

varian
microwave power tube products

VKX-7017
ECO: 134405
ECO: 136888
Date: January 10, 1991
Rev: B
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**PRODUCT SPECIFICATION
ELECTRON TUBE, KLYSTRON TYPE VKX-7017**

Description: A Two-Resonator Klystron Oscillator, External Cavity-Stabilized, Fixed-Tuned, Conduction-Cooled, with Waveguide Output

ABSOLUTE RATINGS: Note 1

Parameters:	E_f	I_f	E_{rs}	I_{rs}	Freq.	t_k
Units:	Vdc	Adc	kVdc	mAdc	GHz	sec.
Maximum:	7.0	2.0	6.3	50	---	---
Minimum:	5.7	(surge)	---	---	---	60
Notes:	3				4	

Parameters:	Body Temp.	Heat Sink Temp.	Ambient Temp.	Altitude	Load Z
Units:	°C	°C	°C	feet	VSWR
Maximum:	130	50	+75	40,000	1.30:1
Minimum:	---	---	-62	---	---
Notes:	5	5		6	

TEST CONDITIONS: Note 2

Parameters:	E_f	E_{rs}	Freq.	Load Z	Temp.
Units:	Vdc	kVdc	MHz	VSWR	°C
Value:	6.30	3.85	---	1.20:1	---
	± 0.12	± 0.25			
Notes:	3		4		5

GENERAL

Unless otherwise required as a line item in the Purchase Order or Contract, only Quality Conformance Inspection, Part 1 (normal production testing) shall be performed.

References shown in parentheses are to paragraphs in MIL-E-1, "Military Specifications for Electron Tubes." References not in parentheses are to paragraphs in MIL-STD-1311, "Test Methods for Electron Tubes." Only those paragraphs of MIL-E-1 and MIL-STD-1311 referenced in this specification shall apply.

Ref.	Test	Conditions	Symbol	Min.	Max.	Units
(3.1a)	General Requirements					
4.8.5	Holding Period	t = 168 hours				
---	Dimensions	Per Outline Drawing 093463, Page 10 Note 7				

Revision Information

Revision C of Outline Drawing 093463. Delete all references to 7017B.



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GENERAL (Continued)

Ref.	Test	Conditions	Symbol	Min.	Max.	Units
(3.6)	Marking	Note 8				
---	Burn-In	t = 24 hours Note 28				

QUALIFICATION TESTING (To be performed only when specified in the Purchase Contract)

---	Salt Spray	Note 9				
---	Humidity	Nonoperating MIL-STD-810 Method 507, Proc. 1 Note 10				
---	Low Pressure Leakage Current	$E_{rs} = 6.0 \text{ kVdc}$ $E_f = 0.0 \text{ V}$ @ 510 mm Hg Note 11	I_{rs} :	---	25	μA
---	Shock	Nonoperating Note 12				
---	Vibration	Nonoperating Note 13				
---	Vibration Sensitivity	Note 14			200	Hz/G
---	Operation: High Temperature	Note 15				
---	Storage: High Temperature	Nonoperating Note 16				
---	Storage: Low Temperature	Note 17				
---	Temperature Shock	Nonoperating Note 18				
---	Power Variation With Temperature	Note 20 (See Figure 1)	ΔP_o :	---	1.0	dB
---	AM Beam Pushing	Note 21	P_{ssb}/P_o :	---	-93	dBc
---	RF Leakage	Note 22	P_o/kg :	---	100	μW



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QUALITY CONFORMANCE INSPECTION, PART 1 (100% Production Testing)

Ref.	Test	Conditions	Symbol	Min.	Max.	Units
1301	Heater Current	$E_f = 6.3$ Vdc $t_k = 120$ Sec. Note 3	I_f :	0.5	0.9	Amp.
---	Beam Current		I_{rs} :	18	30	mAdc
---	Power Output		P_o :	0.25	0.50	Watts
---	FM Noise	Note 23		(Per Figure 2)		
---	FM Beam Pushing	Note 24	$\Delta f_o/\Delta V$:	---	1.0	kHz/V
---	Frequency	Note 4	f_o :	-400	+400	kHz

