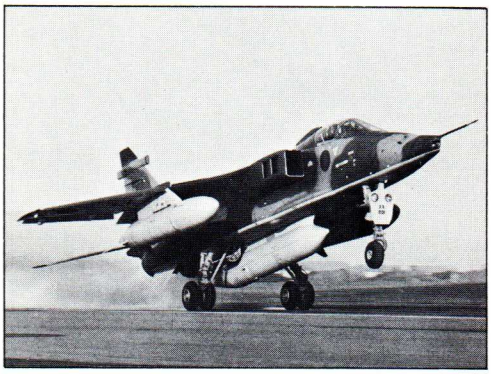
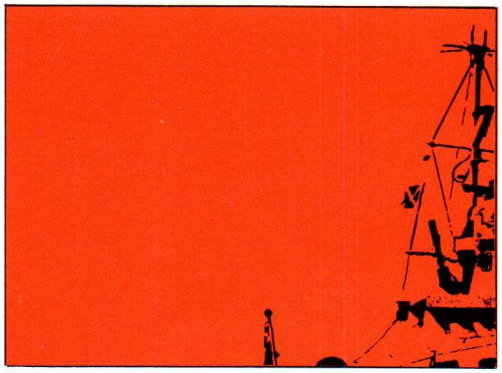
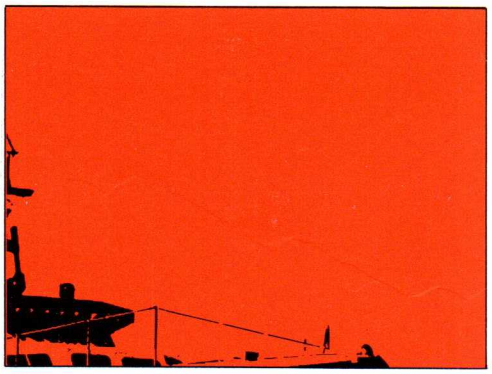
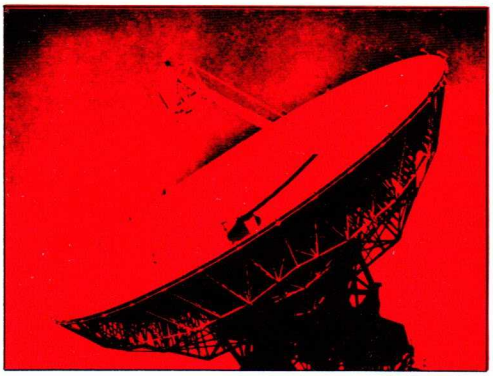
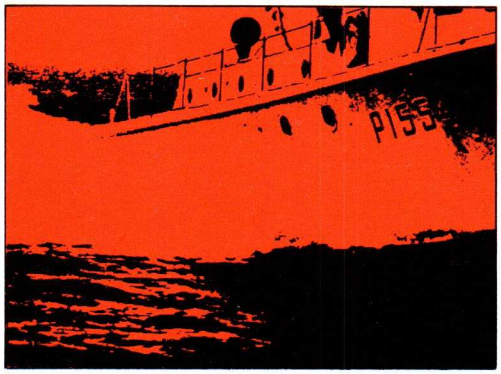
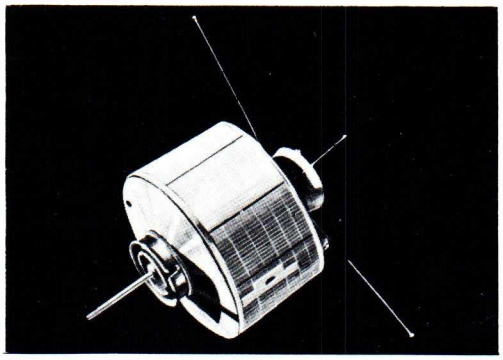
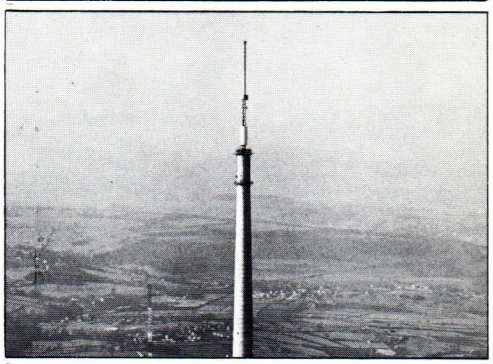
Microwave tubes and devices

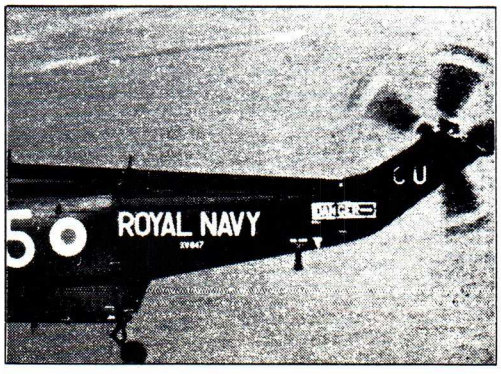
EMI varian

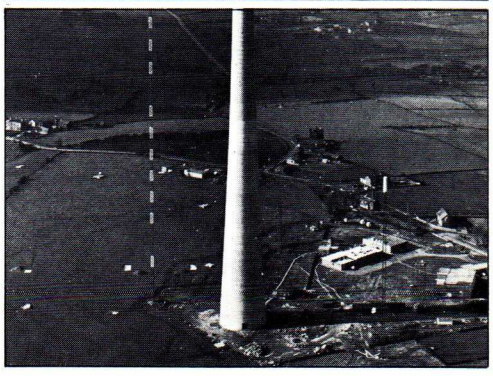
Edition 3





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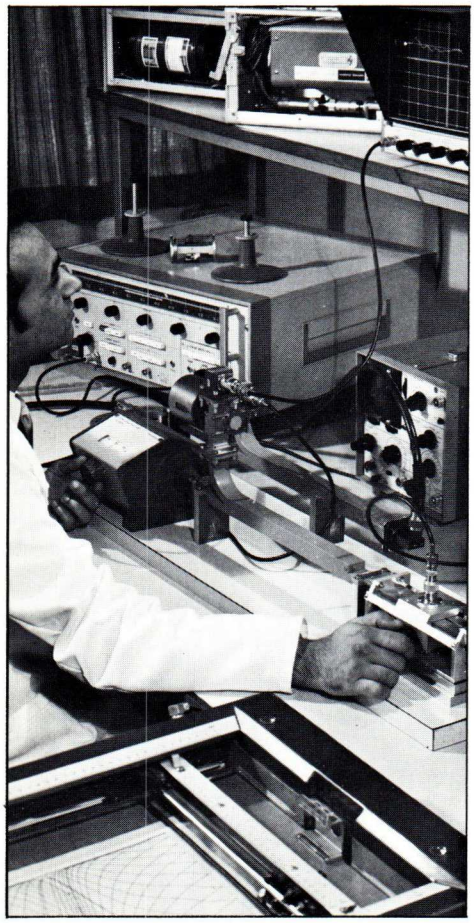


EMI-Varian Limited

EMI-Varian is a British company, formed by two major electronics companies, EMI Limited of Great Britain and Varian Associates of the United States of America, to specialise in the design and production of microwave tubes and associated devices. EMI-Varian is based only two miles from London's Heathrow Airport, at Hayes in Middlesex, close to rail and motorway links to the centre of London and to other major cities.

EMI-Varian supplies a wide variety of microwave components to the British Government and to the European radar and communications industries. The range includes high power klystrons, magnetrons, travelling wave tubes, reflex klystrons, solid state devices, etc.

Through its unique association with both EMI and Varian Associates EMI-Varian has access to unparalleled experience in the development and application of microwave devices.

The British parent company, The Gramophone Company Limited began to work on television in 1930. A year later, when the Gramophone Company and Columbia Gramophone Company merged to form EMI Limited, a team was built up under Sir Isaac Schoenberg which achieved the first high definition television system in the world. It was a 405 line electronic system, and public transmission began from Alexandra Palace, London, in 1936. Television development has taken EMI into many branches of electronics including television cameras, camera pick-up devices, broadband circuitry, parametric amplifiers and high power transmitters and transmission aerials.

The Research Laboratory of EMI turned its attention to radar and night vision devices during the 1940's. It developed the first high power klystron, giving pulses of 20 kW, and also manufactured high power magnetrons. Work in these fields has continued ever since, and EMI currently designs and manufactures a complete range of radar equipment, from advanced components to complete systems of air surveillance, ground radar, and airborne and naval electronic counter measures equipment.

In 1967 the microwave activities of EMI were strengthened by combining the specialised high power klystron design and development team with the klystron production unit to form the Power Tube Division of EMI Electronics. This Division later became the nucleus of EMI-Varian Limited.

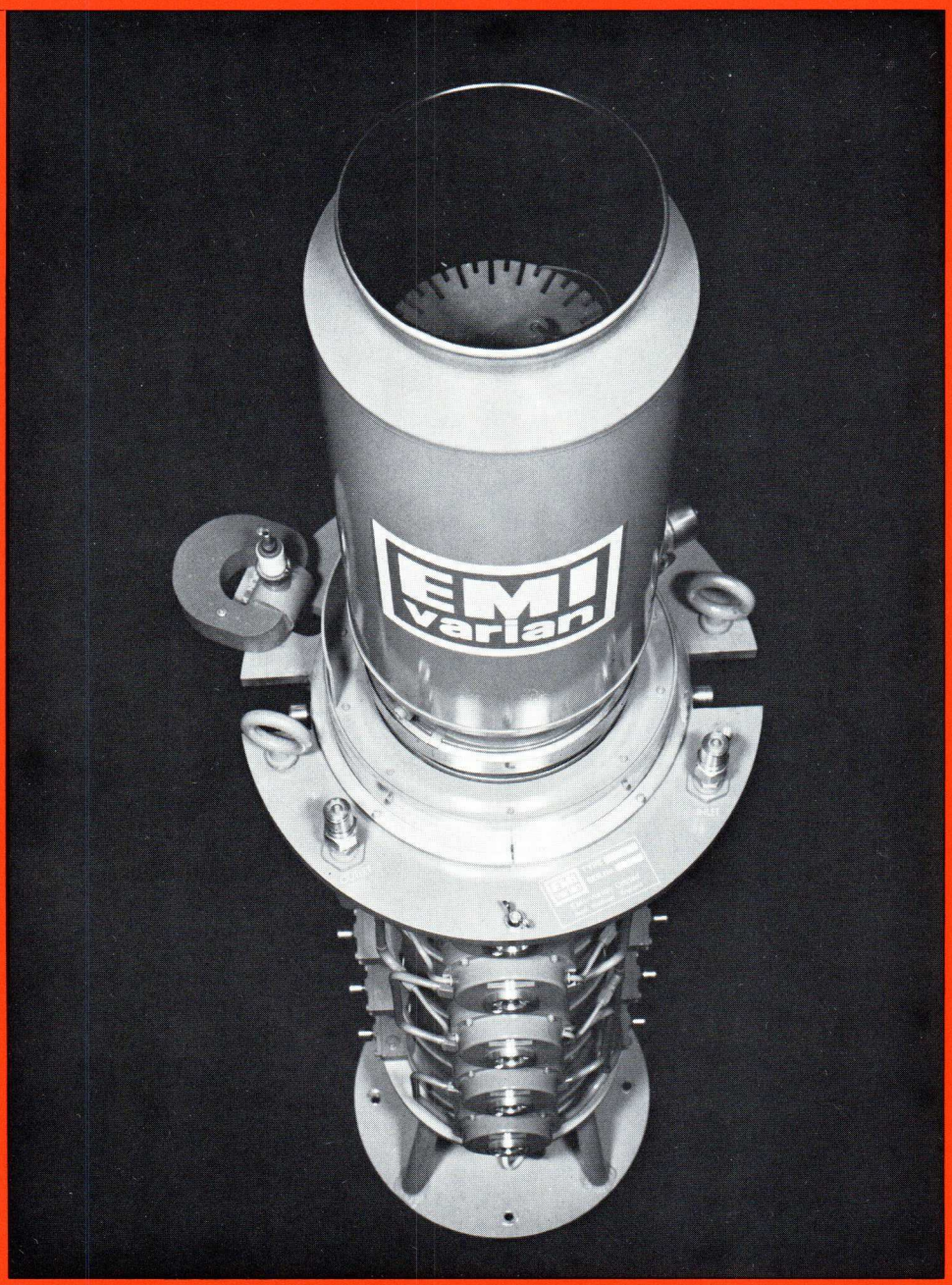
The other parent company, Varian Associates, was formed in 1948 by the Varian brothers, who invented the klystron. Varian Associates started by developing and manufacturing klystrons, but has expanded until it now designs and manufactures the world's largest selection of microwave generators and amplifiers. High power microwave devices from Varian are used in most U.S.A. missile radar systems, and also for navigational aids and weather reconnaissance equipment. Most ground terminals for either military or commercial satellite communication systems which use a high power klystron use a Varian device, including the Comsat, Intelstat, Skynet and Nato communication systems. Varian high frequency amplifiers were used in the first successful transmission of television by satellite, pioneered by the Lincoln Laboratories of MIT.

