' pricing or service offerings could limit their investments and, consequently, revenue from our products. The impact of new or revised legislation or regulations could have a material adverse effect on our business, operating results, financial condition and cash flows.

Some anti-takeover provisions contained in our certificate of incorporation and bylaws, as well as provisions of Delaware law, could impair a takeover attempt.

We have provisions in our certificate of incorporation and bylaws that could have the effect of rendering more difficult or discouraging an acquisition deemed undesirable by our Board. These include provisions:

• authorizing blank check preferred stock, which could be issued with voting, liquidation, dividend and other rights superior to our common stock;

• limiting the liability of, and providing indemnification to, our directors and officers;

• limiting the ability of our stockholders to call, and bring business before, special meetings;

• requiring advance notice of stockholder proposals for business to be conducted at meetings of our stockholders and for nominations of candidates for election to our Board;

• controlling the procedures for conducting and scheduling of Board and stockholder meetings; and

• providing the Board with the express power to postpone previously scheduled annual meetings and to cancel previously scheduled special meetings.

These provisions could delay hostile takeovers, changes in control of the Company or changes in our management. As a Delaware corporation, we are also subject to provisions of Delaware law, including Section 203 of the Delaware General Corporation law, which prevents some stockholders holding more than 15% of our outstanding common stock from engaging in certain business combinations without approval of the holders of substantially all of our outstanding common stock. Any provision of our certificate of incorporation or bylaws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

The nature of our business requires the application of complex revenue and expense recognition rules and the current legislative and regulatory environment affecting generally accepted accounting principles is uncertain. Significant changes in current principles could affect our financial statements going forward and changes in financial accounting standards or practices may cause adverse, unexpected financial reporting fluctuations and harm our operating results. The accounting rules and regulations that we must comply with are complex and subject to interpretation by the Financial Accounting Standards Board (the "FASB"), the SEC and various bodies formed to promulgate and interpret appropriate accounting principles. Recent actions and public comments from the FASB and the SEC have focused on the integrity of financial reporting and internal controls. In addition, many companies' accounting policies are being subject to heightened scrutiny by regulators and the public. Further, the accounting rules and regulations are continually changing in ways that could materially impact our financial statements. For example, in May 2014, the FASB issued Accounting Standards Update ("ASU") No. 2014-09, Revenue from Contracts with Customers ("Topic 606"), as amended, which superseded nearly all existing revenue recognition guidance. We adopted the new revenue standard in our first quarter of 2018 using a modified retrospective approach. In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842), to amend the existing accounting standard for lease accounting. The Company expects to adopt the new standard on January 1, 2019 and use the effective date as the date of initial application. (See Note 2, "Summary of Significant Accounting Policies" for additional information.)

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We are implementing a new enterprise resource planning system, and if this new system proves ineffective or if we experience issues with the transition, we may be unable to timely or accurately prepare financial reports, make payments to our suppliers and employees, or invoice and collect from our users.

We are implementing a new enterprise resource planning, or ERP system. Our ERP system is critical to our ability to accurately maintain books and records and to prepare our financial statements. The transition to our new ERP system may be disruptive to our business if the ERP system does not work as planned or if we experience issues relating to the implementation. Such disruptions could impact our ability to timely or accurately make payments to our suppliers and employees, and could also inhibit our ability to invoice, and collect from our customers. Data integrity problems or other issues may be discovered which, if not corrected, could impact our business or financial results. In addition, we may experience periodic or prolonged disruption of our financial functions arising out of this conversion, general use of such system, other periodic upgrades or updates, or other external factors that are outside of our control. If we encounter unforeseen problems with our ERP system or other related systems and infrastructure, it could adversely affect our financial reporting systems and our ability to produce financial reports, the effectiveness of internal controls over financial reporting, and our business, operating results and financial condition could be adversely affected.

The conditional conversion feature of our convertible senior notes, if triggered, may adversely affect our financial condition and operating results.

In December 2015, we issued $128.3 million in aggregate principal amount of 4.0% convertible senior notes due 2020 (the “Notes”) through a private placement with a financial institution. The Notes bear interest at 4.0% per annum, which is payable semiannually in arrears on June 1 and December 1 of each year, commencing June 1, 2016. In the event the conditional conversion feature of the Notes is triggered, holders of the Notes will be entitled to convert the Notes at any time during specified periods at their option. If one or more holders elect to convert their Notes, unless we elect to satisfy our conversion obligation by delivering solely shares of our common stock (other than paying cash in lieu of delivering any fractional share), we would be required to settle a portion or all of our conversion obligation through the payment of cash, which could adversely affect our liquidity. In addition, even if holders do not elect to convert their Notes, we could be required under applicable accounting rules to reclassify all or a portion of the outstanding principal of the Notes as a current rather than long-term liability, which would result in a material reduction of our net working capital.

The accounting method for convertible debt securities that may be settled in cash, such as the Notes, could have a material effect on our reported financial results.

Under Accounting Standards Codification 470-20, Debt with Conversion and Other Options, which we refer to as ASC 470-20, an entity must separately account for the liability and equity components of the convertible debt instruments (such as the Notes) that may be settled entirely or partially in cash upon conversion in a manner that reflects the issuer’s economic interest cost. The effect of ASC 470-20 on the accounting for the Notes is that the equity component is required to be included in the additional paid-in capital section of stockholders’ equity on our consolidated balance sheet, and the value of the equity component is being treated as a debt discount. As a result, we are required to record a greater amount of non-cash interest expense in current and future periods presented as a result of the amortization of the discounted carrying value of the Notes to their face amount over the term of the Notes. The increased net loss resulting from the amortization of the debt discount under ASC 470-20 could adversely affect our reported or future financial results, the trading price of our common stock and the trading price of the Notes.

In addition, under certain circumstances, convertible debt instruments (such as the Notes) that may be settled entirely or partly in cash are currently accounted for utilizing the treasury stock method, the effect of which is that the shares issuable upon conversion of the Notes are not included in the calculation of diluted earnings per share except to the extent that the conversion value of the Notes exceeds their principal amount. Under the treasury stock method, for diluted earnings per share purposes, the transaction is accounted for as if the number of shares of common stock that would be necessary to settle such excess, if we elected to settle such excess in shares, are issued. We cannot be sure that the accounting standards in the future will continue to permit the use of the treasury stock method or circumstances would change such that we would no longer be permitted to use the treasury stock method. If we are unable to use the treasury stock method in accounting for the shares issuable upon conversion of the Notes, our diluted earnings per share may be adversely affected.

Our common stock price, and therefore the price of our Notes, may be extremely volatile, and the value of an investment in our stock may decline.

Our common stock price has been highly volatile. We expect that this volatility will continue in the future due to factors such as:

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• general market and economic conditions;

• actual or anticipated variations in operating results;

• increases or decreases in the general stock market or to the stock prices of technology companies;

• announcements of technological innovations, new products or new services by us or by our competitors or customers;

• changes in financial estimates or recommendations by stock market analysts regarding us or our competitors;

• announcements by us or our competitors of significant acquisitions, dispositions, strategic partnerships, joint ventures or capital commitments;

• announcements by our customers regarding end user market conditions and the status of existing and future infrastructure network deployments;

• additions or departures of key personnel; and

• future equity or debt offerings or our announcements of these offerings.

In addition, in recent years, the stock market in general, and The NASDAQ Stock Market and the securities of technology companies in particular, have experienced extreme price and volume fluctuations. These fluctuations have often been unrelated or disproportionate to the operating performance of individual companies. These broad market fluctuations have in the past, and may in the future, materially and adversely affect our stock price, regardless of our operating results. In these circumstances, investors may be unable to sell their shares of our common stock at or above their purchase price over the short term, or at all.

Our stock price may decline if additional shares are sold in the market or if analysts drop coverage of or downgrade our stock.

Future sales of substantial amounts of shares of our common stock by our existing stockholders in the public market, or the perception that these sales could occur, may cause the market price of our common stock to decline. In addition, we issue additional shares upon exercise of stock options, including under our 2002 Employee Stock Purchase Plan (“ESPP”), and in connection with grants of restricted stock units (“RSUs”) on an ongoing basis. To the extent we do not elect to pay solely cash upon conversion of our Notes, we will also be required to issue additional shares of common stock upon conversion. Increased sales of our common stock in the market after exercise of outstanding stock options or grants of restricted stock units could exert downward pressure on our stock price. These sales also might make it more difficult for us to sell equity or equity-related securities in the future at a time and price we deem appropriate.

The trading market for our common stock relies in part on the availability of research and reports that third-party industry or securities analysts publish about us. If one or more of the analysts who do cover us downgrade our stock, our stock price may decline. If one or more of these analysts cease coverage of us, we could lose visibility in the market, which in turn could cause the liquidity of our stock and our stock price to decline.

Item 1B. UNRESOLVED STAFF COMMENTS

None.