**QUALITY CONFORMANCE INSPECTION, PART 2
(To be performed only when specified in the contract)**

---	Emission	$E_f = 5.9$ Vdc Note 25	$\frac{\Delta I_{rs}}{I_{rs}}$:	---	0.2	
---	DC Heater Pushing	$E_{f1} = 6.18$ V $E_{f2} = 6.42$ V	$\frac{\Delta f_o}{\Delta V}$:	---	50	Hz/V
---	AC Heater Pushing	Note 26	$\frac{\Delta f_o}{\Delta V}$:	---	40	Hz/V _{rms}
4027	Temperature Coefficient	Note 20	$\frac{\Delta f_o}{\Delta t}$:	---	± 20	kHz/°C
---	AM Noise	Note 27		(Per Figure 3)		

**QUALITY CONFORMANCE INSPECTION, PART 3
(To be performed only when specified in the contract)**

(4.6)	Life Test	Group D Note 19	t :	2,000	---	hours
(4.6.2)	Life Test End Point	Power Output Note 19	P_o :	0.2	---	Watts



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NOTES:

- Note 1: Referring to paragraph (6.5) of MIL-E-1, these values are based on the absolute system and should not be exceeded under continuous or transient conditions. A single rating may be the limitation, and simultaneous operation at another rating may not be possible. Design values for systems should include a safety factor to maintain operation within ratings under voltage and environmental variations. The Life Warranty is predicated on operation of the unit under the specified Test Conditions given in the heading on page 1 of this Product Specification.
- Note 2: All oscillation tests (except the vibration test) shall be made with the unit rigidly connected to an appropriately modified CPR flange operating into the appropriate RG-52/U waveguide equipment. The applied voltages and load shall be as specified on page 1 of this Tube Specification Sheet, under the heading "Test Conditions," except as otherwise specified.
- Note 3: Using dc heater voltage, the positive side of the heater supply must be connected to the heater-cathode terminal, connector J4.
- Note 4: The operating frequency of the unit shall be measured with a digital frequency meter and shall be centered, by type, according to the following table.

Type Number	Frequency
VKX-7017A	9,228.62 MHz
VKX-7017C	9,342.62 MHz

- Note 5: When operating as specified, cooling must be provided such that the unit's temperature, as measured at the baseplate's monitor point, as specified on the outline drawing, page 10, does not exceed 50°C and the tube body temperature does not exceed 130°C. The normal test condition baseplate temperature shall be 45°C, ± 5°C. The unit shall operate to specification over an ambient temperature range of -40°C to +65°C.
- Note 6: The unit shall be capable of operation to specification at 8,000 feet altitude, and storage at the equivalency of 40,000 feet maximum.
- Note 7: Mechanical inspection shall be in accordance with Plan CPS-1 of Handbook H107, Table III-I; with an AQL of 4.0, sample frequency C, the period of time being 3 months.
- Note 8: Minimum marking shall consist of the manufacturer's part number, serial number, source code identification number, and date code.
- Note 9: The unit shall be subjected, nonoperating, to the salt spray tests of MIL-STD-810 for a minimum period of 50 hours with a 20% salt solution. At the end of this period, visually inspect and perform the tests specified for QCI, Part 1.
- Note 10: The unit shall be subjected to MIL-STD-810, Method 507, Procedure 1 (Humidity Test). Upon completion, remove the unit from the test chamber, visually inspect, and perform the tests specified for QCI, Part 1.

Note 11: The heater and the heater-cathode leads shall be tied together for the tests specified. The specified voltage shall be applied between the heater-cathode lead and the tube body (ground). Place the unit in an appropriate chamber and evacuate it to a pressure of 510 mm Hg. Test the unit under the conditions specified. Leakage current shall not exceed the limit specified.

Note 12: The unit shall operate satisfactorily after being subjected to three shocks of a 15-gravity (g) peak acceleration pulse approximating a half sinusoid and have a total duration of 11 ± 1 milliseconds (msec.) applied in both directions along each of three principal axes (18 shocks, total).

Mount the unit, nonoperating, on the shock test facility to simulate normal mounting. Subject the unit to the 18 shocks specified. Upon completion of the test, visually inspect for damage and perform the tests specified in QCI, Part 1.