Varian solid state components were at the heart of the transponder and up-data link on the command module and also the transceiver on the lunar module, during the Apollo series of moonflights. These units provided the only sound and vision links once the spacecraft were more than 30,000 miles from earth, and they transmitted transmitted the memorable television shots from the moon. A Varian hybrid klystron travelling wave tube and and a magnetron were working in the tracking radar used to predict the position of splashdown.

UHF klystrons

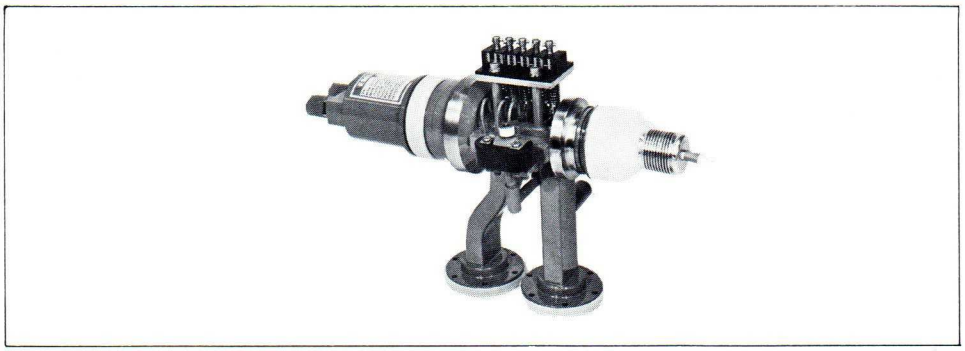
These klystrons have integral cavities, which eliminate r. f. leakage, thus avoiding regeneration and self oscillation, and enabling c.w. power levels of up to 55 kW to be obtained with excellent frequency stability. Because of the very high gain of these klystrons, solid state drivers can be used.

These klystrons were designed as final amplifiers for unmanned u.h.f. television transmitting stations.



Tunable frequency range (MHz)	Output power range (peak sync.) (kW)	Gain at peak sync. (dB)	Efficiency at peak sync. (%)	Cathode voltage (kV)	Cooling requirements klystron and electromagnet Water (L/min)	Air (m^3/min)	Electromagnet required	Electromagnet voltage (V)	Electromagnet currents (A)	Type number
470 - 574	8-12.5	43	39	-12	2	3	VA 1943A	45	10	**VA 943B**
470 - 566	20-30	49	32	-19	21	1.5	VA 1950A	110	30	**VA 946A**
470 - 566	35-45	50	32	-21	26	1.5	VA 1950A	110	30	**VA 950A**
470 - 566	45-55	51	32	-23	26	1.5	VA 1950A	110	30	**VA 953A**
572 - 704	8-12.5	43	39	-12	2	3	VA 1943A	45	10	**VA 944B**
566 - 698	20-30	49	32	-19	21	1.5	VA 1951A	110	30	**VA 947A**
566 - 698	35-45	50	32	-21	26	1.5	VA 1951A	110	30	**VA 951A**
566 - 698	45-55	51	32	-23	26	1.5	VA 1951A	110	30	**VA 954A**
702 - 860	8-12.5	43	39	-12	2	3	VA 1943A	45	10	**VA 945B**
694 - 890	20-30	49	32	-19	21	1.5	VA 1952A	110	30	**VA 948A**
694 - 890	35-45	50	32	-21	26	1.5	VA 1952A	110	30	**VA 952A**
694 - 890	45-55	51	32	-23	26	1.5	VA 1952A	110	30	**VA 955A**

CW power tubes for communications



Frequency (GHz)	Output power (kW)	Gain (dB)	Tuning range (MHz)	1dB Instantaneous bandwidth (MHz)	3dB Instantaneous bandwidth (MHz)	Beam (kV)	Beam (A)	Focusing[2]	Weight (Kg)	Cooling[3]	Type number
1.7-2.4	1.0	38	700		13	6.2	0.6	PM	39	FA	**4K3SL**
2.4-2.7	1.0	43	–		10	6.8	0.6	PM	39	FA	**4K3SK**
4.0-8.0[1]	0.2	37	–			8.5	0.3	PPM	2.7	C	**VTC6262F1**
7.9-8.4	16 - 25	54	any 250	50		25	4.0	EM	9	LFA	**VA876A**
7.9-8.4	8.0	47	500	50		14	2.0	EM	9	LFA	**VA925B**
8.0	8.0	47	–	50		14	2.0	EM	9	LFA	**VA925E**
8.0	1.4	46	–	40		7.4	0.65	PM	34	FA	**VA866S**
10.0-10.25	0.275	46	250		10	4.7	0.25	PM	3.6	L	**PT1160**

Notes:
1. Helix travelling wave tube
2. EM Electromagnet : PM Permanent magnet : PPM Periodic permanent magnet
3. L Liquid : FA Forced air : C Conduction

High power pulsed tubes for radar

Frequency range (GHz)	Peak output power (kW)	Mean output power (kW)	Gain (dB)	Tuning range (MHz)	1dB Instantaneous bandwidth (MHz)	3dB Instantaneous bandwidth (MHz)	Duty cycle	Pulse length (u.sec)	Efficiency (%)	Beam voltage (kV)	Beam current (A)	Weight (Kg)	Focusing[2] method	Beam[3] control	Cooling[4]	Type number
1.22-1.38[1]	6000	6.0	30	–	145[7]		0.001	5	30	160	130	186	EM	C	L	**PT1140**
1.22-1.38	6000	6.0	30	–	150[7]		0.001	5	30	160	130	197	EM	C	L	**PT1141**
1.22-1.38	6000	6.0	30	–	110[7]		0.001	5	30	160	130	186	EM	C	L	**PT1142**
1.22-1.38	6000	6.0	30	–	95[7]		0.001	5	30	160	130	177	EM	C	L	**PT1143**
1.23-1.34	100	5.0	46	110	8		0.05	7.5	40	30	10	58	EM	C	L	**PT1152**
1.23-1.345	300	10.7	40	110		25	0.036	125	32	47	20	58	EM	C	L	**VA838B**
1.23-1.345	340	12.0	49	110		10	0.356	125	42	45	18	58	EM	C	L	
2.75-3.05	20	0.005	30	300		30	0.00025	10	16	28	6	57	PM	C	LFA	**PT1007**
2.75-3.05	50	0.045	48	300		5	0.0009	9	16	35	9	57	PM	C	LFA	**PT1006**
2.75-3.05	200	0.50	44	300		50	0.025	12	25	50	16	57	PM	C	LFA	**PT1008**
2.70-3.20	1000	10.0	30	–	150		0.01	40	35	75	40	80	EM	G	L	**PT1120**
2.70-3.20	1000	10.0	30	–	150		0.01	40	35	75	40	80	EM	C	L	**PT1121**
2.70-3.20	1000	10.0	30	–	200		0.01	40	35	75	40	80	EM	G	L	**PT1122**
2.70-3.20	1000	10.0	30	–	200		0.01	40	35	75	40	80	EM	C	L	**PT1123**
2.70-3.30	5000	5.0	47	–	100		0.001	13.5	30	175	100	1160[5]	EM	C	LFA	**PT1001**
3.0-3.5	2.5	0.25	43	any150	5	7.5	0.1	12	30	12.5	0.8	13	ES	MA	FA	**PT1010A**
3.0-3.5	10	0.25	43	any150	7.5	10	0.025	12	30	20	1.5	13	ES	MA	FA	**PT1010B**
3.0-3.5	2.5	0.25	43	any150	5	7.5	0.1	12	30	12.5	0.8	13	ES	G	FA	**PT1015**
8.6-9.6[6]	30(min)	0.30	49	–			0.01	5		32	8.5	13	PPM	G	FA	**VTX5783A2**
9.0-10.0	2	1.0	46	any300		15	0.5	4	25	11	1.0	11	PM	MA	L	**PT1130**

Notes:
1. Travelling wave tube
2. EM Electromagnet : ES Electrostatic : PM Permanent Magnet : PPM Periodic permanent magnet
3. C Cathode : G Grid : MA Modulating anode
4. L Liquid : FA Forced air
5. Weight included electromagnet, oil jacket, trolley, connectors etc.
6. Coupled cavity travelling wave tube
7. Bandwidth at 1½ dB.

Solid state assemblies

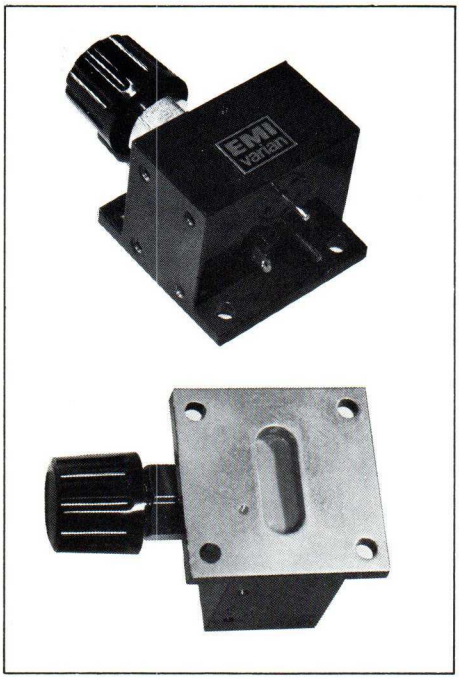
EMI-Varian produce a range of Gunn effect oscillators intended for use as local oscillators in airborne and marine radar applications. These units complement EMI-Varian's existing family of microwave tubes and incorporate a wealth of experience gained, with radar equipment, over many years.

In addition to the local oscillators, inexpensive mechanically tuned Gunn oscillators are available that operate in both X and Ku bands.

A Doppler radar module for use in security and industrial monitoring systems completes this range of solid state assemblies.

The solid state assemblies shown in this leaflet are typical of the range available. Similar items, with variations in specification can be produced to customer's own requirements.

Varactor tuned gunn oscillators



PTS5002

Quick Reference Data

X-Band Mechanical/Electronic Tuned Gunn Oscillator

Centre frequency	9.400 GHz
Mechanical tuning range	± 100 MHz
Electronic tuning range	± 25 MHz
Power output	10 mW
Output connector	WG 16 waveguide

The PTS5002 is a varactor tuned oscillator primarily intended for use as a local oscillator in marine radar with A.F.C.

Typical operation

Gunn supply voltage*	+ 10 volts
Tuning voltage*	+ 2 to + 10 volts

Typical performance

Gunn supply current	120 mA
Varactor (tuning) current	10 µA
Power output	10 mW
Mechanical tuning range	9.3 - 9.5 GHz
Electronic tuning range	± 25 MHz

PTS5003

Quick Reference Data

X-Band Mechanical/Electronic Tuned Gunn Oscillator

Centre Frequency	9.400 GHz
Mechanical tuning range	± 200 MHz
Electronic tuning range	50 MHz
Power output	35 mW
Output connector	WG16 waveguide

The PTS5003 is a varactor tuned oscillator primarily intended for use as a local oscillator for radar systems with A.F.C.

Typical operation

Gunn supply voltage*	+ 9 volts
Tuning voltage*	+ 2 to + 26 volts

Typical performance

Gunn supply current	350 mA
Varactor (tuning) current	10 µA
Power output	35 mW
Mechanical tuning range	9.2 - 9.6 GHz
Electronic tuning range	50 MHz

Characteristics

	PTS 5002 (over temperature range - 25 to + 70°C unless otherwise stated)			PTS 5003 (over temperature range - 35 to + 70°C unless otherwise stated)		
Centre frequency 9.4 GHz	Min.	Max.		Min.	Max.	
Mechanical tuning range	± 100	–	MHz	± 200	–	MHz
Electronic tuning range	± 25	± 35	MHz	± 20	± 40	MHz
Power output	6	18	mW	20	60	mW
Variation in power output over electronic tuning range		1	dB		1	dB
Electronic tuning sensitivity	4	15	MHz/V	1	15	MHz/V
Mechanical tuning sensitivity		200	MHz/turn		200	MHz/turn
Frequency temperature coefficient		- 300	kHz/°C		- 200	kHz/°C
Frequency pushing		2	MHz/V		4	MHz/V
Frequency pulling (V.S.W.R. 1.3 : 1 temp= 30°C)		± 2	MHz		± 2	MHz
Power output variation V.S.W.R. 1.3 : 1 all phases		± 1.5	dB		± 1.5	dB

Maximum and minimum ratings

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

Gunn supply voltage*		+ 12	volts		+ 12	volts
Gunn current operating		150	mA		400	mA
Gunn current starting		220	mA		500	mA
Tuning voltage*		+ 12	volts		+ 26	volts
V.S.W.R. (load)		1.5 : 1			1.5 : 1	
Temperature (ambient)	25	+ 70	°C	- 35	+ 70	°C

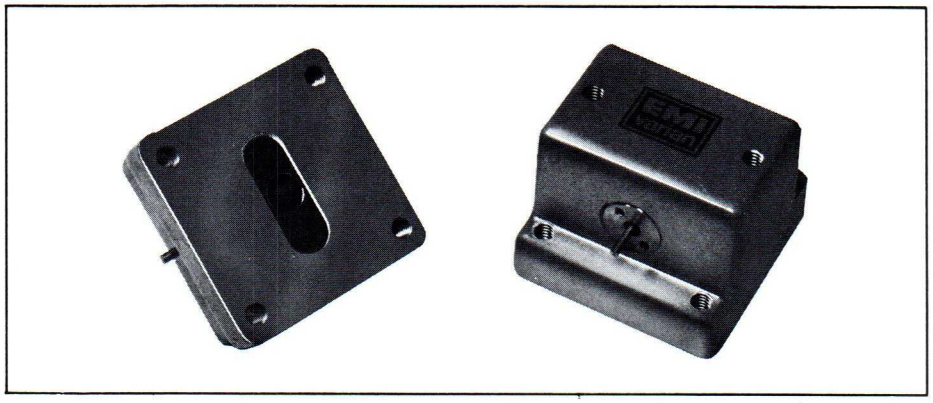
*Units are available with Gunn and Varactor of either polarity.

