



# Making a decision

A new generation of amplifiers is being revealed to the satellite sector. New developments, smaller units and heightened efficiency are all contributing factors to the decision that is taken on which type of amplifier to choose. Helen Jameson looks at the options.

**What does an amplifier do?** In basic terms, a high power amplifier (HPA) is used to amplify a signal before it is transmitted to the satellite. There are various means of doing this and the type of amplifier chosen depends on factors such as linearity, efficiency, reliability and cost.

There are three types of amplifier available – Klystron, Travelling Wave Tube Amplifiers (TWTAs) and Solid State Power Amplifiers (SSPA). Klystron amplifiers have a high power output and are easy to repair. They have a long life of up to eight years but they are bigger and heavier than the other types and only operate within a small frequency range of 40-80MHz. This makes them less suitable and therefore, I would like to concentrate on TWTAs and SSPAs as they take the lion's share of the market.

## TWTA v. SSPA

There is a certain rivalry between two types of amplifier, Travelling Wave Tube Amplifiers (TWTAs) and Solid State Power Amplifiers (SSPAs).

There has been a trend to move away from TWTAs towards SSPA technology due to the fact that the TWTAs contain a tube and filament and therefore there appears to be more to go wrong. In addition, there is the perception that an SSPA's mean-between-time-failure (MBTF) or the average time between failures is better than that of a TWTA.

TWTAs use foot-long vacuum tubes to amplify signals. They amplify signals from a wide range of frequencies and can handle an entire satellite from just one dish. TWTAs are small but can be difficult to repair, are more expensive and have a shorter life-span of 4-6 years.

SSPAs use solid state electronics rather than a tube. They use a combination of quartz-based oscillator clocks and signal mixers to increase power. Should a component fail within the amplifier then the signal would weaken but the amplifier would not lose power completely. However, SSPAs have high power consumption and failures can lead to instabilities.

## Power

SSPAs and TWTAs are competing types of amplifiers, particularly in the 6-14 GHz satellite uplink frequency bands. The TWTAs have always been regarded as having an advantage over SSPAs as they are able to produce large amounts of microwave energy in a single electron tube. TWTAs also have the ability to operate at high temperatures and power densities. SSPAs, on the other hand, are not able to disseminate the heat produced as efficiently and therefore, they are normally accepted as being the amplifier of choice for low-power applications. However, the use of thermal design and 'heatsink' technology has given rise to a new type of SSPA. This has resulted in great reductions in size and weight and it means that SSPAs can be used for applications usually dominated by TWTAs plus there is the added attraction of lower cost of manufacture.

## Reliability

It is widely accepted that TWTAs are slightly more reliable than SSPAs. However, recently, there have been vast improvements made regarding the reliability of both types of amplifier and reliability alone is not

reason enough to choose an SSPA over a TWTA. Both have their pros and cons when the question of reliability is posed. SSPAs tend to perform better at lower powers but TWTAs perform best at higher powers. When looking for a cost-effective amplifier this should be taken into account.

The new generation of satellite requirements is seeing SSPAs offering features such as power, temperature and voltage sensors with communication ports and power monitoring and gain settings.

## Ruggedness

TWTAs are rugged amplifiers that now use 'multi-collector' technology. This enables them to function using lower amounts of energy. They are widely used for applications such as RF testing, radar simulation and calibration and are renowned for their performance and reliability. The tube amplifiers are very suitable for use in hostile environments and are capable of dealing with shock and vibration very well.

On the other hand, SSPA products now can meet the demand for on-the-move platforms, even airborne systems as they have become much smaller and lighter. Higher power and broader bandwidth applications are also being developed for SSPAs where TWTAs were used before. Both TWTAs and SSPAs are used for army and naval applications due to their stamina in difficult conditions.

When selecting the correct amplifier for your needs the points mentioned above are the factors that should be taken into consideration. There is no right or wrong as far as selection of an amplifier is concerned. There are pros and cons to each. As long as the product can deliver an excellent quality of signal in the environment you require it then it is doing its job.

## Delivering solutions

At present Xicom Technology a Radyne Company offers the world's most extensive range of tube-based amplifiers. Highly regarded for their reliable output power and efficiency, Xicom Travelling Wave Tube Amplifiers (TWTAs), Klystron Power Amplifiers (KPAs) and Solid State Power Amplifiers (SSPAs) are used in broadcast and broadband applications throughout the world where customers need to increase power and bandwidth. Xicom High Power Amplifiers (HPAs) provide power levels vital to satcom applications, both traditional broadcast, the Direct-To-Home (DTH), Satellite News Gathering (SNG) and flyaway markets, and emerging broadband, specifically the Internet Protocol (IP)-over-Satellite market.

The company has recently received a number of orders for Ka-band amplifiers, an emerging market where it has a leading market share. ■

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