Note 13: Mount the unit, nonoperating, on the vibration test facility to simulate normal mounting. Conduct a resonant search from 10 to 300 to 10 hertz (Hz) for a minimum period of 30 minutes along each perpendicular axis at the following vibratory accelerations:

Plus and minus 2.5 g from 10 to 36 Hz
 0.036 inch double amplitude from 36 to 46 Hz
 Plus and minus 4.0 g from 46 to 300 Hz

Vibrate the unit at the two major resonant frequencies noted in each plane for 15 minutes at each frequency. Where only one major resonant frequency is found, vibrate at test frequency for 15 minutes; the remaining time, up to 30 minutes total time in each plane, shall be spent in continued cycling. Where no major resonant frequencies are found, the total time, up to 30 minutes in each plane, shall be spent in continued cycling. At the completion of vibration, visually inspect for damage and perform the examination tests specified in QCI, Part 1, to determine satisfactory operation.

Note 14: The unit shall be designed to meet all performance requirements of this specification during test conditions (Page 1), and the vibration parameters specified in MIL-STD-167 in all three perpendicular planes, except that the amplitude for the 5-Hz to 10-Hz range shall be 0.10 ± 0.01 in. (See Table I, below.)

TABLE I

Frequency (Hz)	Vibration (1/2 Amplitude Displacement-Inches)
5-10	0.10 ± 0.01
11-15	0.03 ± 0.006
16-25	0.02 ± 0.004
26-33	0.01 ± 0.002

The vibration frequency input shall be explored over the range 5 Hz to 33 Hz with amplitudes not to exceed those specified in Table I. Frequency duration measurements and the frequency modulation sensitivity to vibration shall be determined. The measured deviation rates per G force of acceleration shall not exceed the specified value.

Note 15: Place the unit in the test chamber and raise the ambient temperature to 65°C. Stabilize the baseplate at 50°C at this temperature (see Note 5), operate for 4 hours, then perform the examination tests specified in QCI, Part 1.

Return the unit to standard room conditions and stabilize. Visually inspect for damage and perform the examination tests specified in QCI, Part 1, to determine satisfactory operation.

Note 16: Place the unit, nonoperating, in the test chamber and raise the temperature to 71°C with relative humidity kept at not greater than 15 percent. Maintain these conditions for 6 hours. Return the unit to standard room conditions and stabilize. Visually inspect for damage and perform the examination tests specified in QCI, Part 1, to determine satisfactory operation.

Note 17: Place the unit, nonoperating, in the test chamber, cool the chamber to -54°C and maintain at this temperature for 72 hours. At the end of this period, visually inspect for damage. Raise the temperature of the chamber to -40°C and maintain at this temperature for 24 hours. At the conclusion of this period and while maintaining the baseplate monitor point (specified on drawing) at this temperature, perform the examination tests specified in QCI, Part 1, to determine satisfactory operation. Visually inspect for damage and perform the examination tests specified in QCI, Part 1, to determine satisfactory operation.

Note 18: With the unit stabilized at standard room temperature and nonoperating, place it in a chamber with temperature of -54°C. Maintain chamber temperature for 1 hour. Remove the unit from the chamber and stabilize at standard room temperature. Replace the unit, nonoperating, in a chamber with temperature of 71°C. Maintain chamber temperature for 1 hour. Remove the unit from the chamber and stabilize at standard room temperature. Visually inspect for damage and perform the examination tests specified in QCI, Part 1, to determine satisfactory operation.

Note 19: The Life Test shall be conducted as specified in the Varian Microwave Tube Products Quality Assurance Work Instruction 5.44 at the test conditions shown on page 1 of this specification, and shall consist of a minimum of 400 of the following cycles:

Condition	On Time
Heater ON	1 minute
Beam and Heater ON	284 minutes
Beam and Heater OFF	15 minutes

TOTAL TIME = 300 minutes
or 5 hours per cycle.