Precautions: The Gunn and Varactor Diodes will be damaged if the supply voltage is reversed or subjected to transients. Protection against transients should be included in any power supply.

Mechanically tuned gunn oscillators

All of these units may be mechanically tuned over a minumum range of ±100 MHz. The parameters of these units could be modified to suit particular requirements.

Type	Frequency	Power output
PTS 5013	9-11 GHz	10 mW
PTS 5013/1	9-11 GHz	25 mW
PTS 5013/2	9-11 GHz	50 mW
PTS 5013/3	9-11 GHz	100 mW
PTS 5012	14-16 GHz	10 mW



Doppler radar module

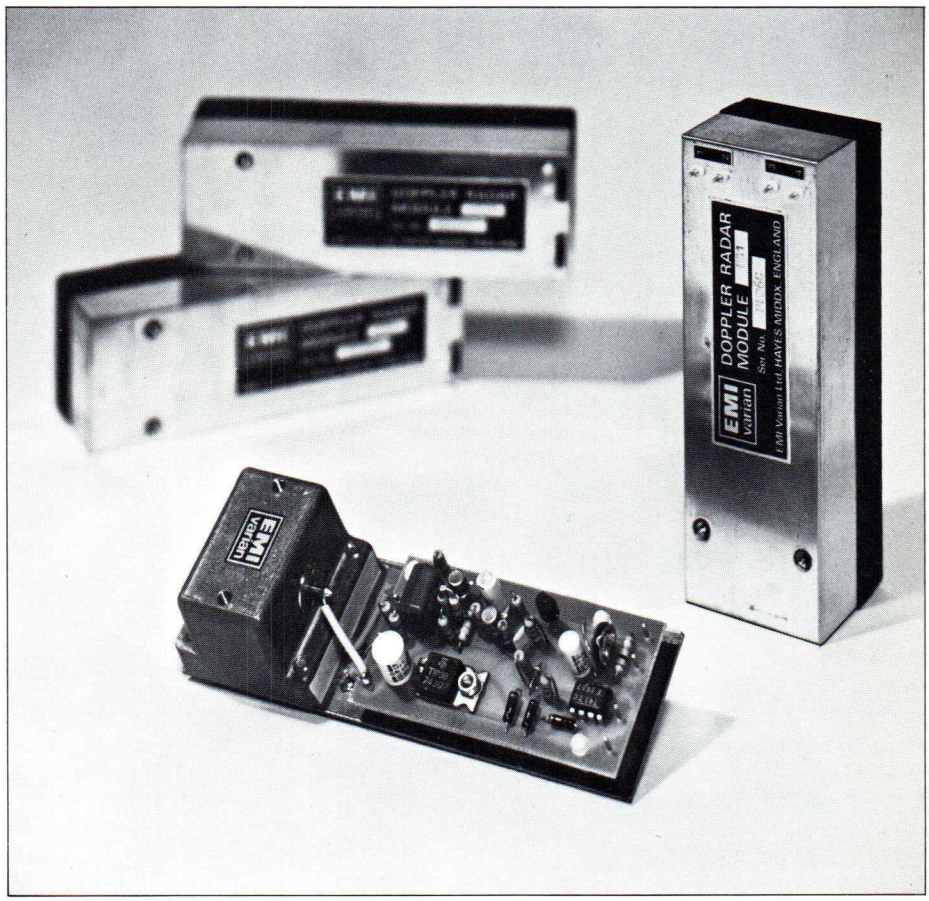
The EMI-Varian Doppler Radar Modules are sub-units available for incorporation into systems for intruder detection, speed measurement, counters, proximity detectors, etc. The units use the homodyne principle and comprise the transmitter, transmit aerial, receive aerial, mixer, A.F. amplifier and regulator, all mounted in a screening can with a plastic radome over the aerials.

The transmit and receive aerials are linearly polarised and have beamwidths in the E & H planes of approximately 25° and 90° respectively.

The aerials and mixer are printed on a single substrate using microstrip techniques.

Reflections from a moving target produce a frequency shift proportional to the target velocity. The return is compared with a sample of the transmit frequency at the mixer to extract the difference frequency. The sample is obtained by direct leakage between the receive and transmit aerials, and from reflection at the radome. The mixer is also biased to optimise performance. The A.F. amplifier takes the mixer output to a level that can be readily interfaced with any subsequent processing circuits.

The Doppler Radar Module should give an acceptable return from a man at ranges in excess of 20 metres. The spacial coverage of the unit will depend upon the environment rather that the aerial characteristics due to reflections from obstacles (walls, pillars, etc.).



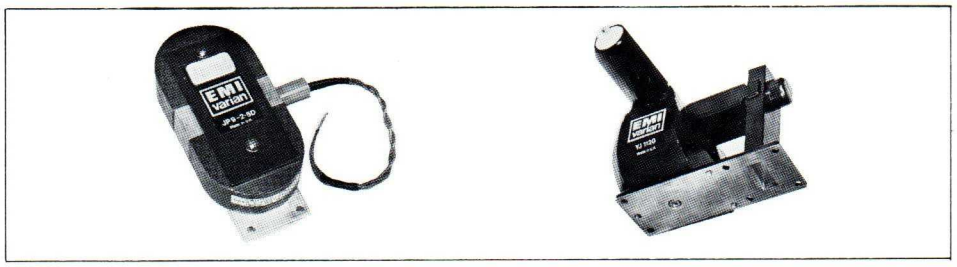
Supply Voltage	+12 volts D.C. nominal (9-15v allowable)
Supply current	140 mA
Power output	10 mW CW
Doppler output	31.8 Hz/mile per hour 19.8 Hz/kilometre per hour
Signal output	4 volts Peak-Peak maximum
A.F. Bandwidth (Output)	33-200 Hz

Typical operation

Type	Frequency
PTS 5007	10.687 GHz
PTS 5008	10.587 GHz
PTS 5009	9.35 GHz
PTS 5010	10.525 GHz
PTS 5011	9.9 GHz

Marine radar magnetrons

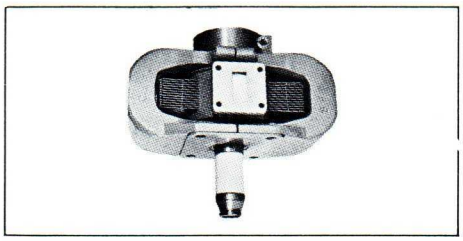
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency. For full specification and recommended operating conditions please refer to our published data sheets available on request.



Frequency (GHz)	Output power (kW)	Duty cycle	Pulse length (u S)	Anode voltage (kV)	Anode current (A)	Type number
9.17 ±0.03	25	0.001	1.0	8.3	8.0	**JP2-22D**
9.375 ± 0.03	3	0.0005	0.5	3.6	3.0	**JP9-2.5H**
9.375 ± 0.03	10	0.0025	2.5	5.5	4.5	**2J42 (CV3676)**
9.375 ± 0.03	10	0.001	1.0	5.7	5.5	**JP9-7D (CV1866)**
9.375 ± 0.03	10	0.001	1.0	5.5	4.5	**JP9-7L**
9.375 ± 0.03	10	0.001	1.0	5.7	5.5	**JP9-7T**
9.375 ± 0.03	20	0.001	1.5	7.8	7.5	**YJ1110**
9.375 ± 0.03	21	0.001	2.5	7.5	7.5	**JP915D (CV5123)**
9.375 ± 0.03	50	0.001	1.0	12.5	12.0	**JP9-50A**
9.41 ±0.065	3	0.0005	0.5	3.6	3.0	**JP9-2.5**
9.41 ±0.065	7	0.001	1.0	4.3	5.0	**YJ1300**
9.41 ±0.03	10	0.001	1.0	5.8	6.0	**YJ1071**
9.41 ±0.03	21	0.001	2.5	7.2	8.6	**JP9-18**
9.41 ±0.03	25	0.001	1.0	8.3	8.0	**YJ1120**
9.415-9.475	7	0.001	1.0	4.3	5.0	**YJ1301**
9.445 ± 0.03	3	0.0005	0.5	3.6	3.0	**JP9-2.5D·**
9.445 ± 0.03	3	0.0005	0.5	3.6	3.0	**JP92.5E (CV10758)**
9.445 ± 0.03	3	0.0005	0.5	3.6	3.0	**JP9-2.5L**
9.445 ± 0.03	21	0.001	2.5	7.5	7.5	**JP9-15B**
9.445 ± 0.03	26	0.001	1.0	8.3	9.0	**YJ1121**
9.445 + 0.015 - 0.03	26	0.001	1.0	8.3	9.0	**YJ1123**
9.475 ± 0.025	25	0.001	1.0	8.3	8.0	**JP9-22L**
9.49 ±0.08	25	0.001	1.0	8.3	8.0	**JP9-22B**
9.55 ±0.03	3	0.0005	0.5	3.6	3.0	**JP9-2.5C**
9.65 ±0.03	26	0.001	1.0	8.3	9.0	**YJ1124**

Coaxial magnetrons

Coaxial magnetrons have a stabilizing cavity interposed between the anode-cathode system and the output waveguide of the magnetron. This cavity makes possible the achievement of superior electrical characteristics, low frequency pushing factors and low frequency pulling factors, and gives small lightweight oscillators with very high powers and long life capability.



Frequency (GHz)	Output power (peak) (kW)	Duty cycle (max)	Pulse length (max) (μS)	Anode voltage (peak) (kV)	Anode current (peak) (A)	Pulling factor (max) (MHz)	Pushing factor (max) (MHz/A)	Temperature co-efficient (typical) (MHz/°C)	Weight (approx) (kg)	Type Number
8.5 -9.6	200	0.001	2.8	22	27	5	0.1	0.2	6.1	**SFD349**
9.373-9.377	70	0.001	5.0	15	15	4	0.09	0.15	3.2	**SFD377A**

Airborne radar magnetrons

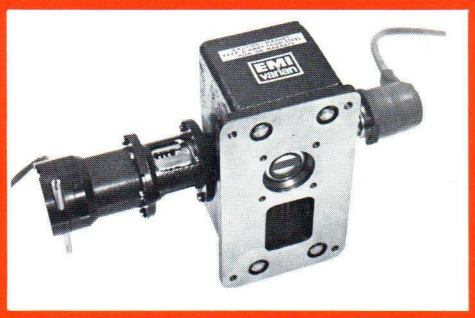
Frequency (GHz)	Output power (kW)	Duty cycle	Pulse length (μS)	Anode voltage (kV)	Anode current (A)	Special features	Type Number
9.24 ± 0.03	22	0.001	1.0	7.5	7.5		**YJ1050 (CV6199)**
9.375 ± 0.03	20	0.0015	1.5	7.8	7.5	HA	**YJ1112**
9.375 ± 0.03	20	0.002	2.5	7.2	7.5	HA	**YJ1060**
9.375 ± 0.03	45	0.0025	5.0	12.4	12		**YJ1200 (CV9424)**
9.375 ± 0.03	45	0.0025	5.0	12.4	12	HA	**YJ1201**
9.375 ± 0.03	50	0.001	2.5	12.5	12		**2J55**
8.8 ± 0.03	0.025	0.2	4.0	0.8	0.15		**JP8-02B (CV6072)**
8.8 + 0.03 - 0.015	0.025	0.2	4.0	0.8	0.15		**YJ1380 (CV6234)**

HA – High altitude

Spin tuned magnetron

Frequency (GHz)	Output power (kW)	Duty cycle	Pulse length (uS)	Anode voltage (kV)	Anode current (A)	Type number
8.7 - 9.7†	100	0.001	1.0	15.0	20.0	**YJ1470**

