CPI has made significant technological advances in amplifier design. SuperLinear TWTAs are the most efficient uplink HPAs available, saving operating expenses and contributing to fewer carbon emissions than any other amplifier technology. CPI also provides the latest in solid-state amplifier design, offering robust products in small, lightweight packaging suitable for almost any environment.
CPI Satcom Division is a leading worldwide supplier of high-power satcom uplink amplifiers. With nearly 40 years of market experience, the company has the largest worldwide installed base of amplifiers and provides impeccable support for its customers with an industry-leading service network. The division was founded as part of Varian Associates in 1971 and has fielded more than 30,000 high-power amplifiers since that time. The company’s research and design center is based in Silicon Valley, Calif. The world-class manufacturing facility is located near Toronto, and is well equipped to handle high and low volume projects as well as customized solutions.

CPI Satcom Division manufactures high-power amplifiers (HPAs) and its leading-edge technology features heavily in all three of its product groups: solid-state power amplifiers (SSPAs) and high-power solid state BUCs (SSPBs); traveling wave tube amplifiers (TWTA); and klystron power amplifiers (KPs). CPI’s amplifiers are available in all frequency bands, including S, C, X, Ku, DBS, Ka, Q and V; and range in RF output power from 10 Watts to 3000 Watts, or more. CPI specializes in products for high-data rate and high-bandwidth applications.

The primary markets for satcom HPAs today include broadcasting, digital satellite newsgathering, mobile communications, DTH services and military communications. These markets require a range of products — from smaller, lighter, more efficient HPAs that are mounted on the antenna feed plate or antenna boom of a mobile terminal, to high-power, high-bandwidth amplifiers used in large gateway terminals.

**Ka-band Amplifiers**

The emergence of Ka-band is a key part of CPI’s business going forward. There is increasing demand for systems that uplink to high throughput satellites, such as those used in the ViaSat, Ka-sat, Hylas, O3b and IPSTAR systems. CPI has always been at the forefront of Ka-band HPA development and production, introducing its first Ka-band product in the 1980s. The company has since been involved in a number of projects around the world that use Ka-band for broadcast or IP applications. Today, CPI possesses the broadest, most established offering of Ka-band HPAs on the market, with three technologies to choose from:

1. **High power klystron amplifiers**, capable of varying degrees of output power and bandwidth combinations from 475 Watts with 500 MHz instantaneous bandwidth, up to 800 Watts with 300 MHz instantaneous bandwidth.

2. **Traveling wave tube amplifiers with RF output powers ranging from 120 watts up to 500 watts, or more.**

3. **High-power solid-state BUCs with RF output powers up to 40 Watts Psat/20 Watts Plin in a very small, lightweight package.**

CPI has fielded nearly 800 high-power Ka-band amplifiers, and CPI amplifiers are relied upon in the gateways of most of the latest high throughput systems.

**SuperLinear Amplifiers**

CPI has led the way in improving amplifier efficiency for more than a decade. With a technical initiative aimed at lowering operating costs and producing more environmentally responsible HPAs, the company has been able to utilize its in-house tube development capabilities and some innovative amplifier design techniques to develop an industry-leading product line of ‘green’ HPAs. With prime power costs steadily on the rise and government environmental initiatives beginning to govern carbon emissions, customers have responded favorably.

A significant step forward in TWTA technology was the creation of SuperLinear® TWTA, which takes the concept of peak power amplifiers to an entirely new level of efficiency. SuperLinear TWTA first appeared about five years ago and have gained considerable interest and market acceptance. Since they are more than twice as efficient as SSPAs and more efficient than traditional TWTAs, this type of HPA is now replacing both older TWTA and SSPA systems. Higher efficiency manifests itself by fulfilling green, carbon reduction initiatives; providing significant ongoing operational cost savings; as well as allowing smaller and lighter products. This new range of SuperLinear TWTTAs also provides higher mean time between failures (MTBF) as the amplifier internal temperatures are lower than comparable amplifier technologies.