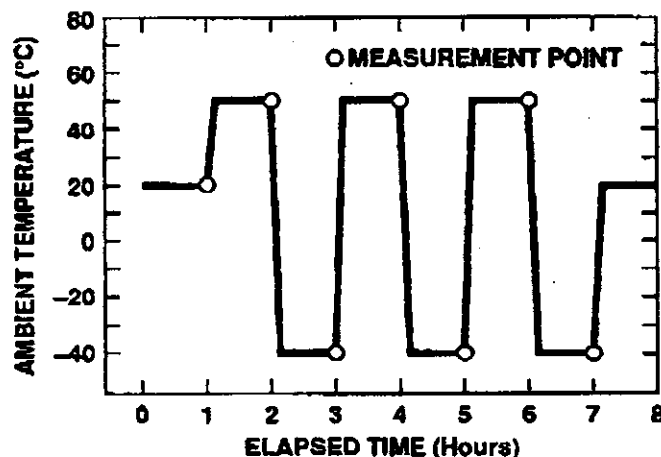
Heater surge current shall not exceed 1.4 A during Life Test. The times mentioned above may all be varied plus or minus 10%. The starting conditions during Life Test shall be such that the beam voltage rises to within 90% of full value within 120 milliseconds. (When referring to paragraph 4.6 of MIL-E-1, replace "month" with "60 days" for life testing the VKX-7017.)

At the end of the Life Test of 400 of the above cycles, the unit shall be capable of meeting the requirements of QCI, Parts 1 and 2, with the exception of the emission and power output tests. Minimum power output shall be as specified.

Note 20: Place the unit in the test chamber at an ambient temperature of +20°C. Operate the unit for 1 hour, stabilizing the baseplate monitor point at +50°C. Maintain the same degree of cooling and raise the test chamber ambient temperature to +55°C. After 1 hour, lower the test chamber ambient temperature to -40°C. After 1 hour more, return the ambient temperature to +20°C. Repeat this cycle for a total of three times, allowing the temperature (ambient) to stabilize at the final +20°C for 1 hour, for a total elapsed time of 8 hours.

Relative power and frequency measurements taken at the end of each of the temperature levels shall be used to find the average temperature coefficients over the three cycles.

The average difference between the highest and the lowest output power levels measured at -40°C, +20°C, and +55°C shall be within the limit specified.



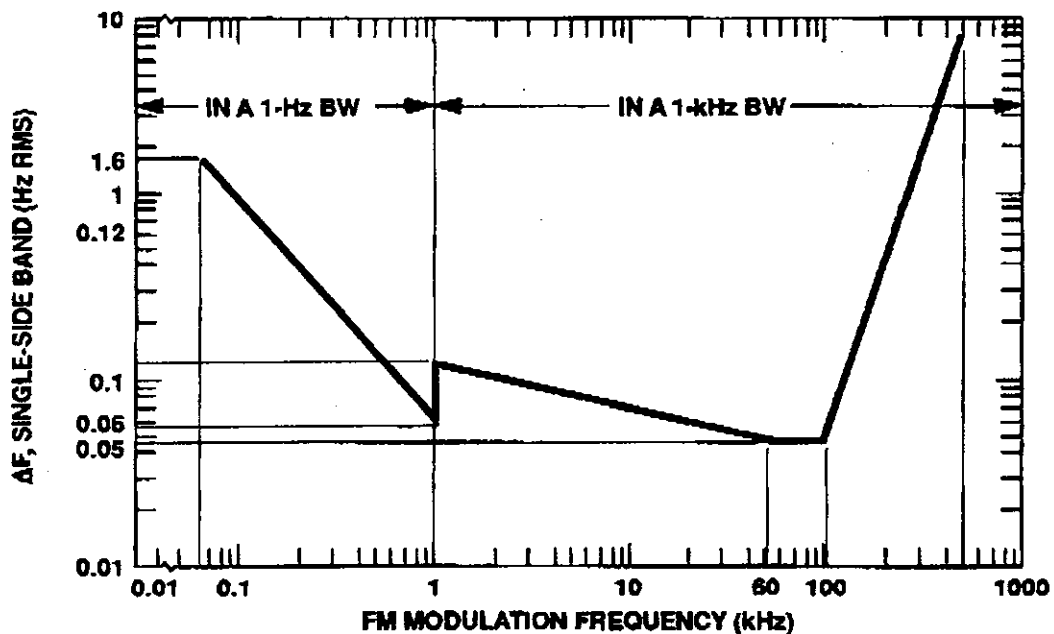
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FIGURE 1

Note 21: Modulate the unit by applying a 50-mV modulation voltage, at a frequency of 10 kHz, to the tube's cathode. The resultant power in the AM sidebands shall be below the carrier power by at least the specified amount.