†Spin tuned over any 450 MHz band at a rate of 500 - 1000 Hz/sec



Equivalents list for marine and low powered airborne radar magnetrons

Type to be replaced	EMI-Varian Type No.	Type to be replaced	EMI-Varian Type No.	Type to be replaced	EMI-Varian Type No.	Type to be replaced	EMI-Varian Type No.
CV370	JP9-7A	JP9-7T	JP9-7T	M5022	YJ1121	YJ1200	YJ1200
CV1866	JP9-7D	JP9-15	YJ1110	M5023	YJ1110	YJ1201	YJ1201
CV2281	YJ1070	JP9-15B	JP9-15B	M5024	YJ1111	YJ1250	YJ1250
CV3528	YJ1110	JP9-15C	JP9-15C	M5021	YJ1390	YJ1300	YJ1300
CV3676	2J42	JP9-15D	JP9-15D	M5025	YJ1112	YJ1390	YJ1390
CV3997	YJ1110	JP9-15E	JP9-15E	M5031	JP9-7L	YJ1410	YJ1410
CV5123	JP9-15D	JP9-15F	JP9-15F	M5042	YJ1250	YJ1470	YJ1470
CV6072	JP8-02B	JP9-15G	JP9-15G	M5043	YJ1300	2J42	2J42
CV6108	YJ1070	JP9-15J	JP9-15J	M5064	JP9-2.5H	2J55	2J55
CV6199	YJ1050	JP9-18	JP9-18	M5089	YJ1123	5960-00-107-7590	2J42
CV6215	YJ1110	JP9-22B	JP9-22B	M506S	YJ1124	5960-00-242-6051	2J55
CV6234	YJ1380	JP9-22C	YJ1124	MAG3	2J42	5960-15-252-9810	2J42H
CV10758	JP9-2.5E	JP9-22D	JP9-22D	MAG4	YJ1110	5960-17-032-8318	JP9-2.5E
CV9424	YJ1200	JP9-22L	JP9-22L	MAG16	YJ1121	5960-90-008-0370	JP9-7A
JP9-02B	JP8-02B	JP9-22R	JP9-22R	ME1101	2J42	5960-99-000-1866	JP9-7D
JP9-2.5	JP9-2.5	JP9-75	JP9-75	ME1101A	YJ1110	5960-99-000-2281	YJ1070
JP9-2.5B	YJ1000	M503A	JP9-7D	ME1101D	JP9-7D	5960-99-000-3528	YJ1110
JP9-2.5C	JP9-2.5C	M508	JP9-7A	S914*	YJ1470	5960-99-000-3676	2J42
JP9-2.5D	JP9-2.5D	M513B	YJ1110	YJ1000	YJ1000	5960-99-000-3997	YJ1110
JP9-2.5E	JP9-2.5E	M515	YJ1120	YJ1050	YJ1050	5960-99-000-5123	JP9-15D
JP9-2.5H	JP9-2.5H	M526	2J42	YJ1060	YJ1060	5960-99-037-2300	JP8-02B
JP9-2.5K	JP9-2.5K	M537A	YJ1070	YJ1070	YJ1070	5960-99-037-2968	YJ1070
JP9-2.5L	JP9-2.5L	M559*	YJ1040	YJ1071	YJ1071	5960-99 037-3736	YJ1040
JP9-2.5M	JP9-2.5M	M575	JP9-75	YJ1112	YJ1112	5960-99-037-4673	YJ1200
JP9-2.5N	JP9-2.5N	M581	YJ1290	YJ1113	JP9-18	5960-99-037-5413	YJ1050
JP9-5M	JP9-5M	M597	YJ1070	YJ1120	YJ1120	5960-99-037-5616	JP9-2.5E
JP9-7	2J42	M598B	JP9-18	YJ1121	YJ1121	5960-99-037-5825	YJ1380
JP9-7A	JP9-7A	M599A	JP9-2.5D	YJ1123	YJ1123	5960-99-118-2275	YJ1123
JP9-7D	JP9-7D	M599B	JP9-2.5E	YJ1124	YJ1124	5960-99-118-2276	YJ1124
JP9-7L	JP9-7L	M5005	YJ1200				

*Near equivalent

Reflex klystrons

These klystrons are designed to allow customers to fit their own cavities to emphasise any parameter desired.

They cover the frequency range from 1.0 - 11.7 GHz according to klystron type and customer's cavity. A limited range of cavities is available, details are available upon request.

Operating frequency range (GHz)	Test frequencies used (GHz)	Output power typical (mW)	Output power minimum (mW)	Mechanical tuning * range (MHz)	Electronic tuning range (MHz)	Reflector voltage range (V)	Beam voltage (V)	Beam current (mA)	Type number
3.0 – 12	8.5 – 10.0	60	30	–	15	-100 to -300	300	35	**CV2346**
8.0 – 11	8.5 – 10.0	80	75	–	15	-100 to -300	300	35	**R9760**
9.1 – 9.3	9.12 – 9.27	30	20	150+	25	-140 to -210	300	35	**CV6002**
3.0 – 12	7.0	60	30	–	15	- 60 to -210	300	40	**R9689/1**
	9.2	60	15						
	11.5	5	2						
7.0 – 12	7.0	70	40	–	10	- 50 to -250	350	50	**R9687**
7.0 – 12	7.0 – 10.0	40	30	3,300	15	- 50 to -500	350	55	**R9696**
	10.0 – 11.7	10	5	3,500					
9.25 – 9.29	9.25 – 9.29	–	120	40	15	-250 to -350	350	55	**R9696A**
5.0 – 8.2	5.4 – 8.2	50	30	2,800	–	- 50 to -550	350	50	**R9701**
5.05 – 5.85	5.05 – 5.85	50	30	800	–	- 50 to -550	350	50	**R9701A**
1.0 – 5.4	3.15 , 3.58	120	60	–	23	- 70 to -500	300	45	**CV6071**
1.0 – 5.4	3.15 , 3.58	120	60	–	20	- 70 to -500	300	45	**R9559**
1.8 – 4.5	2.6 , 3.7	100	40	–	18	- 50 to -500	250	32	**CV2116**

* Valve plugs into external cavity. Cavity dimensions for a given frequency are available on request.

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EMI-Varian Ltd is a British Company formed by EMI Limited, of Great Britain and Varian Associates of the United States of America. EMI-Varian specialise in the design and production of Microwave Devices, and have a comprehensive manufacturing factory based at Hayes in Middlesex. As a result of its unique association with both Companies, EMI-Varian have access to unparalleled experience in Microwave devices.

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Magnetron

X-band fixed frequency

JP9-2·5D JP9-2·5E

SERVICE TYPE No CV10758

FOR MARINE RADAR APPLICATIONS

Quick Reference

X-band fixed frequency pulsed magentron

Frequency (fixed within the band)	9.415 to 9.475
Output power (peak)	4.0 kW
Output	WG 16 waveguide
Coupler	UG-40B/U (5985-99-083-0051)
Construction	Packaged

To be read in conjunction with General operating recommendations-Magnetrons.

Typical Operation

Operational conditions	Cond. 1	Cond. 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	3.0	3.0	A
Pulse duration	0.1	0.5	us
Pulse repetition rate	2000	1000	pulse/s
Rate of rise of voltage pulse	60	60	kV/us

Typical Performance

Anode voltage (peak)	3.6	3.0 kV
Output power (peak)	4.0	4.0 kW
Output power (mean)	0.8	2.0 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage	6.3 V
Heater current	0.55 A
Cathode heating time (minimum)	120 S

PHYSICAL

Mounting position	any
Weight of magnetron	1.02 kg
Weight of magnetron in storage carton	1.82 kg
Dimension of storage carton	

A minimum clearance of 50 mm must be maintained between the magnet and any magnetic materials.

Cooling	Natural or forced air

The magnetron is tested to comply with the following electrical specification.

Test Conditions and Limits

Test conditions

Heater voltage (test)	6.3 V
Anode current (mean)	3.0 mA
Pulse duration (t_p) (note 2)	1.0 μs
Duty factor	0.001
v.s.w.r. at output coupler	1.05:1
Rate of rise of voltage pulse (note 3)	75 kV/μs

Test limits	Min.	Max.
Anode voltage (peak)	3.2	3.8 kV
Output power (mean)	3.0	W
Frequency	9.415	9.475 GHz
r.f. bandwidth at ¼ power		$\frac{2.5}{t_p}$ MHz
Frequency pulling (note 4)		18.0 MHz
Frequency pushing (notes 7 & 9)		2.5 MHz/A
Stability (note 6)		0.25%
Cold impedance (note 9)		
Heater current (note 10)		
Frequency temperature coefficient (notes 7 & 11)		
Input capacitance (notes 7 & 12)		

End of Life Performance

(Under test conditions)

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test condition 2.

	Min.	Max.
Anode voltage (peak)	3.2	3.6 kV
Output power (peak)	2.5 W	
r.f. bandwidth at ¼ power		$\frac{3.0}{t_p}$ MHz
Frequency	9.415	9.475 GHz
Stability (note 6)		2.0%

Maximum and Minimum Ratings

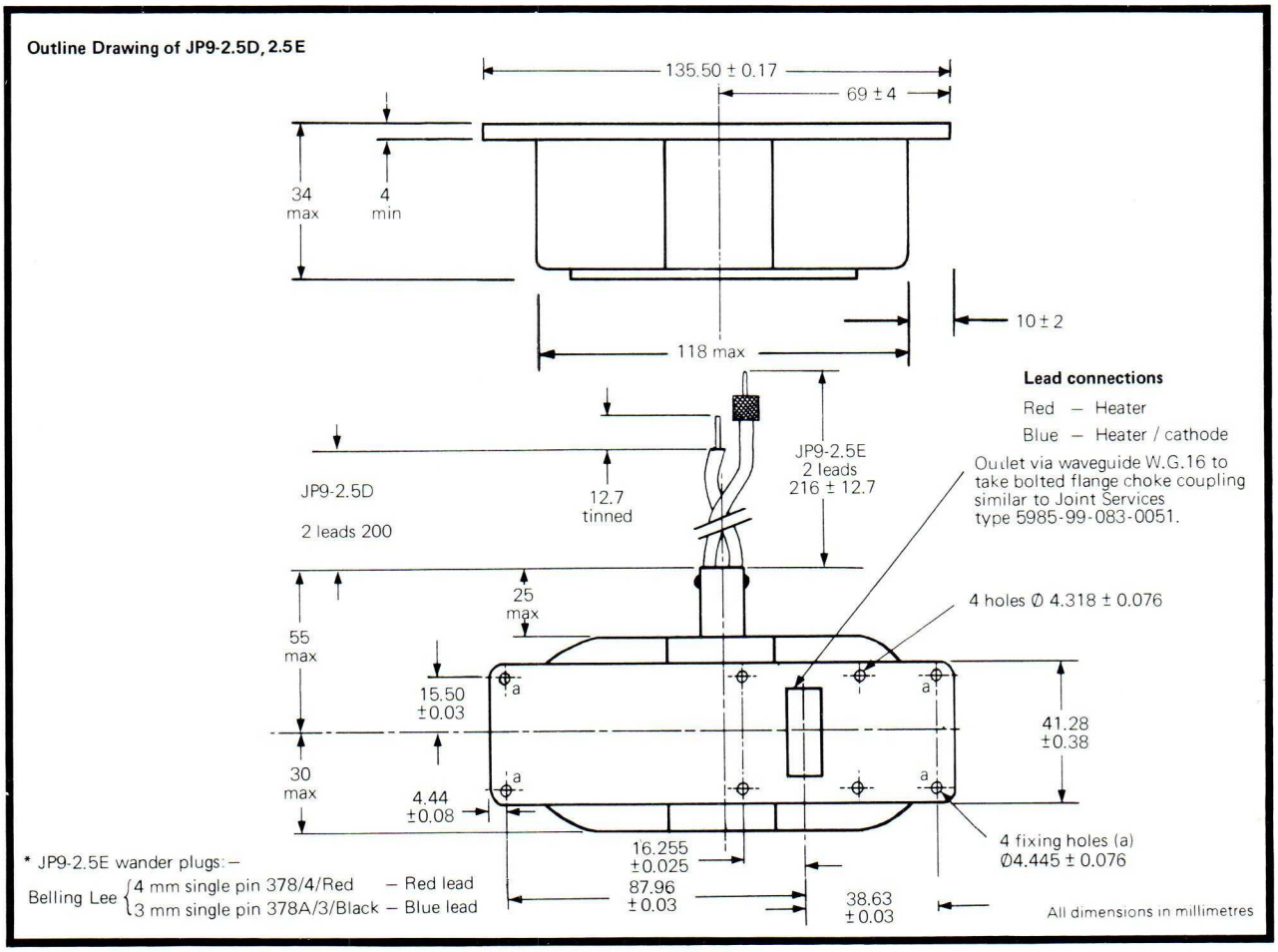
These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

	Min.	Max.
Heater voltage (note 13)	5.7	6.9 V
Heater starting current (peak)		5.0 A
Anode voltage (peak)	3.2	3.8 kV
Anode current (peak)	2.5	3.5 A
Input power (peak)		13.0 kW
Input power (mean)		13.0 W
Duty factor		0.001
Pulse duration (note 2)	0.02	1.0 μs
Rate of rise of voltage		70 kV/us
Anode temperature		120°C
v.s.w.r. at output connection		1.5:1

Notes

1. For ambient temperatures above 0°C. For ambient temperature between 0°C and −55°C the heating time is 180 seconds.
2. The tolerance on the pulse current duration at the 50% amplitude point is ± 10%.
3. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 3.7 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
4. A peak anode current of 3A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
5. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 2.5 to 3.5A peak.
6. Measured with the conditions described in Note 5. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
7. Design test only.
8. Measured over the anode current range 2.5 to 3.5A peak.
9. The cold impedance of the magnetron is measured at the operating frequency and will be such as to give a v.s.w.r. of at least 6:1. The position of voltage minimum from the face of the output flange into the magnetron is 3 to 9mm for JP9-2.5D and 0 to 6mm for the JP9-2.5E.
10. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.5 to 0.6A.
11. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
12. The maximum input capacitance is 9pF.
13. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 1kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditons.

