

## **Millimeter Wave TWT Amplifier System**

The contractor shall provide the hardware necessary to construct a millimeter wave TWT amplifier system. The hardware consists of a 40 Watt millimeter wave TWT power amplifier and an adjunct 20 Watt microwave TWT power amplifier.

Specifications for the millimeter wave TWT are provided in Tables 1A (Electrical), 1B (Environmental/Operating), and 1C (Mechanical). Additionally, the millimeter amplifier requires an RS-232 Interface, an IEEE-488 Interface, an Input Isolator, a 12 meter cable, and a split RF module/power supply to provide for strategic mounting of the RF portion of the amplifier to minimize RF losses between the amplifier and the antenna.

Specifications for the microwave TWT are provided in Tables 2A (Electrical), 2B (Environmental/Operating), and 2C (Mechanical). Additionally, the microwave amplifier requires an output isolator, a Solid State Input Pre-Amplifier (SSIPA), and chassis slides. The output isolator is inserted immediately following the TWT to isolate it from load mismatches to result in improved gain flatness versus frequency and protection of the TWT. The SSIPA is inserted between the RF attenuator and the TWT to raise the overall gain so that at least 0 dBm will produce rated power output.

Table 1A – Millimeter Wave TWT Amplifier Electrical Specifications

Frequency	26.5 to 40 GHz
Output Power - TWT Flange	40W min. 39W min.
Bandwidth	13.5 GHz, instantaneous
Gain – At Rated Power	46 dB min.
Gain Control Range	20 dB min.
Gain Variation – At 6 dB backoff	$\pm 5$ dB over 13.5 GHz, typ.
Gain Stability	$\pm 0.25$ dB/24 hr. max. at constant drive and temperature (after 1 hour warmup period)
Input VSWR	1.7:1 typ.; 2.4:1 max. 1.35:1 typ.; 1.5:1 max., (with optional input isolator)
Output VSWR	2.0:1 typ.; 2.7:1 max.
Load VSWR	2.0:1 max.; no degradation, infinite VSWR without damage
Phase Noise – 1.0 to 350 MHz Below 1.0 MHz	-120 dBc/Hz max. -6dB below IESS 308 (-21 dB typ.)
Spurious	-50 dBc
Noise Power Out	+23 dBm max. total
Primary Power	100 to 264 VAC, 47 to 63 Hz, single phase
Power Consumption	700 VA typ.; 1200 VA max.
Power Factor	.95 min.

Table 1B – Millimeter Wave TWT Amplifier Environmental (Operating) Specifications

Ambient Temperature – RF unit PS unit	-10 to +50°C (+65 with solar loading) -10 to +50°C
Relative Humidity RF unit PS unit	100% condensing 95% non-condensing
Altitude	10,000 ft. with standard adiabatic derating of 2°C/1,000 ft. operating
Shock and Vibration	As encountered in normal transportation
Acoustic Noise	Meets EN61010 requirements

Table 1C – Millimeter Wave TWT Amplifier Mechanical Specifications

Cooling	Forced air
RF Connectors – Input and Output	WR-28 waveguide flange

RF Output Monitor	Type K female
Dimensions, (W x H x D) RF unit PS unit	8.5 x 12.83 x 20 in. (216 x 324 x 508 mm.) 19 x 5.25 x 24 in. (483 x 133 x 610 mm.)
Weight (Standard amplifier, no options) – RF unit PS unit	40 lbs. max. (18.2 kg.) 50 lbs. max (22.7 kg.)
HV Cables/LV Cables	2.5 meters – 0 cm./+30 cm.

Table 2A – Microwave TWT Amplifier Electrical Specifications

Frequency	4.0 to 18 GHz
Rated Output Power	20W CW
Small Signal Gain	35 - 40 dB
Gain Variation	10 dB peak-to-peak (typical), except M-Band 15 dB (typical)
Gain Stability	$\pm 0.25$ dB/day at constant drive and temperature
Input VSWR	2.0:1 typical
Output VSWR	2.0:1 typical
Load VSWR	1.3:1 max. for full spec. compliance, 2.0:1 max. for no damage, any value without damage if Output Isolator option included
Phase Noise – 1.0 to 350 MHz Below 1.0 MHz	-120 dBc/Hz max. -6dB below IESS 308 (-21 dB typ.)
Noise and Spurious	-50 dBc typical excluding harmonics and residual modulation
Noise Power Out	+23 dBm max. total
Primary Power	115 Vac, $\pm 10\%$ , 50/60 Hz, single phase
Power Consumption	400 Watts

Table 2B – Microwave TWT Amplifier Environmental (Operating) Specifications

Ambient Temperature	0 to +50°C
Relative Humidity	95% non-condensing
Altitude	6,000 ft. max.
Shock and Vibration	As normally encountered in a protected engineering environment

Table 2C – Microwave TWT Amplifier Mechanical Specifications

Cooling	Forced air with integral blower, air intake from sides and rear, exhaust at rear
RF Connectors	Type N (female), Front panel
Dimensions, (W x H x D)	19 x 3.5 x 19.25 in. (480 x 89 x 487 mm.)
Weight	35 lbs. max. (15.9 kg.)