

TWTA vs. SSPA: Advantages and Disadvantages

Functions	Advantages	Disdvantages	Advantages	Disadvantages
<i>All units have the same linearity, intermodulation, and spectral regrowth performance</i>				
Linearity and Intermodulation Distortion	TWTA and GaN SSPA equal		GaN SSPA and TWTA equal	
Available Output Power	TWTAs have a higher available output power and at higher frequencies			
Efficiency of Operation (i.e., AC Power Consumption)	TWTAs are more efficient in the back-off state	High Voltages = 10,000 volts+		High Current = 100 Amps+
Size and Weight	TWTA packages including power supplies are smaller and weigh less			Basic RF Modules are smaller than TWTA but the power supply and required heat sinks make the overall package larger than TWTAs and are heavier
Heat Dissipation	TWTA power distributed over a relatively large area, making heat sinking a less challenging task			Power FETs dissipate large amounts of power at a concentrated point. Heat dissipation is currently one of the most challenging problems in SSPA design
Reliability	TWTAs have logged many years of reliable operation on spacecrafts/satellites	Tubes have a limited life from 40,000 to 100,000 hours of continuous operation	No limited life. Theoretically could have MTBFs greater than 1,000,000 hours	Power Supply reliability is a known SSPA problem
Source of Supply	Foreign and domestic tube suppliers			Below 20 GHz, all power FET suppliers are foreign
Temperature Stability	TWTs are very stable over temperature	Solid state driver amplifiers need to be temperature compensated		SSPAs and driver amplifiers need to be temperature compensated
Noise Power			10 dBm beter than TWT	
Harmonics			20 dBc better than TWT	
Reliability vs. Temperature	Operate up to 85 degrees C			Operate up to 65 degrees C