Outline Drawing of JP9-2.5D, 2.5E



Marine Radar Magnetrons

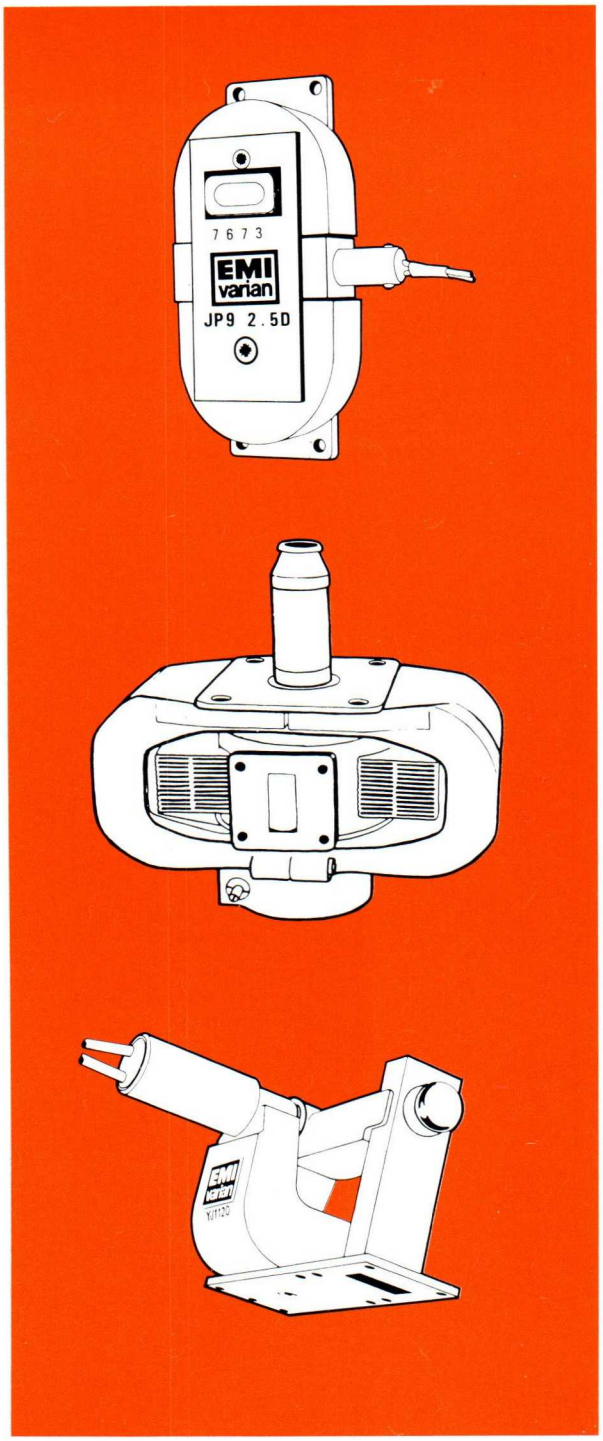
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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Magnetrons
Fixed Frequency
YJ1120

FOR MARINE RADAR APPLICATIONS

Quick Reference

X-band fixed frequency pulsed magnetron

Frequency (fixed within the band)	9.380 to 9.440 GHz
Output power (peak)	25 kW
Output Coupler	WG16 waveguide UG-40B/U (5985-99-083-0051)
Construction	packaged

To be read in conjunction with General Operating Recommendations — Magnetrons

Typical Operation

Operational conditions	Condition 1	Condition 2
Heater voltage	6.3	6.3 V
Anode current (peak)	8.0	8.0 A
Pulse duration	0.05	1.0 μs
Pulse repetition rate	2000	500 pulse/s
Rate of rise of voltage pulse	120	120 kV/us

Typical Performance

	Condition 1	Condition 2
Anode voltage (peak)	8.3	8.3 kV
Output power (peak)	25.0	25.0 kW
Output power (mean)	2.5	12.5 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage (note 1)	6.3 V
Heater current	0.5 A
Cathode heating time (minimum) (note 2)	120 s

PHYSICAL

Mounting position	any
Weight of magnetron	1.4 kg
Weight of magnetron in storage carton	2.9 kg
Dimension of storage carton	199 x 203 x 249 mm
A minimum clearance of 50mm must be maintained between the magnet and any magnetic materials.	
Cooling	natural or forced air

Test Conditions and Limits

The magnetron is tested to comply with the following electrical specification.

Test conditions

Heater voltage (test)	6.3	V
Anode current (mean)	4.0	mA
Pulse duration (t_p) (note 3)	0.5	μs
Duty factor	0.0005	
v.s.w.r. at output coupler	1.05:1	
Rate of rise of voltage pulse (note 4)	125	kV/μs

Test limits	**Min**	**Max**	
Anode voltage (peak)	7.5	8.5	kV
Output power (mean)	10		W
Frequency	9.380	9.440	GHz
r.f. bandwidth at ¼ power		$\frac{2.5}{t_p}$	MHz
Frequency pulling (note 5)		18.0	MHz
Frequency pushing (notes 8 and 9)		1.5	MHz/A
Stability (note 7)		0.25	%
Cold impedance (note 10)			
Heater current (note 11)			
Frequency temperature coefficient (notes 8 and 12)			
Input capacitance (notes 8 and 13)			

Maximum and Minimum Ratings

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

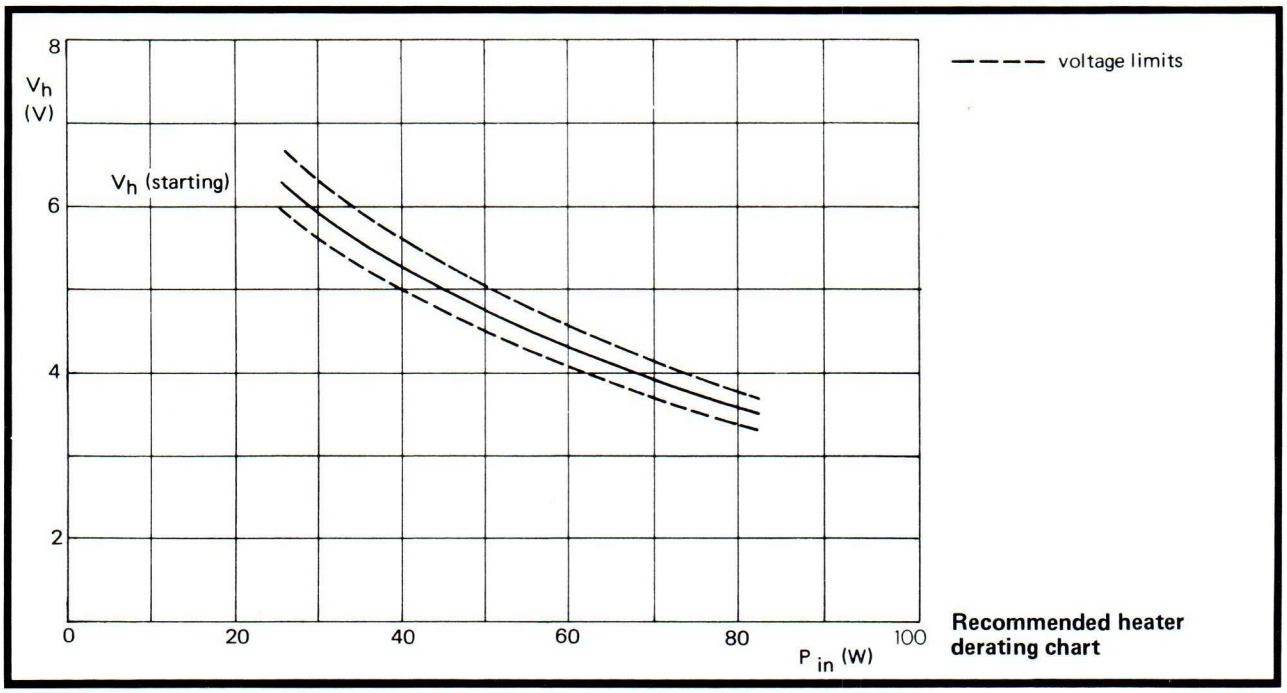
	Min.	**Max.**	
Heater voltage (notes 1 and 15)	5.9	6.7	V
Heater starting current (peak)		5.0	A
Anode voltage (peak)	7.5	8.5	kV
Anode current (peak)	6.0	10.0	A
Input power (peak)		75.0	kW
Input power (mean)		85.0	W
Duty factor		0.0015	
Pulse duration (note 3)	0.05	2.0	us
Rate of rise of voltage pulse (note 4)		120	kV/us
Anode temperature (note 14)		120	°C
v.s.w.r. at output connection		1.5:1	

End of Life Performance

(Under Test Conditions)

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test condition 2.

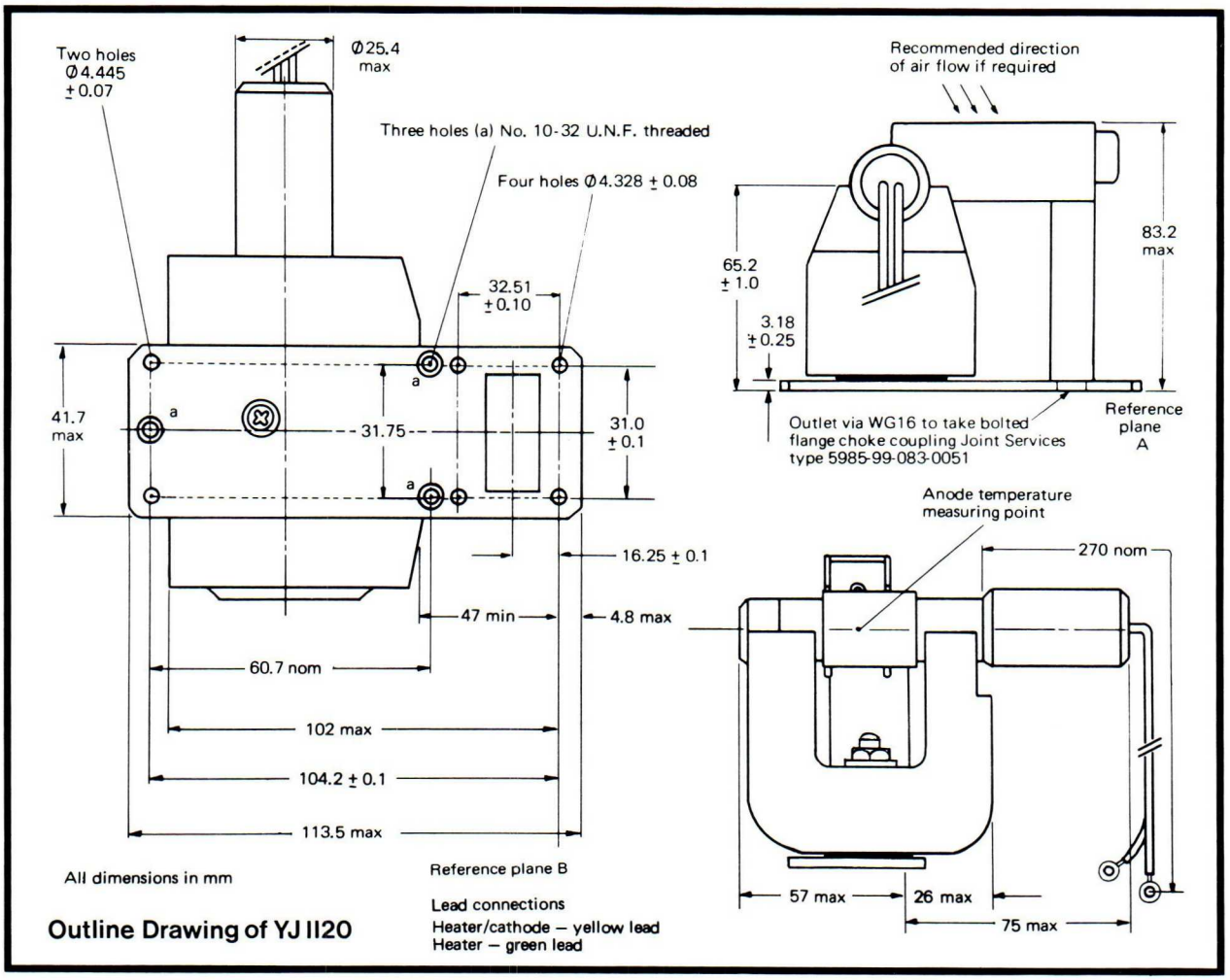
	Min.	**Max.**	
Anode voltage (peak)	7.5	8.5	kV
Output power (peak)	16.0		W
r.f. bandwidth at ¼ power		$\frac{3.0}{t_p}$	MHz
Frequency	9.380	9.440	GHz
Stability (note 7)		2.0	%



Recommended heater derating chart

Notes

1. With no anode power. For average pulse input powers greater than 40 watts the heater voltage MUST be reduced immediately after the application of anode power. The recommended heater derating chart is shown opposite.
2. For ambient temperatures above 0°C. For ambient temperature between 0°C and −55°C the heating time is 180 seconds.
3. The tolerance on the pulse current duration at the 50% amplitude point is ± 10%.
4. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 8.3 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
5. A peak anode current of 8A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
6. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 6 to 10 A peak.
7. Measured with the conditions described in Note 6. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
8. Design test only.
9. Measured over the anode current range 6 to 10A peak.
10. The cold impedance of the magnetron is measured at the operating frequency and will be such as to give a v.s.w.r. of at least 6:1. The position of voltage minimum from the face of the output flange into the magnetron is 16.5 to 22.5 mm.
11. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.43 to 0.6A.
12. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
13. The maximum input capacitance is 9pF.
14. Measured at the point indicated on the outline drawing.
15. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 1kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditions.