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Item 2. PROPERTIES

All of our facilities are leased, including our principal operations and corporate headquarters in San Jose, California. We have research and development centers in the United States, France, Israel and Hong Kong. We have sales and service offices primarily in the U.S. and various locations in Europe and Asia. Our leases, which expire at various dates through June 2028, are for an aggregate of approximately 388,000 square feet of space, (this excludes 49,000 square feet of space that is vacant and available for sublease). Our San Jose lease, which expires in August 2020, is for approximately 143,000 square feet of such space. We have two business segments: Video and Cable Access. Because of the interrelation of these segments, a majority of these segments use substantially all of the properties, at least in part, and we retain the flexibility to use each of the properties in whole or in part for each of the segments. We believe that the facilities that we currently occupy are adequate for our current needs and that suitable additional space will be available, as needed, to accommodate the presently foreseeable expansion of our operations.

Item 3. LEGAL PROCEEDINGS

In October 2011, Avid Technology, Inc. ("Avid") filed a complaint in the United States District Court for the District of Delaware alleging that our MediaGrid product infringes two patents held by Avid. A jury trial on this complaint commenced on January 23, 2014 and, on February 4, 2014, the jury returned a unanimous verdict in favor of us, rejecting Avid's infringement allegations in their entirety. In January 2015, Avid filed an appeal with respect to the jury's verdict with the Federal Circuit. In January 2016, the Federal Circuit issued an order vacating the verdict of noninfringement and remanding the case to the trial court for a new trial on infringement.

In June 2012, Avid served a subsequent complaint in the United States District Court for the District of Delaware alleging that our Spectrum product infringes one patent held by Avid. The complaint sought injunctive relief and unspecified damages. In September 2013, the U.S. Patent Trial and Appeal Board ("PTAB") authorized an inter partes review to be instituted as to claims 1-16 of the patent asserted in this second complaint. In July 2014, the PTAB issued a decision finding claims 1-10 invalid and claims 11-16 not invalid. We filed an appeal with respect to the PTAB's decision on claims 11-16 in September 2014, and the Federal Circuit affirmed the PTAB's decision in April 2016.

In July 2017, the court issued a scheduling order consolidating both cases and setting the trial date for November 6, 2017.

On October 19, 2017, the parties agreed to settle the consolidated cases by entering into a settlement and patent portfolio cross-license agreement, and the cases were dismissed with prejudice. In connection with the agreement, we recorded a $6.0 million litigation settlement expense in "Selling, general and administrative expenses" in our 2017 Consolidated Statement of Operations. Of the associated $6.0 million settlement liability, $2.5 million was paid in October 2017 and the remaining $1.5 million and $2.0 million will be paid in the second quarter of 2019 and the third quarter of 2020, respectively.

From time to time, we are involved in lawsuits as well as subject to various legal proceedings, claims, threats of litigation, and investigations in the ordinary course of business, including claims of alleged infringement of third-party patents and other intellectual property rights, commercial, employment, and other matters. While certain matters to which we are a party may specify the damages claimed, such claims may not represent reasonably possible losses. Given the inherent uncertainties of litigation, the ultimate outcome of these matters cannot be predicted at this time, nor can the amount of possible loss or range of loss, if any, be reasonably estimated.

An unfavorable outcome on any litigation matters could require us to pay substantial damages, or, in connection with any intellectual property infringement claims, could require us to pay ongoing royalty payments or could prevent us from selling certain of our products. As a result, a settlement of, or an unfavorable outcome on, any of the matters referenced above or other litigation matters could have a material adverse effect on our business, operating results, financial position and cash flows.

Our industry is characterized by the existence of a large number of patents and frequent claims and related litigation regarding patent and other intellectual property rights. From time to time, third parties have asserted, and may in the future assert, exclusive patent, copyright, trademark and other intellectual property rights against us or our customers. Such assertions arise in the normal course of our operations. The resolution of any such assertions and claims cannot be predicted with certainty.

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Item 4. MINE SAFETY DISCLOSURE

Not applicable.

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PART II

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

Market Information of our Common Stock

Our common stock is traded on The NASDAQ Global Select Market under the symbol HLIT, and has been listed on NASDAQ since our initial public offering in 1995. The following table sets forth, for the periods indicated, the high and low sales price per share of our common stock as reported on The NASDAQ Global Select Market:

	2018		2017	
	Sales Price		Sales Price	
Quarter ended	High	Low	High	Low
First quarter	$4.20	$2.95	$6.10	$4.90
Second quarter	4.45	3.40	6.00	4.90
Third quarter	5.55	4.15	5.35	2.80
Fourth quarter	6.16	4.57	4.55	2.85

Holders

As of February 22, 2019, there were approximately 347 holders of record of our common stock.

Dividend Policy

We have never declared or paid any dividends on our capital stock. At this time, we expect to retain future earnings, if any, for use in the operation and expansion of our business and do not anticipate paying any cash dividends in the foreseeable future.

Repurchases of Equity Securities by the Issuer

There were no stock repurchases during the year ended December 31, 2018. Our stock repurchase program expired on December 31, 2016. Further stock repurchases would require authorization from the Board.

Sales of Unregistered Securities

There were no sales of unregistered securities during the year ended December 31, 2018.

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Stock Performance Graph

Set forth below is a line graph comparing the annual percentage change in the cumulative return to the stockholders of our common stock with the cumulative return of The NASDAQ Telecommunications Index and of the Standard & Poor's (S&P) 500 Index for the period commencing December 31, 2013 and ending on December 31, 2018. The graph assumes that $100 was invested in each of the Company's common stock, the S&P 500 and The NASDAQ Telecommunications Index on December 31, 2013, and assumes the reinvestment of dividends, if any. The comparisons shown in the graph below are based upon historical data. Harmonic cautions that the stock price performance shown in the graph below is not indicative of, nor intended to forecast, the potential future performance of the Company's common stock.

	12/13	12/14	12/15	12/16	12/17	12/18
Harmonic Inc.	100.00	94.99	55.15	67.75	56.91	63.96
S&P 500	100.00	113.69	115.26	129.05	157.22	150.33
NASDAQ Telecom	100.00	102.75	100.20	106.61	130.48	130.76

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The information contained in this Stock Performance Graph section shall not be deemed to be “soliciting material”, “filed” or incorporated by reference in previous or future filings with the SEC, or subject to the liabilities of Section 18 of the Exchange Act, except to the extent that Harmonic specifically incorporates it by reference into a document filed under the Securities Act or the Exchange Act.

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Item 6. SELECTED FINANCIAL DATA

The selected financial data set forth below as of December 31, 2018 and 2017, and for the fiscal years ended December 31, 2018, 2017 and 2016, are derived from our Consolidated Financial Statements included elsewhere in this Annual Report on Form 10-K. The selected financial data as of December 31, 2016, 2015 and 2014, and for the fiscal years ended December 31, 2015 and 2014 are derived from audited financial statements not included in this Annual Report on Form 10-K. This financial data should be read in conjunction with Item 7, Management's Discussion and Analysis of Financial Condition and Results of Operations, and the Consolidated Financial Statements and related notes included elsewhere in this Annual Report on Form 10-K. These historical results are not necessarily indicative of the results to be expected in the future.

On February 29, 2016, we completed our acquisition of TVN and applied the acquisition method of accounting for the business combination. The selected consolidated balance sheet data as of December 31, 2016 represents the consolidated statement of financial position of the combined company. The selected consolidated statement of operations data for the year ended December 31, 2016 of the combined entity includes 10 months of operating results of TVN, beginning March 1, 2016.

	Year ended December 31,				
	2018	2017	2016	2015	2014
	(In thousands, except per share amounts)				
Consolidated Statements of Operations Data					
Net revenue	$403,558	$358,246	$405,911	$377,027	$433,557
Cost of revenue	194,349	188,426	205,161	174,315	221,209
Gross profit	209,209	169,820	200,750	202,712	212,348
Operating expenses:					
Research and development	89,163	95,978	98,401	87,545	93,061
Selling, general and administrative	118,952	136,270	144,381	120,960	131,322
Amortization of intangibles	3,187	3,142	10,402	5,783	6,775
Restructuring and related charges	2,918	5,307	14,602	1,372	2,761
Total operating expenses	214,220	240,697	267,786	215,660	233,919
Loss from operations	(5,011)	(70,877)	(67,036)	(12,948)	(21,571)
Interest income (expense), net	(11,401)	(11,078)	(10,628)	(333)	132
Other expense, net	(536)	(2,222)	(31)	(282)	(356)
Loss on impairment of long-term investments	—	(530)	(2,735)	(2,505)	—
Loss from continuing operations before income taxes	(16,948)	(84,707)	(80,430)	(16,068)	(21,795)
Provision for (benefit from) income taxes	4,087	(1,752)	(8,116)	(407)	24,453
Loss from continuing operations	$(21,035)	$(82,955)	$(72,314)	$(15,661)	$(46,248)
Net loss per share from continuing operations:					
Basic and diluted	$(0.25)	$(1.02)	$(0.93)	$(0.18)	$(0.50)
Shares used in per share calculations:					
Basic and diluted	85,615	80,974	77,705	87,514	92,508

	As of December 31,				
	2018	2017	2016	2015	2014
	(In thousands)				
Consolidated Balance Sheet Data					
Cash, cash equivalents and short-term investments	$65,989	$57,024	$62,558	$152,794	$104,879
Working capital	$60,297	$29,686	$71,938	$201,250	$142,754
Total assets	$510,835	$508,059	$554,069	$524,957	$480,518
Convertible notes, long-term	$114,808	$108,748	$103,259	$98,295	$—
Total stockholders' equity	$228,250	$218,343	$270,641	$328,168	$371,813

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

The following discussion should be read in conjunction with the consolidated financial statements and the related notes. The following discussion contains forward-looking statements that reflect our plans, estimates and beliefs. Our actual results could differ materially from those discussed in the forward-looking statements. Factors that could cause or contribute to these differences include, but are not limited to, those discussed below and those listed under Item 1A, Risks Factors.