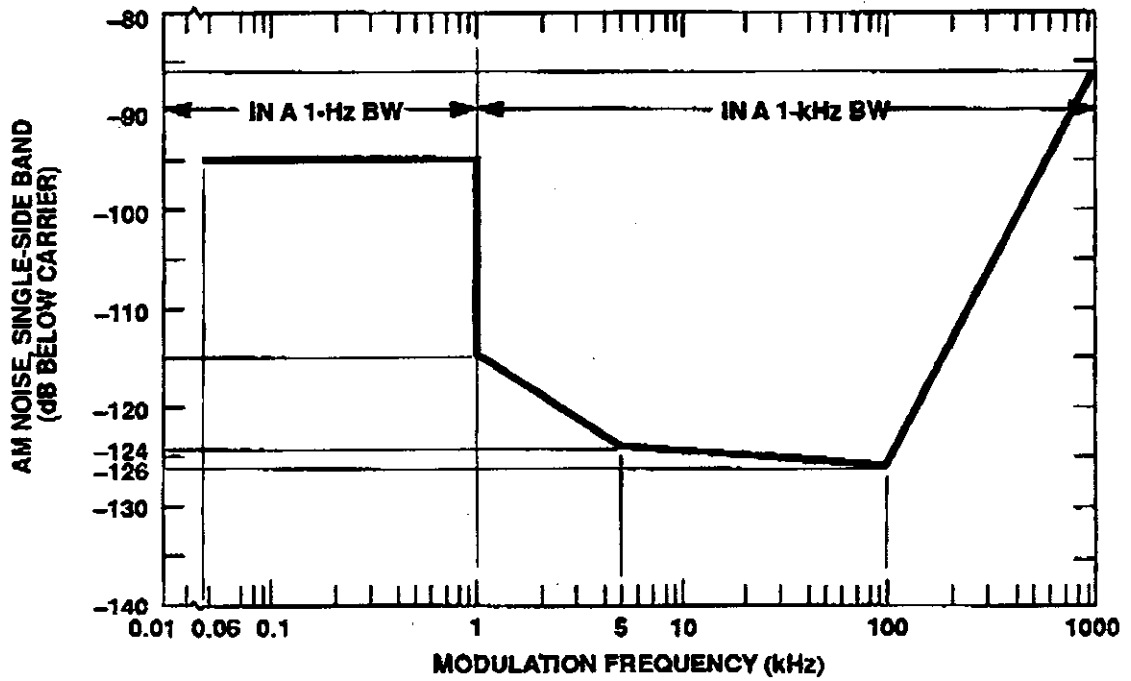
Note 22: This test shall be performed using a calibrated power detector in connection with a search antenna consisting of an open-ended UG 39/U waveguide or equivalent. This antenna shall be used to search the region immediately surrounding the unit at a distance of $3 \pm 1/4$ inches, with the unit operating as specified in Note 2. The maximum indicated leakage power level outside the unit at any point, at the operating frequency, shall not exceed the specified limit.

- Note 23: The total FM noise, both random and coherent, shall be measured in an appropriate bandwidth in the range from 60 Hz to 500 kHz from the carrier and converted to the bandwidths shown in Figure 2 and shall be less than the limits shown in Figure 2.
- Note 24: Modulate the unit by applying a 10-mV modulation voltage at a frequency of 10 kHz to the tube's cathode. The FM deviation shall be measured using a Microwave FM Discriminator, or its equivalent.
- Note 25: The beam current shall not drop more than the specified proportion when the heater voltage is decreased from the normal operating potential to the lower specified value.
- Note 26: The heater voltage shall be modulated with a 150-mV_{rms} signal at a frequency of 1,200 Hz and the frequency deviation shall not exceed the limits specified.
- Note 27: The total AM noise, both random and coherent, shall be measured in an appropriate bandwidth in the range from 60 Hz to 1 MHz from the carrier and converted to the bandwidths shown in Figure 3 and shall be less than the limits shown in Figure 3.
- Note 28: Burn-in shall consist of a period of operation at room ambient temperature, 25 ± 5°C, for 24 hours at normal test conditions as specified on page 1.



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FIGURE 2. FM NOISE LIMITS



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FIGURE 3. AM NOISE LIMITS