Outline Drawing of YJ 1120

Marine Radar Magnetrons

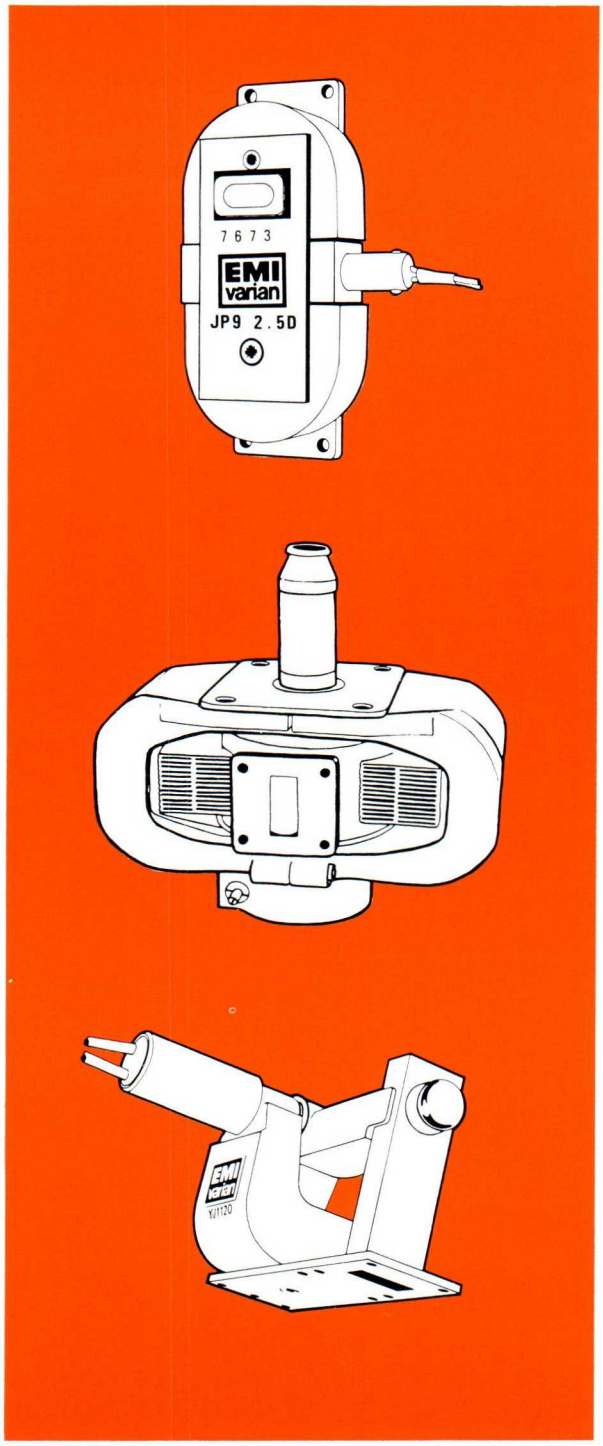
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.015	1	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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EMI-Varian

Magnetron

X-band fixed frequency

YJ1121

FOR MARINE RADAR APPLICATION

Quick Reference

X-band fixed frequency pulsed magnetron

Frequency (fixed within the band)	9.415 to 9.475 GHz
Output power (peak)	28 kW
Output coupler	WG 16 waveguide UG-40B/U (5985-99-083-0051)
Construction	Packaged

To be read in conjunction with General operating Recommendation-Magnetrons.

Typical Operation

Operational conditions	Cond. 1	Cond. 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	9.0	9.0	A
Pulse duration	0.05	1.0	us
Pulse repetition rate	2000	500	pulse/s
Rate of rise of voltage pulse	120	120	kV/μs

Typical Performance

Anode voltage (peak)	8.3	8.3 kV
Output power (peak)	28.0	28.0 kW
Output power (mean)	2.8	14.0 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage (note 1)	6.3 V
Heater current	0.5 A
Cathode heating time (minimum) (note 2)	120 s

PHYSICAL

Mounting position	any
Weight of Magnetron	1.4 kg
Weight of Magnetron in storage carton	2.9 kg
Dimensions of storage carton	199 x 203 x 249 mm

A minimum clearance of 50 mm must be maintained between the magnet and any magnetic materials.

Cooling	natural or forced air

Test Conditions and Limits

The magnetron is tested to comply with the following electrical specification.

Test conditions

Heater voltage (test)	6.3 V
Anode current (mean)	4.5 mA
Pulse duration (t_p) (note 3)	0.5 μs
Duty factor	0.0005
v.s.w.r. at output coupler	1.05:1
Rate of rise of voltage pulse (note 4)	125 kV/us

Test limits	Min.	Max.
Anode voltage (peak)	7.5	8.5 kV
Output power (mean)	11.0	W
Frequency	9.415	9.475 GHz
r.f. bandwidth at ¼ power	$\frac{2.5}{t_p}$	MHz
Frequency pulling (note 5)	18.0	MHz
Frequency pushing (notes 8 & 9)	1.5	MHz/A
Stability (note 7)	0.25%	
Cold impedance (note 10)		
Frequency temperature coefficient (notes 8 & 12)		
Input capacitance (notes 8 & 13)		
Heater current (note 11)		

Maximum & Minimum Ratings

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

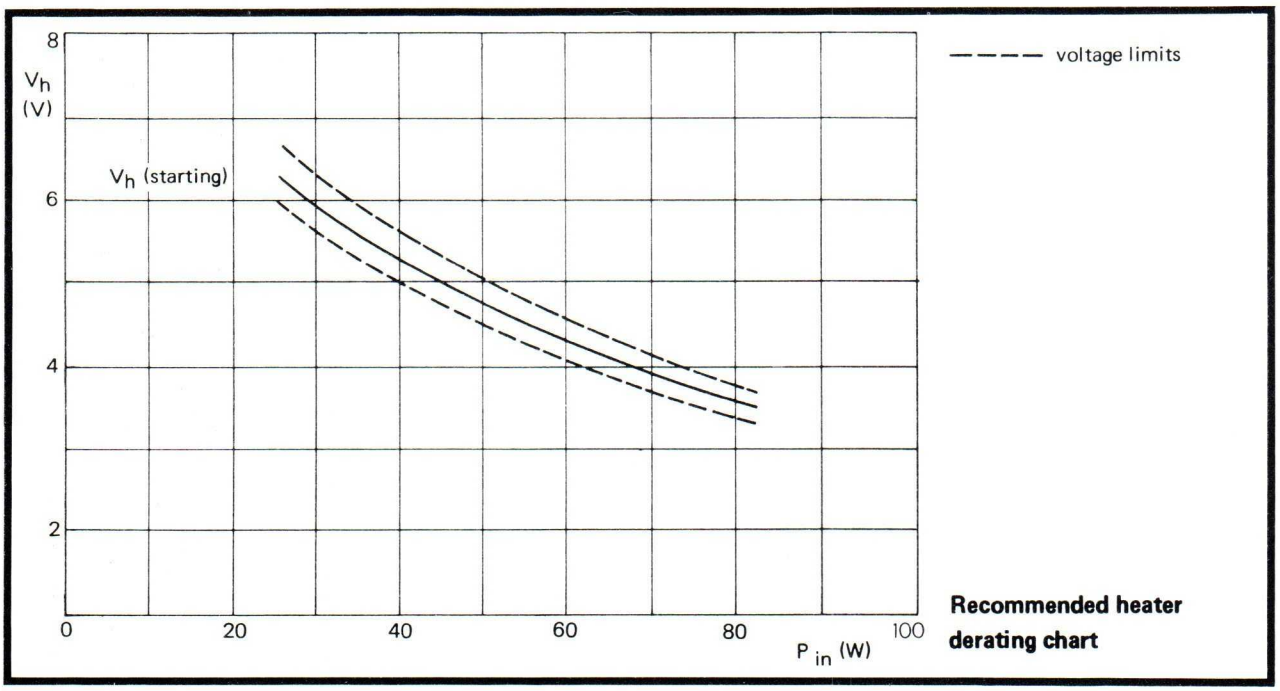
	Min.	Max.
Heater voltage (notes 1 & 15)	5.9	6.7 V
Heater starting current (Peak)		5.0 A
Anode voltage (peak)	7.5	8.5 kV
Anode current (peak)	6.0	10.0 A
Input power (peak)		75.0 kW
Input power (mean)		85.0 W
Duty factor		0.0015
Pulse duration (note 3)		2.0 μs
Rate of rise of voltage pulse (note 4)		120 kV/μs
Anode temperature (note 14)		120°C
v.s.w.r. at output connection		1.5:1

End of Life Performance

(Under test conditions)

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test condition 2.

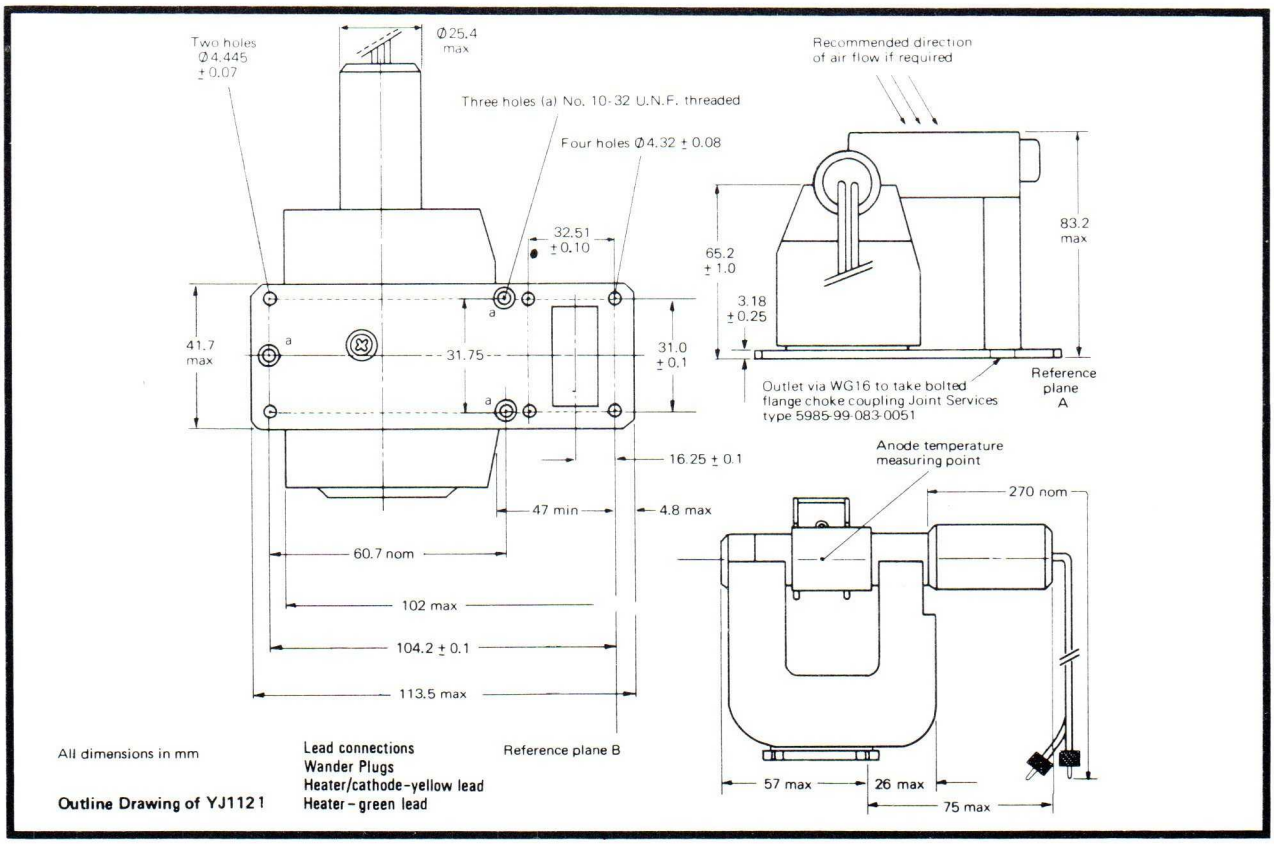
	Min.	Max.
Anode voltage (peak)	7.5	8.5 kV
Output power (peak)	18.0	kW
r.f. bandwidth at ¼ power		$\frac{3.0 \text{ MHz}}{t_p}$
Frequency	9.415	9.475 GHz
Stability (note 7)		2.0%