Business Overview

We are a leading global provider of (i) versatile and high performance video delivery software, products, system solutions and services that enable our customers to efficiently create, prepare, store, playout and deliver a full range of high-quality broadcast and OTT video services to consumer devices, including televisions, personal computers, laptops, tablets and smart phones and (ii) cable access solutions that enable cable operators to more efficiently and effectively deploy high-speed internet, for data, voice and video services to consumers' homes.

We do business in three geographic regions: the Americas, EMEA and APAC and operate in two segments, Video and Cable Access. Our Video business sells video processing, production and playout solutions, and services worldwide to cable operators and satellite and telecommunications ("telco") Pay-TV service providers, which we refer to collectively as "service providers," as well as to broadcast and media companies, including streaming media companies. Our Video business infrastructure solutions are delivered either through shipment of our products, software licenses or as software-as-a-service ("SaaS") subscriptions. Our Cable Access business sells cable access solutions and related services, including our CableOS software-based cable access solution, primarily to cable operators globally.

Historically, our revenue has been dependent upon capital spending in the cable, satellite, telco, broadcast and media industries, including streaming media. Our customers' capital spending patterns are dependent on a variety of factors, including but not limited to: economic conditions in the U.S. and international markets; access to financing; annual budget cycles of each of the industries we serve; impact of industry consolidations; and customers suspending or reducing capital spending in anticipation of new products or new standards, new industry trends and/or technology shifts. If our product portfolio and product development plans do not position us well to capture an increased portion of the capital spending in the markets in which we compete, our revenue may decline. As we attempt to further diversify our customer base in these markets, we may need to continue to build alliances with other equipment manufacturers, content providers, resellers and system integrators, managed services providers and software developers; adapt our products for new applications; take orders at prices resulting in lower margins; and build internal expertise to handle the particular operational, payment, financing and/or contractual demands of our customers, which could result in higher operating costs for us.

A majority of our revenue has been derived from relatively few customers, due in part to the consolidation of our service provider customers. Sales to our 10 largest customers in 2018, 2017 and 2016 accounted for approximately 37%, 24% and 28% of our revenue, respectively. Although we are attempting to broaden our customer base by penetrating new markets and further expanding internationally, we expect to see continuing industry consolidation and customer concentration. During 2018, Comcast accounted for 15% of our net revenue. During 2017 and 2016, no single customer accounted for more than 10% of our net revenue. The loss of any significant customer, any material reduction in orders by any significant customer, or our failure to qualify our new products with any significant customer could materially and adversely affect our operating results, financial condition and cash flows.

Our net revenue increased $45.3 million, or 13% in 2018, compared to 2017, primarily due to an increase in our Cable Access segment revenue of $52.1 million, partially offset by decrease in our Video segment revenue of $5.6 million. The increase in our Cable Access segment revenue in 2018 was primarily due to an increase in sales of CableOS related hardware, software and support services. The decrease in our Video segment revenue in 2018 was primarily due to a shift in product mix to software-based products.

Our Video segment customers continue to be cautious with investments in new technologies, such as next-generation IP architecture and Ultra HD. We believe a material and growing portion of the opportunities for our video business are linked to a migration by our customers to IP workflows and the distribution of linear and on-demand, OTT, and new mobile video services. We continue to steadily transition our video business away from legacy and customized computing hardware to more software-centric solutions and services, including OTT SaaS subscription offerings that enable video compression and processing through our VOS software platform running on standard off-the-shelf servers, data centers and in the cloud.

Our Cable Access strategy is to continue to deliver software-based cable access technologies, which we refer to as our CableOS solutions, to our cable operator customers. We believe our CableOS software-based cable access solutions are superior to hardware-based systems and delivers unprecedented scalability, agility and cost savings for our customers. Our

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CableOS solutions, which can be deployed based on a centralized, distributed Remote PHY or hybrid architecture, enable our customers to migrate to multi-gigabit broadband capacity and the fast deployment of DOCSIS 3.1 data, video and voice services. We believe our CableOS solutions resolve space and power constraints in the headend and hub, eliminate dependence on hardware upgrade cycles and significantly reduce total cost of ownership, and will help us become a major player in the cable access market. In the meantime, we believe our Cable Access segment is gaining momentum in the marketplace as our customers have begun to adopt new virtualized DOCSIS 3.1 CMTS solutions and distributed access architectures. While we are in the early stages of field trials and deployments and may experience near-term challenges, we continue to make progress in the development of our CableOS solutions and in the growth of our CableOS business, with expanded commercial deployments, field trials, and customer engagements since our first CableOS shipments in the fourth quarter of 2016.

To support our Cable Access strategy and foster the further development and growth of this segment, in September 2016, we issued Comcast a Warrant to further incentivize them to purchase our products and adopt our technologies, particularly our CableOS solutions. Pursuant to the Warrant, Comcast may, subject to certain vesting provisions, purchase up to 7,816,162 shares of our common stock, for a per share exercise price of $4.76. Because the Warrant is considered an incentive for Comcast to purchase certain of the Company's products, the value of the Warrant is recorded as a reduction in the Company's net revenues to the extent such value does not exceed net revenues from pertinent sales to Comcast. (See Note 16, "Warrants," of the Notes to our Consolidated Financial Statements for additional information).

As the timing of our customers' investment decisions can be uncertain, we have implemented restructuring plans to better align the Company's resources and strategic goals. We continue to focus on expense controls on a company-wide basis. (See Note 10, "Restructuring and Related Charges" of the Notes to our Consolidated Financial Statements for additional information).

Our aggregate balance of cash and cash equivalents as of December 31, 2018 was $66.0 million, and we generated $12.3 million of cash from operations during the fiscal year ended December 31, 2018. We also entered into a $15 million line of credit with Silicon Valley Bank in September 2017 which has not been used to withdraw any cash till date. We expect that our current sources of liquidity will provide us adequate liquidity based on our current plan for the next twelve months.

Critical Accounting Policies, Judgments and Estimates

The preparation of financial statements and related disclosures requires Harmonic to make judgments, assumptions and estimates that affect the reported amounts of assets and liabilities, the disclosure of contingencies and the reported amounts of revenue and expenses in the financial statements and accompanying notes. Material differences may result in the amount and timing of revenue and expenses if different judgments or different estimates were made. See Note 2 of the Notes to our Consolidated Financial Statements for details of our accounting policies. Critical accounting policies, judgments and estimates that we believe have the most significant impact on Harmonic's financial statements are set forth below:

- Revenue recognition;
- Valuation of inventories;
- Business combination;
- Impairment of goodwill or long-lived assets;
- Assessment of the probability of the outcome of current litigation;
- Accounting for income taxes; and
- Stock-based compensation.

Revenue Recognition

On January 1, 2018, the Company adopted ASC 606, Revenue from Contracts with Customers ("Topic 606"), using the modified retrospective method applied to those contracts which were not completed as of January 1, 2018. Results for the reporting period beginning January 1, 2018 are presented under Topic 606, while prior period amounts are not restated and continue to be reported in accordance with our historic accounting under ASC 605, Revenue Recognition ("Topic 605"). (See Note 2 "Summary of Significant Accounting Policies-Recently Adopted Accounting

Pronouncements" for additional information.)

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Valuation of Inventories

We state inventories at the lower of cost or net realizable value. Cost is computed using standard cost, which approximates actual cost, on a first-in, first-out basis. We write down the cost of excess or obsolete inventory to net realizable value based on future demand forecasts and historical consumption. If there were to be a sudden and significant decrease in demand for our products, or if there were a higher incidence of inventory obsolescence because of rapidly changing technology and customer requirements, we could be required to record additional charges for excess and obsolete inventory and our gross margin could be adversely affected. Inventory management is of critical importance in order to balance the need to maintain strategic inventory levels to ensure competitive lead times against the risk of inventory obsolescence because of rapidly changing technology and customer requirements.