CPI’s SuperLinear TWTTAs are designed for optimal operation at backoff RF power levels that are required in order to meet traditional international intermodulation specifications. Most traditional HPAs are designed to run from small signal to saturated power. However, the true usable RF power in a typical uplink application is limited by linearity requirements set by Intelsat and other satellite organizations. While RF power backoff of 3 dB to 7 dB is all that is ever required, one still needs the top-end peak power to avoid clipping of the transmitted signal. This clipping results in intermodulation products, spectral regrowth and other non-

**CPI's high power SuperLinear TWTTAs are available in C-, X- and Ku-band.**

![500 W CW Ka-band TWTA](image)
HPA and, as with traditional HPAs, are recommended for maximum carrier traffic.

While the DTH market in the United States and Western Europe is beginning to mature, the demand for amplifiers for this market is flourishing in other parts of the world. CPI has provided amplifiers that are used in nearly all DTH systems around the world. These systems normally transmit to dedicated transponders and compress many TV channels on each transponder. DTH systems typically uplink at Ku-, DBS- or Ka-band frequencies and the amplifier needs to provide sufficient linear RF power to overcome any potential atmospheric losses such as rain fade, which can be extreme at these frequencies.

CPI’s GEN IV klystron power amplifiers (KPAs) are the ideal choice for many DTH service providers. Its leadership in this market is due to the product being so efficient and reliable. The technological breakthrough for the GEN IV was the invention of the multi-stage depressed collector (MSDC) klystron in the late 1990s, developed by CPI Satcom’s sister divisions: Microwave Power Products (MPP) and Communications & Medical Products (CMP). The MSDC klystron has demonstrated MTBF in excess of 200,000 hours.

Higher power TWTAs in Ku- and DBS-bands have also recently become available to the market and this does provide some options for DTH service providers in certain areas of the world where atmospheric losses may not be too severe. These TWTAs are available from CPI packaged as either indoor (IDU) or outdoor (ODU) amplifiers. ODUs can be of particular interest to service providers as the amplifier can be located at the antenna or within the antenna hub. This reduces the RF losses between the amplifier and the antenna feed and permits the RF power required to be less than an amplifier located some distance away in a building. There are always other issues to consider when deciding what type of amplifier technology to use. A service provider must balance ease of maintenance, equipment reliability and service availability in certain environments. Today CPI offers TWTAs with RF power up to 1.25 kW SuperLinear in Ku-band and up to 750W in DBS-band.

Mobile terminals are coming into their own in markets around the world. They are needed for a variety of applications including satellite news-gathering, temporary communications systems, military terminals, border security and disaster recovery. Mobile communications systems are seeing increased requirements for small, lightweight and powerful broadband terminals to provide increased system capacity. CPI offers TWT ODUs and high-power SSPBs that are well suited for this purpose. These products are available in C, X, Ku and Ka-bands. CPI also has an eye toward flexibility, offering quick turnaround on custom solutions where, for example, changes in outline or connector locations might be desired to fit within a customer specific terminal.

CPI is a leading supplier of ODUs with a complete range of products for both commercial and government/military applications.

The company understands that mission-critical applications operate in harsh environments and the products need to be rugged, reliable and operate in a variety of scenarios that could have operating temperatures up to 60 degrees Celsius. CPI has shipped approximately 5,000 ODUs to various locations and environments all over the world. Customers have learned to depend on CPI’s products, service and support to get their task accomplished wherever they are located.

Whether the goal is to make lighter, smaller and more reliable SSPAs, or to advance green initiatives and reduce prime power costs, CPI has made great strides in all three of its product groups. The company’s TWTAs are state-of-the-art when compared with any technology, with unmatched efficiency that also contributes to lighter and smaller product designs. CPI’s solid-state amplifiers are modular and robust, and the company’s SSPB offerings can quickly be adapted to support mission-critical applications. CPI KPAs are renowned the world over for their high-reliability and efficiency. Each of the three technologies is well suited for multiple applications, and CPI is highly experienced in matching customer needs to the most appropriate amplifier solution.
CPI Ka-band amplifiers

The most reliable products, the most experienced supplier.

No matter the application, CPI has the Ka-band amplifier to meet your needs. We feature an array of products with bandwidths up to 3500 MHz and output power up to 800 watts. Our extensive range of tube and solid state amplifiers is used in both commercial and military systems.

CPI has fielded over 600 Ka-band HPAs during the past 20 years. Designs derived from our experience have resulted in the most rugged and reliable amplifiers in the industry.

Look to CPI before you leap into Ka-band. Call or visit our website for more information.

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