Recommended heater derating chart

Notes

1. With no anode power. For average pulse input powers greater than 40 watts the heater voltage MUST be reduced immediately after the application of anode power. The recommended heater derating chart is shown opposite.
2. For ambient temperatures above 0°C. For ambient temperature between 0°C and −55°C the heating time is 180 seconds.
3. The tolerance on the pulse current duration at the 50% amplitude point is ± 10%.
4. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 8.3 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
5. A peak anode current of 9.0A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
6. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 6 to 10A peak.
7. Measured with the conditions described in Note 6. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
8. Design test only.
9. Measured over the anode current range 6 to 10A peak.
10. The cold impedance of the magnetron is measured at the operating frequency and will be such as to give a v.s.w.r. of at least 6:1. The position of voltage minimum from the face of the output flange into the magnetron is 16.5 to 22.5mm.
11. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.42 to 0.6A.
12. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
13. The maximum input capacitance is 9pF.
14. Measured at the point indicated on the outline drawing.
15. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 1kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditons.



Marine Radar Magnetrons

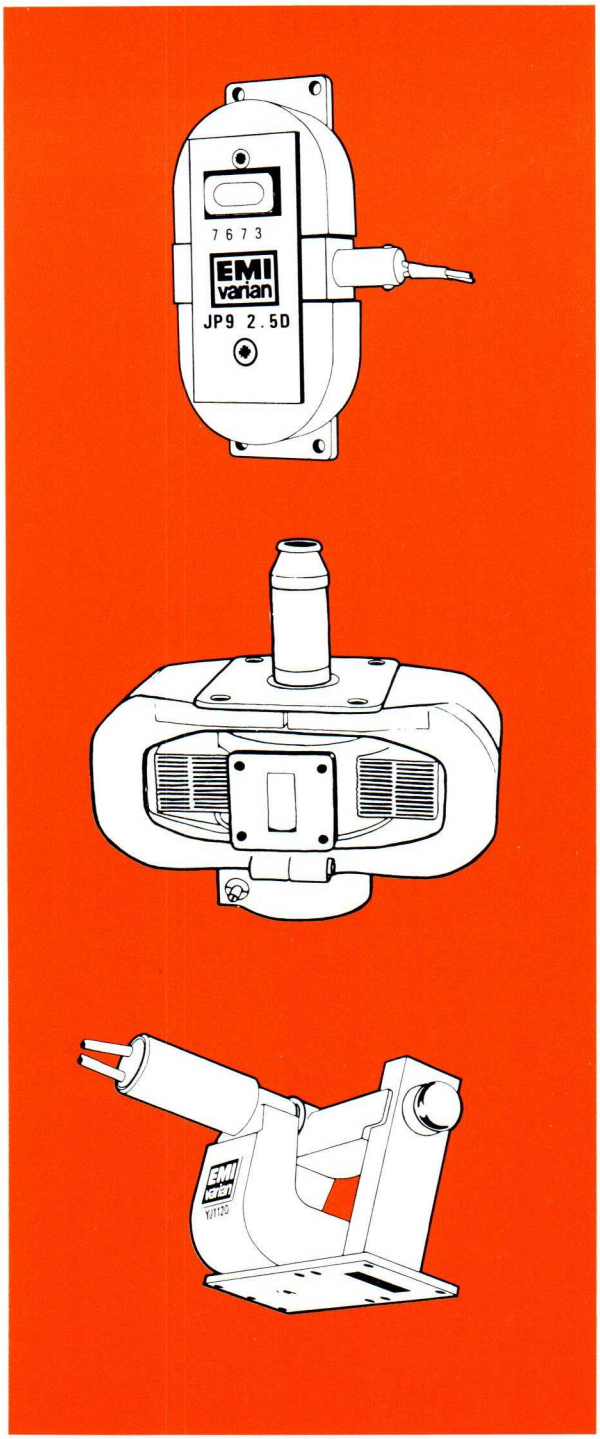
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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Magnetron

YJ1301

FOR MARINE RADAR APPLICATIONS

Quick Reference

X-band fixed frequency pulsed magnetron

Frequency (fixed within the band)	9.415 to 9.475 GHz
Output power (peak)	7.0 kW
Output	WG 10 waveguide
Coupler	UG-40B/U (5985-99-083-0051)
Construction	Packaged

Typical Operation

Operational conditions	Cond. 1	Cond. 2
Heater voltage	6.3	6.3 V
Anode current (peak)	5.0	5.0 A
Pulse duration	0.1	1.0 μs
Pulse repetition rate	2000	1000 pulse/s
Rate of rise of voltage pulse	6.0	6.0 kV/μs

Typical Performance

Anode voltage (peak)	4.25	4.25 kV
Output power (peak)	7.0	7.0 kW
Output power (mean)	1.4	7.0 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage	6.3 V
Heater current	0.55 A
Cathode heating time (minimum) (Note 1)	120 S

PHYSICAL

Mounting position	any
Weight of magnetron	1.25 kg
Weight of magnetron in storage carton	1.82 kg
Dimension of storage carton	190 x 190 x 288 mm

A minimum clearance of 50 mm must be maintained between the magnet and any magnetic materials.

Cooling	noted for forced air

Test Conditions and Limits

The magnetron is tested to comply with the following electrical specification.

Test conditions

Heater voltage (test)	6.3 V
Anode current (mean)	5.0 mA
Pulse duration (t_p) (note 2)	1.0 μs
Duty factor	0.001
v.s.w.r. at output coupler	1.05:1
Rate of rise of voltage pulse (note 3)	75 kV/us

Test limits	Min.	Max.
Anode voltage (peak)	4.0	4.5 kV
Output power (mean)	6.0	W
Frequency	9.415	9.475 GHz
r.f. bandwidth at ¼ power		$\frac{2.5 \text{ MHz}}{t_p}$
Frequency pulling (note 4)		18 MHz
Frequency pushing (notes 7 & 9)		2.5 MHz
Stability (note 6)		0.25%
Cold impedance (note 9)		
Heater current (note 10)		
Frequency temperature coefficient (notes 7 & 11)		
Input capacitance (notes 7 & 12)		

Maximum and Minimum Ratings

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

	Min.	Max.
Heater voltage (note 13)	5.7	6.9 V
Heater starting current (peak)		5.0 A
Anode voltage (peak)	4.0	4.5 kV
Anode current (peak)	4.0	6.0 A
Input power (peak)		27.0 kW
Input power (mean)		27.0 W
Duty factor		0.001
Pulse duration (note 2)		1.0 μs
Rate of rise of voltage pulse (note 3)		75 kV/μs
Anode temperature		120°C
v.s.w.r. at output connection		1.5:1

End of Life Performance

(Under test conditions)

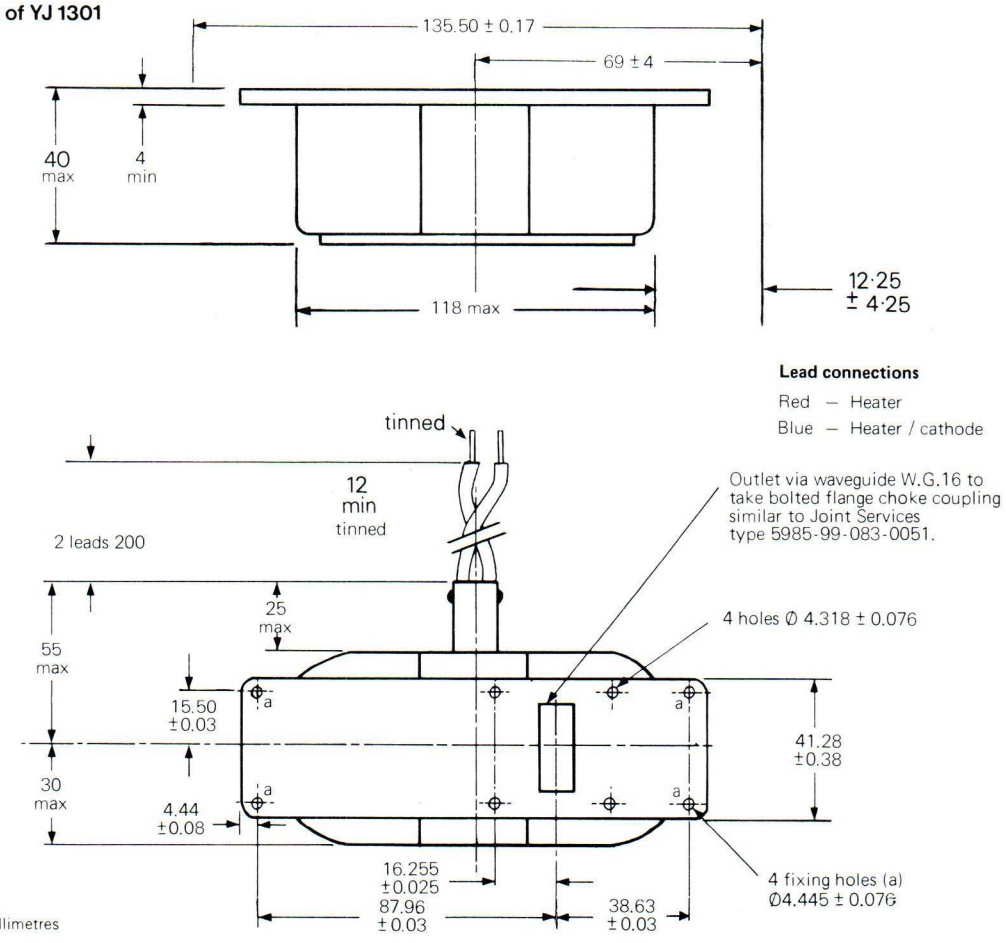
The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test condition 2.

	Min.	Max.
Anode voltage (peak)	4.0	4.5 kV
Output power (peak)	5.0 W	
r.f. bandwidth at ¼ power		3.0/tp MHz
Frequency	9.415	9.475 GHz
Stability (note 6)		2.0%

Notes

1. For ambient temperatures above 0°C. For ambient temperature between 0°C and −55°C the heating time is 180 seconds.
2. The tolerance on the pulse current duration at the 50% amplitude points is ± 10%.
3. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 4.4 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
4. A peak anode current of 5A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
5. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 4 to 6A peak.
6. Measured with the conditions described in Note 5. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
7. Design test only.
8. Measured over the anode current range 4 to 6A peak.
9. The cold impedance of the magnetron is measured at the operating frequency and will be such as to give a v.s.w.r. of at least 6:1. The position of voltage minimum from the face of the output flange into the magnetron is 3 to 9mm.
10. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.5 to 0.6A.
11. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
12. The maximum input capacitance is 9pF.
13. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 1kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditons.