Business Combination

We applied the acquisition method of accounting for business combinations to our acquisition of TVN, which closed on February 29, 2016. (See Note 6, “Business Acquisition,” for additional information on TVN acquisition). Under this method of accounting, all assets acquired and liabilities assumed are recorded at their respective fair values at the date of the completion of the transaction. Determining the fair value of assets acquired and liabilities assumed requires management’s judgment and often involves the use of significant estimates and assumptions, including assumptions with respect to future cash inflows and outflows, discount rates, intangibles and other asset lives, among other items. Fair value is defined as the price that would be received in a sale of an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (an exit price). Market participants are assumed to be buyers and sellers in the principal (most advantageous) market for the asset or liability. Additionally, fair value measurements for an asset assume the highest and best use of that asset by market participants. As a result, we may have been required to value the acquired assets at fair value measurements that do not reflect its intended use of those assets. Use of different estimates and judgments could yield different results. Any excess of the purchase price over the fair value of the net assets acquired is recognized as goodwill.

Impairment of Goodwill or Long-lived Assets

Goodwill represents the difference between the purchase price and the estimated fair value of the identifiable assets acquired and liabilities assumed. We test for goodwill impairment at the reporting unit level, which is the same as our operating segment, on an annual basis in the fourth quarter of each of our fiscal years, and at any other time at which events occur or circumstances indicate that the carrying amount of goodwill may exceed its fair value.

In evaluating goodwill for impairment, we first assess qualitative factors to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying value (including goodwill). If we conclude that it is not more likely than not that the fair value of a reporting unit is less than its carrying value, then no further testing is required. However, if we conclude that it is more likely than not that the fair value of a reporting unit is less than its carrying value, then the two-step goodwill impairment test is performed to identify a potential goodwill impairment and measure the amount of impairment to be recognized, if any. The two-step impairment test involves estimating the fair value of all assets and liabilities of the reporting unit, including the implied fair value of goodwill, through either estimated discounted future cash flows or market-based methodologies.

During the fourth quarter of 2018, we performed goodwill impairment testing for our two reporting units as part of our annual goodwill impairment test and concluded that goodwill was not impaired. We have not recorded any impairment charges related to goodwill for any prior periods.

We evaluate the recoverability of intangible assets and other long-lived assets when indicators of impairment are present. When impairment indicators are present, we evaluate the recoverability of intangible assets and other long-lived assets on the basis of undiscounted cash flows expected to result from the use of each asset group and its eventual disposition. If the undiscounted expected future cash flows are less than the carrying amount of the asset, an impairment loss is recognized in order to write down the carrying value of the asset to its estimated fair market value.

Assessment of the Probability of the Outcome of Current Litigation

From time to time, we are involved in lawsuits as well as subject to various legal proceedings, claims, threats of litigation, and investigations in the ordinary course of business, including claims of alleged infringement of third-party patents and other intellectual property rights, commercial, employment and other matters. We assess potential liabilities in connection with each lawsuit and threatened lawsuits and accrue an estimated loss for these loss contingencies if both of the following conditions are met: information available prior to issuance of the financial statements indicates that it is probable that a liability has been incurred at the date of the financial statements and the amount of loss can be reasonably estimated. While certain

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matters to which we are a party specify the damages claimed, such claims may not represent reasonably probable losses. Given the inherent uncertainties of litigation, the ultimate outcome of these matters cannot be predicted at this time, nor can the amount of possible loss or range of loss, if any, be reasonably estimated.

An unfavorable outcome on any litigation matters could require us to pay substantial damages, or, in connection with any intellectual property infringement claims, could require us to pay ongoing royalty payments or could prevent us from selling certain of our products. As a result, a settlement of, or an unfavorable outcome on, any of the matters referenced above or other litigation matters could have a material adverse effect on our business, operating results, financial position and cash flows.

See Note 19, “Legal Proceedings,” of the Notes to our Consolidated Financial Statements for additional information on the Avid litigation).

Accounting for Income Taxes

In preparing our financial statements, we estimate our income taxes for each of the jurisdictions in which we operate. This involves estimating our actual current tax expense and assessing temporary differences resulting from differing treatment of items, such as reserves and accruals, for tax and accounting purposes. These temporary differences result in deferred tax assets and liabilities, which are included within our Consolidated Balance Sheet.

We are subject to examination of our income tax returns by various tax authorities on a periodic basis. We regularly assess the likelihood of adverse outcomes resulting from such examinations to determine the adequacy of our provision for income taxes. We apply the provisions of the applicable accounting guidance regarding accounting for uncertainty in income taxes, which requires application of a more-likely-than-not threshold to the recognition and de-recognition of uncertain tax positions. If the recognition threshold is met, the applicable accounting guidance permits us to recognize a tax benefit measured at the largest amount of such tax benefit that, in our judgment, is more than fifty percent likely to be realized upon settlement. It further requires that a change in judgment related to the expected ultimate resolution of uncertain tax positions be recognized in earnings in the period in which such determination is made.

We file annual income tax returns in multiple taxing jurisdictions around the world. A number of years may elapse before an uncertain tax position is audited and finally resolved. While it is often difficult to predict the final outcome or the timing of resolution of any particular uncertain tax position, we believe that our reserves for income taxes reflect the most likely outcome. We adjust these reserves, as well as the related interest and penalties, in light of changing facts and circumstances. If our estimate of tax liabilities proves to be less than the ultimate assessment, a further charge to expense would result. If payment of these amounts ultimately proves to be unnecessary, the reversal of the liabilities would result in tax benefits being recognized in the period when we determine the liabilities are no longer necessary. Any changes in estimate, or settlement of any particular position, could have a material impact on our operating results, financial condition and cash flows.

Stock-based Compensation

We measure and recognize compensation expense for all stock-based compensation awards made to employees and non-employee directors, including stock options, restricted stock units and awards related to our Employee Stock Purchase Plan (“ESPP”), based upon the grant-date fair value of those awards. The grant date fair value of restricted stock units is based on the fair value of our common stock on the date of grant. The grant date fair value of our stock options and ESPP is estimated using the Black-Scholes option pricing model.

The determination of fair value of stock options and ESPP on the date of grant, using an option-pricing model, is affected by our stock price, as well as assumptions regarding a number of highly complex and subjective variables. These variables include our expected stock price volatility over the term of the awards, actual and projected employee stock option exercise behaviors, risk-free interest rates, and expected dividends. We estimated the expected life of the awards based on an analysis of our historical experience of employee exercise and post-vesting termination behavior considered in relation to the contractual life of the options and purchase rights. The risk-free interest rate assumption is based upon observed interest rates appropriate for the expected term of the awards. We do not currently pay cash dividends on our common stock and do not anticipate doing so in the foreseeable future. Accordingly, our expected dividend yield is zero.

Prior to January 1, 2017, stock-based compensation expense was recorded net of estimated forfeitures and, accordingly, was recorded for only those stock-based awards that we expected to vest. Upon the adoption of Accounting Standard Update No. 2016-09, Compensation - Stock Compensation (Topic 718) issued by the Financial Accounting Standards Board, our accounting policy was changed to account for forfeitures as they occur. The change was applied on a modified retrospective approach with a cumulative effect adjustment of $69,000 to retained earnings as of January 1, 2017 (which increased the accumulated deficit). The implementation of this accounting standard update has no impact to our statement of cash flows

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because we do not have any excess tax benefits from share-based compensation as our tax provision is primarily under full valuation allowance. No prior periods were recast as a result of this change in accounting policy.
We recognize the stock-based compensation expense for performance-based RSUs ("PRSUs") based on the probability of achieving certain performance criteria, as defined in the PRSU agreements. We estimate the number of PRSUs ultimately expected to vest and recognize expense using the graded vesting attribution method over the requisite service period. Changes in our estimates related to probability of achieving certain performance criteria and number of PRSUs expected to vest could significantly affect the stock-based compensation expense from one period to the next.
If factors change and we employ different assumptions to determine the fair value of our stock-based compensation awards granted in future periods, the compensation expense may differ significantly from what we have recorded in the current period.
See Note 12, "Employee Benefit Plans and Stock-based Compensation," of the notes to our Consolidated Financial Statements for additional information.

Results of Operations
Net Revenue
The following table presents the breakdown of net revenue by geographical region (in thousands, except percentages):

	Year ended December 31,						
	2018	2017	2016	2018 vs. 2017		2017 vs. 2016	
Americas	$218,900	$171,736	$207,249	$47,164	27 %	$(35,513)	(17)%
EMEA	107,074	117,129	126,752	(10,055)	(9)%	(9,623)	(8)%
APAC	77,584	69,381	71,910	8,203	12 %	(2,529)	(4)%
Total net revenue	$403,558	$358,246	$405,911	$45,312	13 %	$(47,665)	(12)%
Regional revenue as a % of total net revenue:							
Americas	54 %	48 %	51 %				
EMEA	27 %	33 %	31 %				
APAC	19 %	19 %	18 %				

Fiscal 2018 compared to Fiscal 2017
Net revenue in the Americas increased $47.2 million, or 27% in 2018, compared to 2017, primarily due to an increase in revenue from sale of CableOS products and services.
EMEA net revenue decreased $10.1 million, or 9% in 2018, compared to 2017, primarily due to lower cable access volumes in the region and lower video product volumes as a result of soft demand for our traditional linear broadcast products, which was partially offset by increased volumes of OTT-related products as customers transition to OTT.
APAC net revenue increased $8.2 million, or 12% in 2018 compared to 2017, primarily due to improved demand from our service provider and broadcast and media customers for our video products and services.
Fiscal 2017 compared to Fiscal 2016
Net revenue in the Americas decreased $35.5 million, or 17%, in 2017 compared to 2016, primarily due to decreased demand for our video products as customers transition investment from traditional linear broadcast video products to our new OTT and SaaS solutions, which are being used to stream premium video content to mobile devices, computers and smart TVs, including large screen Ultra HD TVs.
EMEA net revenue decreased $9.6 million, or 8%, in 2017 compared to 2016, primarily due to the aforementioned shift from traditional broadcast Pay-TV products to OTT technologies and SaaS subscriptions, partially offset by an increase in Cable Access segment revenue as a result of increased customer demand for our new CableOS solution, compared to 2016.

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APAC net revenue decreased $2.5 million, or 4% in 2017 compared to 2016, primarily due to timing of customer investments in video infrastructure as well as the negative impact from the technology shift in both segments.

Gross Profit

The following presents the gross profit and gross profit as a percentage of net revenue (“gross margin”) (in thousands, except percentages):

	Year ended December 31,						
	2018	2017	2016	2018 vs. 2017		2017 vs. 2016	
Gross profit	$209,209	$169,820	$200,750	$39,389	23%	$(30,930)	(15)%
As a percentage of net revenue (“gross margin”)	51.8 %	47.4 %	49.5 %	4.4 %		(2.1)%	

Our gross margins are dependent upon, among other factors, the proportion of software sales, product mix, customer mix, product introduction costs, price reductions granted to customers and achievement of cost reductions.

Gross margin increased 4.4% in 2018, as compared to 2017, primarily due to more favorable margins generated in our Cable Access segment due to increased CableOS activity. Our Video segment gross margin also improved marginally, primarily due to a favorable product mix.

Gross margin decreased 2.1% in 2017, as compared to 2016, primarily due to an unfavorable product mix, including transition from our traditional linear broadcast products to our new SaaS solutions, as well as lower service margins due to increased CableOS field trial activities and new production introduction costs, higher under-absorbed factory overhead costs, primarily driven by lower revenue and purchase levels year over year. In 2017, we recorded an inventory obsolescence charge of approximately $3.7 million for our legacy Cable Access product lines, compared to $4.0 million in 2016.

Research and Development

Our research and development expenses consist primarily of employee salaries and related expenses, contractors and outside consultants, supplies and materials, equipment depreciation and facilities costs, all associated with the design and development of new products and enhancements of existing products. The following table presents the research and development expenses and the expenses as a percentage of net revenue (in thousands, except percentages):

	Year ended December 31,						
	2018	2017	2016	2018 vs. 2017		2017 vs. 2016	
Research and development	$89,163	$95,978	$98,401	$(6,815)	(7)%	$(2,423)	(2)%
As a percentage of net revenue	22.1 %	26.8 %	24.2 %				

The $6.8 million, or 7%, decrease in research and development expenses in 2018 compared to 2017 was primarily due to lower employee compensation costs due to headcount reductions, lower utilization of third-party engineering services as the Company continues the process of transforming its research and development activities from capital intensive hardware development to predominantly software development and lower travel and other discretionary costs due to vigilant cost management throughout the Company. The decrease in research and development expenses was partially offset by $6.0 million in reimbursements of engineering spending by one of our large customers which ended in 2017 and higher incentive compensation associated with the Company’s performance. The research and development expense in 2018 was net of $5.9 million of French R&D tax credits.

The $2.4 million, or 2%, decrease in research and development expenses in 2017 compared to 2016 was primarily due to lower project material and outside consulting spending due to the completion of certain research and development projects in early 2017, lower employee compensation costs due to headcount reduction, and lower outside engineering services due to cost reduction efforts. The research and development expenses in each of 2017 and 2016 were net of $6.0 million in reimbursements of engineering spending in each of the year by one of our large customers, as well as $5.9 million and $6.1 million of French R&D tax credits, respectively.

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Our TVN French Subsidiary participates in the French CIR program which allows companies to monetize eligible research expenses. We recognize R&D tax credits receivable from the French government for spending on innovative research and development as an offset to research and development expenses.

Selling, General and Administrative

The following table presents the selling, general and administrative expenses and the expense as a percentage of net revenue (in thousands, except percentages):

	Year ended December 31,				
	2018	2017	2016	2018 vs. 2017	2017 vs. 2016
Selling, general and administrative	$118,952	$136,270	$144,381	$(17,318)(13)%	$(8,111)(6)%
As a percentage of net revenue	29.5 %	38.0 %	35.6 %		

The $17.3 million, or 13%, decrease in selling, general and administrative expenses in 2018 compared to 2017 was primarily due to lower employee compensation costs due to headcount reductions, higher legal and settlement charges recorded during 2017 related to Avid litigation, and lower travel and other discretionary costs due to vigilant cost management throughout the Company. This decrease was partially offset by higher incentive compensation associated with the Company's performance.

The $8.1 million, or 6%, decrease in selling, general and administrative expenses in 2017 compared to 2016 was primarily due to lower TVN acquisition- and integration- related costs in 2017 as majority of the integration projects were completed in early 2017. In addition, lower headcount expenses and lower depreciation expenses from reduction in capital expenditure also contributed to the decrease year over year. These reductions were offset in part by a $6.0 million charge related to the Avid litigation settlement in 2017.

Segment Financial Results

The following table provides summary financial information by reportable segment (in thousands, except percentages):

	Year ended December 31,						
	2018 (2)	2017 (1)	2016	2018 vs. 2017		2017 vs. 2016	
Video							
Revenue	$313,828	$319,473	$351,489	$(5,645)	(2)%	$(32,016)	(9)%
Gross profit	178,170	173,414	194,044	4,756	3 %	(20,630)	(11)%
Operating income (loss)	26,170	(2,024)	11,963	28,194	(1,393)%	(13,987)	(117)%
Segment revenue as % of total segment revenue	77.5 %	89.2 %	86.6 %	(11.7)%		2.6 %	
Gross margin %	56.8 %	54.3 %	55.2 %	2.5 %		(0.9)%	
Operating margin %	8.3 %	(0.6)%	3.4 %	8.9 %		(4.0)%	
Cable Access							
Revenue	$90,908	$38,773	$54,422	$52,135	134 %	$(15,649)	(29)%
Gross profit	40,207	8,892	21,174	31,315	352 %	(12,282)	(58)%
Operating loss	(578)	(23,154)	(12,131)	22,576	(98)%	(11,023)	91 %
Segment revenue as % of total segment revenue	22.5 %	10.8 %	13.4 %	11.7 %		(2.6)%	
Gross margin %	44.2 %	22.9 %	38.9 %	21.3 %		(16.0)%	
Operating margin %	(0.6)%	(59.7)%	(22.3)%	59.1 %		(37.4)%	
Total							
Segment Revenue	$404,736	$358,246	$405,911	$46,490	13 %	$(47,665)	(12)%
Gross profit	218,377	182,306	215,218	36,071	20 %	(32,912)	(15)%
Operating income (loss)	25,592	(25,178)	(168)	50,770	(202)%	(25,010)	14,887 %

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A reconciliation of our consolidated segment operating income (loss) to consolidated loss before income taxes is as follows (in thousands):

	Year ended December 31,		
	2018 [2]	2017 [1]	2016
Total segment operating income (loss)	$25,592	$(25,178)	$(168)
Amortization of warrants [2]	(1,178)	—	—
Unallocated corporate expenses	(3,769)	(20,767)	(38,972)
Stock-based compensation	(17,289)	(16,610)	(13,060)
Amortization of intangibles	(8,367)	(8,322)	(14,836)
Consolidated loss from operations	(5,011)	(70,877)	(67,036)
Non-operating expense, net	(11,937)	(13,830)	(13,394)
Loss before income taxes	$(16,948)	$(84,707)	$(80,430)

(1) We have historically employed an aggregate allocation methodology based on total revenues to attribute professional services revenue and sales expenses between our Video and Cable Access segments. Beginning in the fourth quarter of 2017, we have prospectively changed to a more precise attribution methodology as the activities of selling and supporting our CableOS solution have become increasingly distinct from those of our Video solutions. The impact of making this change for the year ended December 31, 2017 compared to our historical approach was an increase in operating loss of $5.9 million from the Video segment and a corresponding decrease in operating loss of the Cable Access segment. We believe that the updated allocation methodology provides greater clarity regarding the operating metrics of the Video and Cable Access business segments.
(2) Our segment revenue for 2018 is not net of amortization of Comcast warrants, which primarily relate to our Cable Access segment. After netting the amortization of warrants from the segment revenue for Cable Access, our revenue for Cable Access segment for the year ended December 31, 2018 was $89,730 thousand and our total revenue for the year ended December 31, 2018 was $403,558 thousand.

Unallocated Corporate Expenses

Together with amortization of intangibles and stock-based compensation, we do not allocate restructuring and related charges, TVN acquisition- and integration-related costs, and certain other non-recurring charges to the operating income for each segment because our management does not include this information in the measurement of the performance of the operating segments.

Video

Our Video segment net revenue decreased $5.6 million, or 2% in 2018, compared to 2017, due to a decrease of $4.4 million in Video service revenue and a decrease of $1.2 million in Video product revenue. The decrease in our Video service revenue in 2018 was primarily due to reduced activity in connection with SaaS deployments. The decrease in our Video product revenue was primarily due to decreased demand for our traditional linear broadcast products as customers transition to our new OTT and SaaS solutions. Video segment operating margin increased 8.9% in 2018, compared to 2017, primarily due to better margins as a result of a more favorable product mix, lower operating expenses due to headcount reductions and lower other discretionary costs due to vigilant cost management throughout the Company. The increase in Video segment margin was partially offset by a decrease due to the change in methodology for allocating professional services revenue between segments in the fourth quarter of 2017.

Our Video segment net revenue decreased $32.0 million, or 9%, in 2017 compared to 2016, due to a $39.9 million decrease in video product revenue, offset in part by a $7.9 million increase in video service revenue. The decrease in our Video segment net revenue in 2017 reflects our customers' transition from our traditional linear broadcast products to our new OTT technologies and SaaS solutions, partially offset by higher revenue due to the inclusion of two additional months of TVN post-acquisition revenue, compared to 2016. Video segment operating margin decreased 4.0% in 2017, compared to 2016, primarily due to decrease in video product revenue which led to higher unabsorbed factory overhead and higher inventory obsolescence charges for our legacy broadcast video inventory, offset partially by a decrease in discretionary operating expenses.

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Cable Access
Our Cable Access segment net revenue increased $52.1 million, or 134% in 2018, compared to 2017, primarily due to increase in shipments of hardware, software and services for our CableOS solution. Cable Access segment operating margin increased 59.1% in 2018, compared to 2017, due to higher revenue and related higher margins on sale of both software and professional services. The change in methodology for allocating professional services revenue between segments in the fourth quarter of 2017 also contributed to the increase in Cable Access margins in 2018 as compared to 2017.
Our Cable Access segment net revenue decreased $15.6 million, or 29%, in 2017 compared to 2016, primarily due to continuing lower demand for our legacy EdgeQAM technologies as some of our customers deferred purchases as they plan for a migration to next generation technologies and architectures. Cable Access segment operating margin decreased 37.4% in 2017, compared to 2016, due to the reduced demand for our legacy EdgeQAM products as well as higher service costs related to increased CableOS trial activity and new product introduction costs, as well as higher research and development expenses for CableOS development in 2017.
Amortization of Intangibles
The following table summarizes the amortization of intangibles (in thousands, except percentages):

	Year ended December 31,						
	2018	2017	2016	2018 vs. 2017		2017 vs. 2016	
Amortization of intangibles	$3,187	$3,142	$10,402	$45	1%	$(7,260)	(70)%
As a percentage of net revenue	0.8 %	0.9 %	2.6 %				

The amortization of intangibles expense in 2018 remained relatively flat compared to 2017.
The decrease in amortization of intangibles expense in 2017, compared to 2016, was primarily due to intangibles for customer relationships and maintenance agreements relating to Omneon acquisition being fully amortized in 2016.
Restructuring and Related Charges
We have implemented several restructuring plans in the past few years. The goal of these plans is to bring operational expenses to appropriate levels relative to our net revenues, while simultaneously implementing extensive company-wide expense control programs. We account for our restructuring plans under the authoritative guidance for exit or disposal activities. The restructuring and related charges are included in “Cost of revenue” and “Operating expenses-restructuring and related charges” in the Consolidated Statements of Operations. The following table summarizes the restructuring and related charges (in thousands):

	Year ended December 31,						
	2018	2017	2016	2018 vs. 2017		2017 vs. 2016	
Cost of revenue	$857	$1,279	$3,400	$(422)	(33)%	$(2,121)	(62)%
Operating expenses-Restructuring and related charges	2,918	5,307	14,602	(2,389)	(45)%	(9,295)	(64)%
Total restructuring and related charges	$3,775	$6,586	$18,002	$(2,811)	(43)%	$(11,416)	(63)%

The $2.8 million decrease in restructuring and related charges in 2018, compared to 2017, was primarily due to higher TVN VDP and severance costs recorded in 2017 related to the Harmonic 2016 and 2017 Restructuring Plans, partially offset by facility exit costs and severance costs recorded under the Harmonic 2018 Restructuring Plan.
The $11.4 million decrease in restructuring and related charges in 2017, compared to 2016, was primarily due to lower TVN VDP costs in 2017, compared to 2016. Most of the TVN VDP costs were recorded in 2016 based on the departing employees’ service period.
See Note 10, “Restructuring and Related Charges,” of the Notes to our Consolidated Financial Statements for details on each of our restructuring plans.

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Interest Expense, Net

Interest expense, net was $11.4 million, $11.1 million and $10.6 million during 2018, 2017 and 2016, respectively. The year-over-year increase in interest expense, net is primarily due to higher amortization of debt discount and issuance costs for the Notes issued in December 2015. See Note 11, “Convertible Notes, Other Debts and Capital Leases,” of the Notes to our Consolidated Financial Statements for additional information.

Other Expense, Net

Other expense, net was $0.5 million, $2.2 million and $31,000 during 2018, 2017 and 2016, respectively. Other expense, net is primarily comprised of foreign exchange gains and losses on cash, accounts receivable and intercompany balances denominated in currencies other than the functional currency of the reporting entity. Our foreign currency exposure is primarily driven by the fluctuations in the foreign currency exchanges rates of the Euro, British pound, Japanese yen and Israeli shekel. The decrease in other expense, net in 2018 compared to 2017 was primarily due to higher foreign exchange losses resulting from the strengthening of the Euro against the U.S. dollars in 2017. See “Foreign Currency Exchange Risk” under Item 7A of this Annual Report on Form 10-K for additional information.

Loss on Impairment of Long-term Investments

In 2014, we acquired a 3.3% interest in Vislink plc (“Vislink”), a U.K. public company listed on the AIM exchange, for $3.3 million. On February 3, 2017, Vislink completed the disposal of its hardware division and changed its name to Pebble Beach Systems (“PBS”).

Since mid-2016, the stock price of PBS, has traded below its cost basis as a result of which we recorded a total of $2.7 million and $0.5 in impairment charges in 2016 and 2017, respectively. We sold this investment for $0.1 million in the third quarter of 2018.

Income Taxes

We reported the following operating results for each of the three years ended December 31, 2018, 2017 and 2016 (in thousands, except percentages):

	Year ended December 31,		
	2018	2017	2016
Loss before income taxes	(16,948)	(84,707)	(80,430)
Provision for (benefit from) income taxes	4,087	(1,752)	(8,116)
Effective income tax rate	(24)%	2%	10%

Our effective tax rate generally differs from the U.S. federal statutory rate of 21% due to favorable tax rates associated with certain earnings from our operations in lower tax jurisdictions throughout the world and our valuation allowance in the U.S. In addition, our effective tax rates vary in each period primarily due to specific one-time, discrete items that affected the tax rate in the respective period.

In 2018, our effective income tax rate of (24)% differed from the U.S. federal statutory rate of 21% primarily due to geographical mix of income and losses, full valuation allowance against U.S. federal, California and other states deferred tax assets, foreign withholding taxes and income taxes on earnings from operations in foreign tax jurisdictions.

On December 22, 2017, the Tax Cuts and Jobs Act (the “TCJA”) was enacted which, among other things, lowered the U.S. federal corporate income tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred and creates new taxes on certain foreign sourced earnings. As of December 31, 2018, we completed the accounting for transition tax and concluded that it had no tax impact because our cumulative unremitted earnings and profits are negative.

The TCJA also includes a requirement to pay a minimum tax on foreign earnings for tax years beginning after December 31, 2017. An accounting policy choice is allowed to either treat taxes due on future U.S. inclusions as a current period expense or account for the minimum tax in the measurement of deferred tax assets. We elected to treat the minimum tax as a period cost. As such, we did not recognize any deferred taxes related to the minimum tax.

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In 2017, our effective income tax rate of 2% differed from the U.S. federal statutory rate of 35% primarily due to our geographical income mix, favorable tax rates associated with certain earnings from operations in lower-tax jurisdictions, tax rate changes in foreign jurisdictions, tax benefits associated with the release of tax reserves for uncertain tax positions resulting from the expiration of the applicable statute of limitations, a one-time benefit from the reduction of a valuation allowance on alternative minimum tax (“AMT”) credit carryforwards that will be refundable as a result of the TCJA, partially offset by the increase in the valuation allowance against U.S. federal, California and other state deferred tax assets, detriment from non-deductible stock-based compensation, and the net of various other discrete tax adjustments.

In 2016, our effective income tax rate of 10% differed from the then-applicable U.S. federal statutory rate of 35% primarily due to our geographical income mix and our tax valuation allowance, favorable tax rates associated with certain earnings from operations in lower-tax jurisdictions, favorable resolutions of uncertain tax positions, and the tax benefit from the realization of certain deferred tax assets as a result of the TVN acquisition, partially offset by the increase in the valuation allowance against U.S. federal, California and other state deferred tax assets, detriment from non-deductible stock-based compensation, non-deductible amortization of foreign intangibles, and the net of various discrete tax adjustments.

For a reconciliation of our effective tax rate to the U.S. federal statutory rate of 21% and further explanation of our provision for taxes, see Note 14, “Income Taxes,” of the notes to our Consolidated Financial Statements.

Liquidity and Capital Resources

As of December 31, 2018, our principal sources of liquidity consisted of cash and cash equivalents of $66.0 million, net accounts receivable of $81.8 million, our $15 million line of credit with Silicon Valley Bank, described in more detail below, and financing from French government agencies. As of December 31, 2018, we had $128.25 million in convertible senior notes outstanding (“Notes”), which are due on December 1, 2020. The Notes bear interest at a fixed rate of 4.00% per year, payable semiannually in arrears on June 1 and December 1 of each year. We also had debts with French government agencies and to a lesser extent, with other financial institutions, primarily in France, in the aggregate of $19.9 million at December 31, 2018.

Our cash and cash equivalents of $66.0 million as of December 31, 2018 consisted of bank deposits held throughout the world, of which $48.1 million of the cash and cash equivalents balance was held outside of U.S. At present, such foreign funds are considered to be indefinitely reinvested in foreign countries to the extent of indefinitely reinvested foreign earnings. In the event funds from foreign operations are needed to fund cash needs in the United States and if U.S. taxes have not already been previously accrued, we may be required to accrue and pay additional U.S. and foreign withholding taxes in order to repatriate these funds.

Our principal uses of cash will include repayments of debt and related interest, purchases of inventory, payroll, restructuring expenses, and other operating expenses related to the development and marketing of our products, purchases of property and equipment and other contractual obligations for the foreseeable future. We believe that our cash and cash equivalents of $66.0 million at December 31, 2018 will be sufficient to fund our principal uses of cash for at least the next 12 months. However, we may need to raise additional funds to fund our operations, to take advantage of unanticipated strategic opportunities or to strengthen our financial position. In the future, we may enter into other arrangements for potential investments in, or acquisitions of, complementary businesses, services or technologies, which could require us to seek additional equity or debt financing. Additional funds may not be available on terms favorable to us or at all.

On September 27, 2017, we entered into a Loan and Security Agreement (the “Loan Agreement”) with Silicon Valley Bank (the “Bank”). The Loan Agreement provides for a secured revolving credit facility in an aggregate principal amount of up to $15.0 million. Under the terms of the Loan Agreement, the principal amount of loans, plus the face amount of any outstanding letters of credit, at any time cannot exceed up to 85% of our eligible receivables. Under the terms of the Loan Agreement, we may also request letters of credit from the Bank. Loans under the Loan Agreement will bear interest at our option, and subject to certain conditions, at an annual rate of either a prime rate or a LIBOR rate plus an applicable margin of 2.25%. There will be no applicable margin for prime rate advances when we are in compliance with the liquidity requirement of at least $20.0 million in the aggregate of consolidated cash plus availability under the Loan Agreement (the “Liquidity Requirement”) and a 0.25% margin for prime rate advances when we are not in compliance with the Liquidity Requirement. We may not request LIBOR advances when not in compliance with the Liquidity Requirement. Interest on each advance is due and payable monthly and the principal balance is due at maturity. Our obligations under the revolving credit facility are secured by a security interest on substantially all of its assets, excluding intellectual property. The Loan Agreement contains customary affirmative and negative covenants. We must comply with financial covenants requiring maintaining (i) a minimum short-term asset to short-term liabilities ratio and (ii) minimum adjusted EBITDA, in the amounts and for the periods as set forth in the Loan Agreement. We must also maintain a minimum liquidity amount, comprised of unrestricted cash held at accounts with the Bank plus proceeds available to be drawn under the Loan Agreement, equal to $10.0 million at all times.

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There were no borrowings under the Loan Agreement from the closing of the Loan Agreement through December 31, 2018. As of December 31, 2018, we were in compliance with the covenants under the Loan Agreement.

The table below presents selected cash flow data for the periods presented (in thousands):

	Year ended December 31,		
	2018	2017	2016
	(In thousands)		
Net cash provided by operating activities	$12,284	$3,064	$438
Net cash used in investing activities	(6,940)	(4,501)	(69,734)
Net cash provided by (used in) financing activities	2,651	895	(152)
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(763)	1,879	(415)
Net increase (decrease) in cash, cash equivalents and restricted cash	$7,232	$1,337	$(69,863)

Operating Activities

Net cash provided by operating activities increased $9.2 million in 2018 compared to 2017, primarily due to decrease in net loss, offset in part by higher cash being used for our working capital needs.

Net cash provided by operating activities increased $2.6 million in 2017 compared to 2016, primarily due to more cash being generated from net working capital, offset in part by a $1.2 million increase in net loss.

We expect that cash provided by or used in operating activities may fluctuate in future periods as a result of a number of factors, including fluctuations in our operating results, shipment linearity, accounts receivable collections performance, inventory and supply chain management, and the timing and amount of compensation and other payments.

Investing Activities

Net cash used in investing activities increased $2.4 million in 2018 compared to 2017, primarily due to a decrease in proceeds from sales and maturities of investments of $6.8 million, offset by a decrease in purchases of property and equipment of $4.4 million.

Net cash used in investing activities decreased $65.2 million in 2017 compared to 2016, primarily due to the $75.7 million net cash paid for the TVN acquisition in 2016 and less cash used for purchases of property and equipment, offset in part by lesser proceeds from sale and maturities of marketable investments.

Financing Activities

Net cash provided by financing activities increased $1.8 million in 2018 compared to 2017, primarily due to lower payment of tax withholding obligations related to net share settlements of restricted stock units.

Net cash provided by financing activities increased $1.0 million in 2017 compared to 2016, primarily due to lower net debt payments in 2017, offset in part by higher payments of tax withholding obligations related to net share settlements of RSUs in 2017.

Off-Balance Sheet Arrangements

None as of December 31, 2018.

Contractual Obligations and Commitments

Future payments under contractual obligations and other commercial commitments, as of December 31, 2018 are as follows (in thousands):

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	Payments due in each fiscal year				
	Total Amounts Committed	Less than 1 year	1 to 3 years	4 to 5 years	More than 5 years
Convertible debt	$128,250	$—	$128,250	$—	$—
Operating leases (1)	39,179	13,515	14,227	4,743	6,694
Purchase commitments (2)	35,946	30,005	5,220	721	—
Other debts	19,697	7,084	11,940	607	66
Interest on convertible debt	10,260	5,130	5,130	—	—
Avid litigation settlement fees	3,500	1,500	2,000	—	—
TVN VDP obligations (3)	2,409	1,585	824	—	—
Capital Lease	162	91	71	—	—
Total contractual obligations	$239,403	$58,910	$167,662	$6,071	$6,760
Other commercial commitments:					
Standby letters of credit	$2,179	$2,179	$—	$—	$—
Indemnification obligations (4)	—	—	—	—	—
Total commercial commitments	$2,179	$2,179	$—	$—	$—

(1) We lease facilities under operating leases expiring through June 2028. Certain of these leases provide for renewal option for periods ranging from one to five years in the normal course of business.
(2) During the normal course of business, in order to reduce manufacturing lead times and ensure adequate component supply, we enter into agreements with certain contract manufacturers and suppliers that allow them to procure inventory and services based upon criteria as defined by the Company.
(3) In 2016, we established the TVN VDP to enable the French employees of TVN to voluntarily terminate their employment with certain benefits. See Note 10, “Restructuring and Related Charges-TVN VDP,” of the notes to our Consolidated Financial Statements for additional information.
(4) We indemnify our officers and the members of our Board pursuant to our bylaws and contractual indemnity agreements. We also indemnify some of our suppliers and most of our customers for specified intellectual property matters and some of our other vendors, such as building contractors, pursuant to certain parameters and restrictions. The scope of these indemnities varies, but, in some instances, includes indemnification for defense costs, damages and other expenses (including reasonable attorneys’ fees).

Due to the uncertainty with respect to the timing of future cash flows associated with our unrecognized tax benefits at December 31, 2018, we are unable to make reasonably reliable estimates of the period of cash settlement with the respective taxing authority. Therefore, $0.5 million of unrecognized tax benefits classified as “Income taxes payable, long-term” in the accompanying Consolidated Balance Sheet as of December 31, 2018, had been excluded from the contractual obligations table above. See Note 14, “Income Taxes,” of the notes to our Consolidated Financial Statements for a discussion on income taxes.

New Accounting Pronouncements

See Note 2 of the accompanying Consolidated Financial Statements for a full description of recent accounting pronouncements, including the respective expected dates of adoption and effects on results of operations and financial condition.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK.

Foreign Currency Exchange Risk

We market and sell our products and services through our direct sales force and indirect channel partners in North America, EMEA, APAC and Latin America. Accordingly, we are subject to exposure from adverse movements in foreign currency exchange rates, primarily the Euro, British pound, Israeli shekel and Japanese yen. Our U.S. dollar functional

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subsidiaries, which account for approximately 95%, 95% and 88% of our consolidated net revenues in 2018, 2017 and 2016, respectively, recorded net billings denominated in foreign currencies of approximately 14%, 18% and 13% of their net revenues in 2018, 2017 and 2016, respectively. In addition, a portion of our operating expenses, primarily the cost of personnel to deliver technical support on our products and professional services, sales and sales support and research and development, are denominated in foreign currencies, primarily the Euro, Israeli shekel and British pound. We use derivative instruments, primarily forward contracts, to manage exposures to foreign currency exchange rates and we do not enter into foreign currency forward contracts for trading purposes.

Derivatives Not Designated as Hedging Instruments (Balance Sheet Hedges)

We enter into forward currency contracts to hedge foreign currency denominated monetary assets and liabilities. These derivative instruments are marked to market through earnings every period and mature generally within three months. Changes in the fair value of these foreign currency forward contracts are recognized in “Other expense, net” in the Consolidated Statement of Operations, and are largely offset by the changes in the fair value of the assets or liabilities being hedged.

The U.S. dollar equivalents of all outstanding notional amounts of foreign currency forward contracts are summarized as follows (in thousands):

	December 31,	
	2018	2017
Derivatives not designated as hedging instruments:		
Purchase	$28,975	$12,875
Sell	$—	$1,509

Interest Rate Risk

Our exposure to market risk for changes in interest rates relates primarily to our outstanding debt arrangements with variable rate interests as well as our borrowings under the Loan Agreement.

On September 27, 2017, we entered into the Loan Agreement with Silicon Valley Bank. The Loan Agreement provides for a secured revolving credit facility in an aggregate principal amount of up to $15.0 million. Loans under the Loan Agreement will bear interest, at our option, and subject to certain conditions, at an annual rate of either a prime rate or a LIBOR rate (each as customarily defined), plus an applicable margin. The applicable margin for LIBOR rate advances is 2.25%. There will be no applicable margin for prime rate advances when we are in compliance with the Liquidity Requirement and a margin of 0.25% for prime rate advances when we are not in compliance with the Liquidity Requirement. We may not request LIBOR advances when it is not in compliance with the Liquidity Requirement. Interest on each advance is due and payable monthly and the principal balance is due at maturity.

As of December 31, 2018, the Company committed $1.8 million towards security for letters of credit issued under the Loan Agreement. We have no borrowings under the Loan Agreement from the closing of the Loan Agreement through December 31, 2018.

As of December 31, 2018, our cash balance was $66.0 million. We had no short-term investments as of December 31, 2018.

As a result of the TVN acquisition, we assumed various debt instruments. The aggregate debt balance of such instruments at December 31, 2018 was $19.9 million, of which $0.2 million relates to obligations under capital leases with fixed interest rates. The remaining $19.7 million are debt instruments primarily financed by French government agencies, and, to a lesser extent, term loans from other financing institutions. These debt instruments have maturities ranging from three to seven years; expiring from 2019 through 2025. A majority of the loans are tied to the 1 month EURIBOR rate plus spread. (See Note 11, “Convertible notes, Other Debts and Capital Leases,” of the notes to our Consolidated Balance Sheets for additional information). As of December 31, 2018, a hypothetical 1.0% increase in market interest rates on our debts subject to variable interest rate fluctuations would increase our interest expense by approximately $0.2 million annually.

As of December 31, 2018, we had $128.3 million aggregate principal amount of the Notes outstanding, which have a fixed 4.0% coupon rate.

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Item 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of Harmonic Inc.:

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheet of Harmonic Inc. and its subsidiaries (the Company) as of December 31, 2018 and the related consolidated statements of operations, comprehensive loss, stockholders' equity, and cash flows for the year ended December 31, 2018, and the related notes (collectively referred to as the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control-Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above 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 ended December 31, 2018 in conformity with accounting principles generally accepted in the United States of America. Also, in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control-Integrated Framework (2013) issued by COSO.

Change in Accounting Principle

As discussed in Note 2 to the consolidated financial statements, the Company has changed its method of accounting for revenue in 2018 due to the adoption of Accounting Standards Update (ASU) No. 2014-09, Revenue from Contracts with Customers (Topic 606), using the modified retrospective method.

Basis for Opinion

The Company's management is responsible for these consolidated financial statements, 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 Report on Internal Control over Financial Reporting appearing under Item 9A. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting 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 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 consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audit of the consolidated financial statements 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. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinions.

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/Armanino LLP

We have served as the Company's auditor since 2018.

San Ramon, California
March 1, 2019

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of Harmonic Inc.:
Opinion on the Financial Statements

We have audited the consolidated balance sheet of Harmonic Inc. and its subsidiaries (the “Company”) as of December 31, 2017, and the related consolidated statements of operations, comprehensive loss, stockholders’ equity and cash flows for each of the two years in the period ended December 31, 2017, 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, 2017, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2017 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 audits. 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 audits 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 audits 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 audits provide a reasonable basis for our opinion.
/s/ PricewaterhouseCoopers LLP
San Jose, California
March 5, 2018

We served as the Company's auditor from 1989 to 2018.

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HARMONIC INC.
CONSOLIDATED BALANCE SHEETS
(In thousands, except per share data)

	December 31, 2018	December 31, 2017
ASSETS		
Current assets:		
Cash and cash equivalents	$65,989	$57,024
Accounts receivable, net	81,795	69,844
Inventories	25,638	25,976
Prepaid expenses and other current assets	23,280	18,931
Total current assets	196,702	171,775
Property and equipment, net	22,321	29,265
Goodwill	240,618	242,827
Intangibles, net	12,817	21,279
Other long-term assets	38,377	42,913
Total assets	$510,835	$508,059
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Other debts and capital lease obligations, current	$7,175	$7,610
Accounts payable	33,778	33,112
Income taxes payable	1,099	233
Deferred revenue	41,592	52,429
Accrued and other current liabilities	52,761	48,705
Total current liabilities	136,405	142,089
Convertible notes, long-term	114,808	108,748
Other debts and capital lease obligations, long-term	12,684	15,336
Income taxes payable, long-term	460	917
Other non-current liabilities	18,228	22,626
Total liabilities	282,585	289,716
Commitments and contingencies (Note 18)		
Stockholders' equity:		
Preferred stock, $0.001 par value, 5,000 shares authorized; no shares issued or outstanding	—	—
Common stock, $0.001 par value, 150,000 shares authorized; 87,057 and 82,554 shares issued and outstanding at December 31, 2018 and 2017, respectively	87	83
Additional paid-in capital	2,296,795	2,272,690
Accumulated deficit	(2,067,416)	(2,057,812)
Accumulated other comprehensive income (loss)	(1,216)	3,382
Total stockholders' equity	228,250	218,343
Total liabilities and stockholders' equity	$510,835	$508,059

The accompanying notes are an integral part of these consolidated financial statements.

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HARMONIC INC.
CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except per share data)

	Year ended December 31,		
	2018	2017	2016
Revenue:			
Product	$252,067	$224,645	$285,260
Service	151,491	133,601	120,651
Total net revenue	403,558	358,246	405,911
Cost of revenue:			
Product	127,268	119,802	145,714
Service	67,081	68,624	59,447
Total cost of revenue	194,349	188,426	205,161
Total gross profit	209,209	169,820	200,750
Operating expenses:			
Research and development	89,163	95,978	98,401
Selling, general and administrative	118,952	136,270	144,381
Amortization of intangibles	3,187	3,142	10,402
Restructuring and related charges	2,918	5,307	14,602
Total operating expenses	214,220	240,697	267,786
Loss from operations	(5,011)	(70,877)	(67,036)
Interest expense, net	(11,401)	(11,078)	(10,628)
Other expense, net	(536)	(2,222)	(31)
Loss on impairment of long-term investments	—	(530)	(2,735)
Loss before income taxes	(16,948)	(84,707)	(80,430)
Provision for (benefit from) income taxes	4,087	(1,752)	(8,116)
Net loss	$(21,035)	$(82,955)	$(72,314)
Net loss per share:			
Basic and diluted	$(0.25)	$(1.02)	$(0.93)
Shares used in per share calculations:			
Basic and diluted	85,615	80,974	77,705

The accompanying notes are an integral part of these consolidated financial statements.

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HARMONIC INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(In thousands)
Year ended
December 31,