Outline Drawing of YJ 1301



Marine Radar Magnetrons

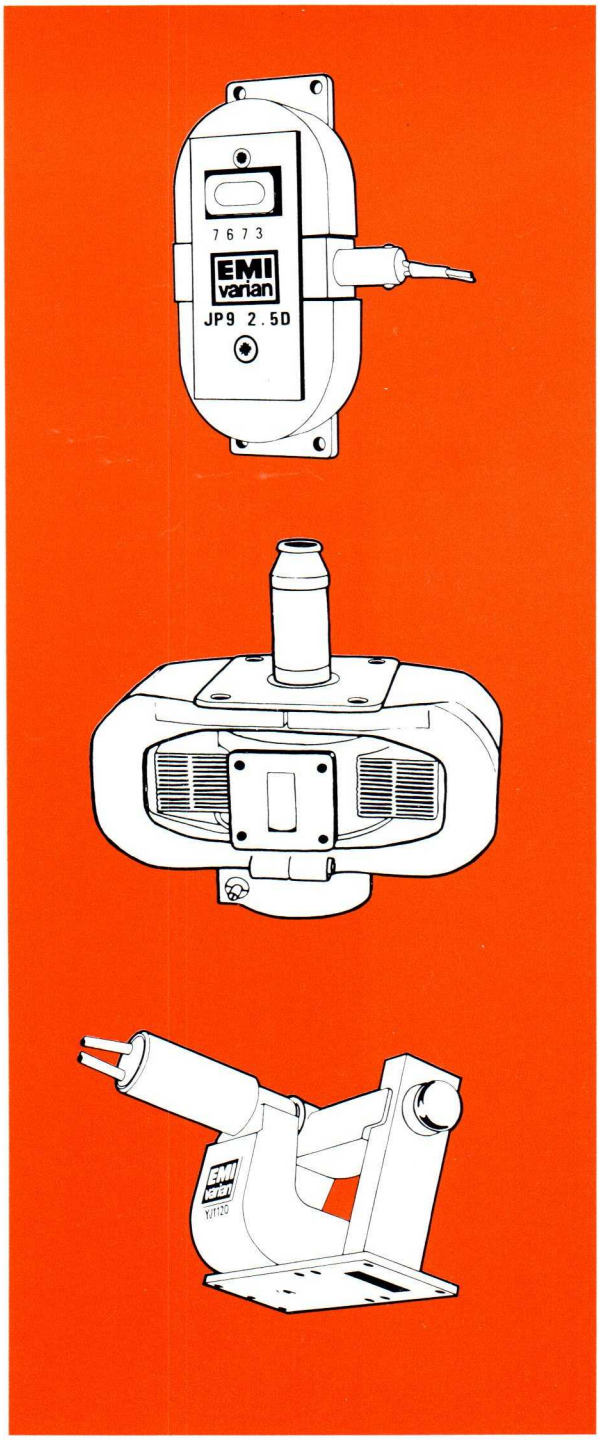
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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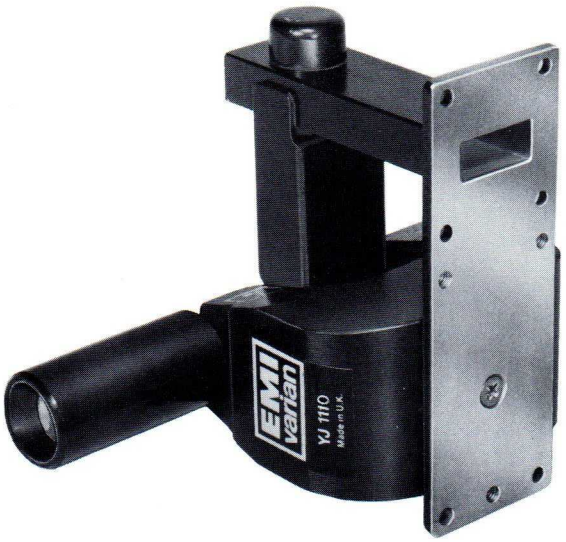
Magnetron

X-band fixed frequency YJ1110

FOR MARINE RADAR APPLICATIONS



Quick Reference

X-band fixed frequency pulsed magnetron

Frequency (fixed within the band)	9.345 to 9.405 GHz
Output power (peak)	20 kW
Output	WG 16 waveguide
Coupler	UG-40B/U (5985-99-083-0051)
Construction	Packaged

To be read in conjunction with General operating recommendations – Magnetrons.

Typical Operation

Operating conditions	Cond. 1	Cond. 2	
Heater voltage	6.3	6.3	V
Anode current (peak)	7.5	7.5	A
Pulse duration	0.05	0.5	us
Pulse repetition rate	1000	1000	pulse/s
Rate of rise of voltage pulse	120	120	kV/μs

Typical Performance

Anode voltage (peak)	7.8	7.8	kV
Output power (peak)	20	20	kW
Output power (mean)	1.0	10	W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage (note 1)	6.3 V
Heater current	0.5 A
Cathode heating the time (minimum) (note 2)	120 S

PHYSICAL

Mounting position	any
Weight of magnetron	1.5 kg
Weight of magnetron in storage carton	2.9 kg
Dimension of storage carton	199 x 203 x 249 mm

A minimum clearance of 50 mm must be maintained between the magnet and any magnetic materials.

Cooling	natural or forced air

Magnetron YJ1110 Specification

Test Conditions and Limits

The magnetron is tested to comply with the following electrical specification.

Test conditions

Heater voltage (test)	4.5 V
Anode current (mean)	7.0 mA
Pulse duration (t_p) (note 3)	1.0 μs
Duty factor	0.001
v.s.w.r. at output coupler	1.05:1
Rate of rise of voltage pulse (note 4)	125 kV/μs

Test limits	Min.	Max.
Anode voltage (peak)	7.0	8.2 kV
Output power (mean)	16	W
Frequency	9.345	9.405 GHz
r.f. bandwidth at ¼ power		$\frac{2.5 \text{ MHz}}{t_p}$
Frequency pulling (note 5)		18 MHz
Frequency pushing (notes 8 & 9)		1.5 MHz/A
Stability (note 7)		0.1%
Cold impedance (note 10)		
Heater current (note 11)		
Frequency temperature coefficient (notes 8 & 12)		
Input capacitance (notes 8 & 13)		

Maximum & Minimum Ratings

(Under test conditions)

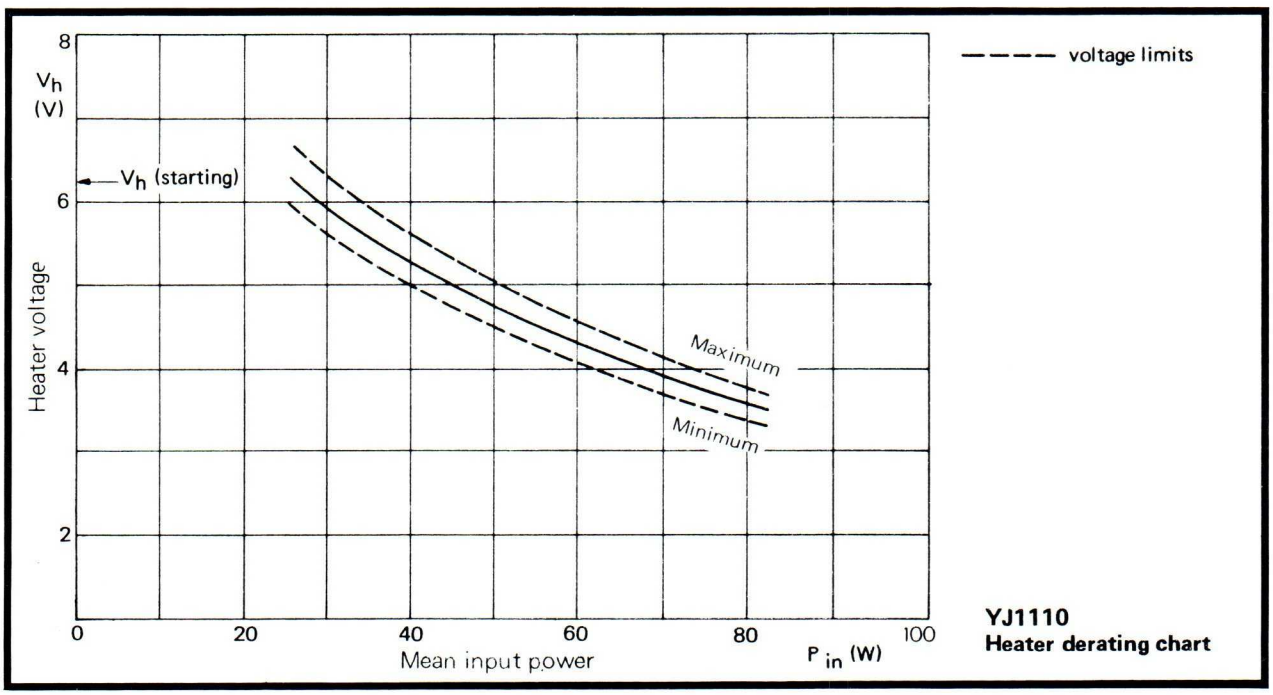
The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test conditions.

	Min.	Max.
Anode voltage (peak)	7.0	8.4 kV
Output power (peak)		14.0 W
r.f. bandwidth at ¼ power		$\frac{3.0 \text{ MHz}}{t_p}$
Frequency	9.345	9.405 GHz
Stability (note 7)		1.0%

End of Life Performance

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

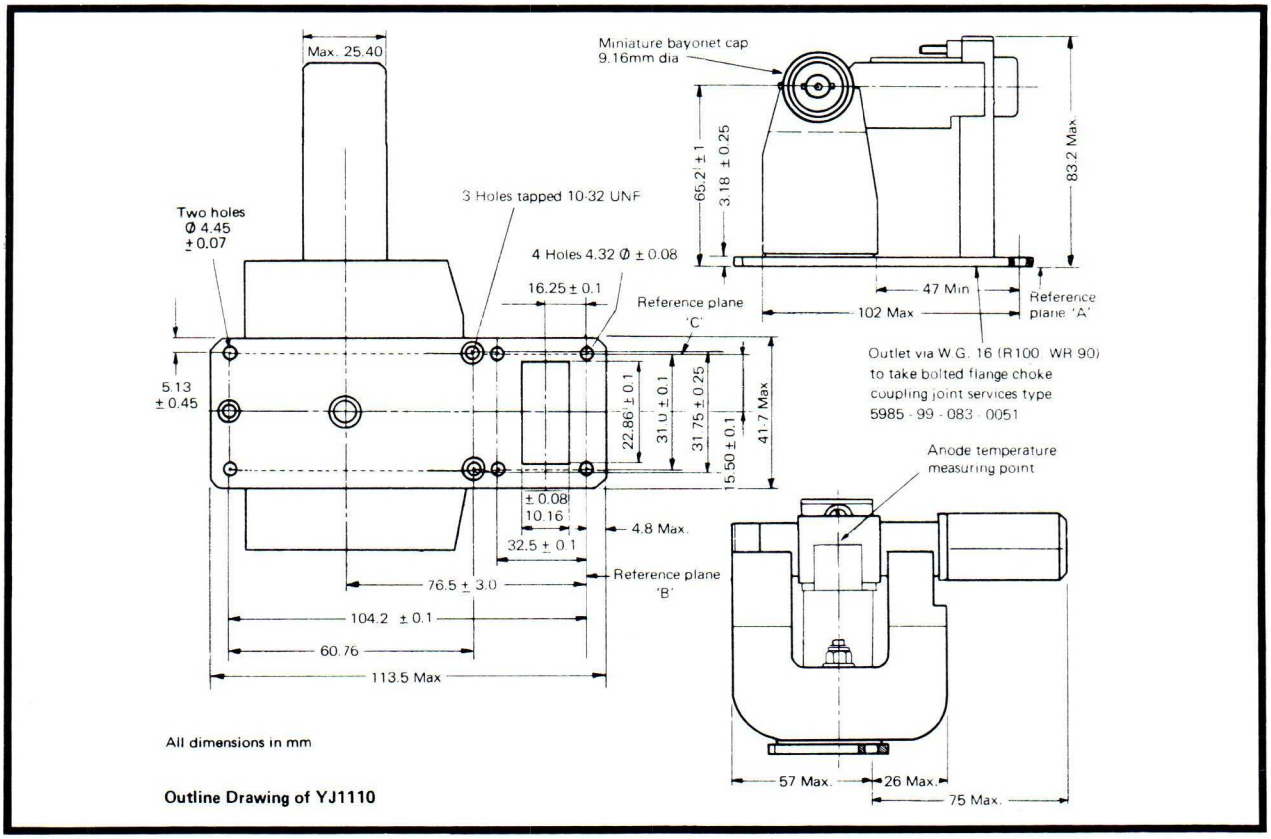
	Min.	Max.
Heater voltage (notes 1 & 5)	5.7	6.9 V
Heater starting current (peak)		5.0 A
Anode voltage (peak)	7.0	8.2 kV
Anode current (peak)	6.0	9.0 A
Input power (peak)		60 kW
Input power (mean)		85 W
Duty factor		0.0015
Pulse duration (note 3)		2.5 μs
Rate of rise of voltage pulse (note 4)		120 kV/μs
Anode temperature (note 14)		120°C
v.s.w.r. at output connection		1.5:1



YJ1110
Heater derating chart

Notes

1. With no anode power. For average pulse input powers greater than 25 watts the heater voltage MUST be reduced immediately after the application of anode power. The recommended heater derating chart is shown opposite.
2. For ambient temperatures above 0°C. For ambient temperature between 0°C and −55°C the heating time is 180 seconds.
3. The tolerance on the pulse current duration at the 50% amplitude point is ± 10%.
4. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 7.8 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
5. A peak anode current of 7A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
6. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 6 to 9A peak.
7. Measured with the conditions described in Note 6. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
8. Design test only.
9. Measured over the anode current range 6 to 9A peak.
10. The cold impedance of the magnetron is measured at the operating frequency and will be such as to give a v.s.w.r. of at least 6:1. The position of voltage minimum from the face of the output flange into the magnetron is 16.5 to 22.5mm.
11. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.43 to 0.6A.
12. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
13. The maximum input capacitance is 8pF.
14. Measured at the point indicated on the outline drawing.
15. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 1kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditons.



Marine Radar Magnetrons

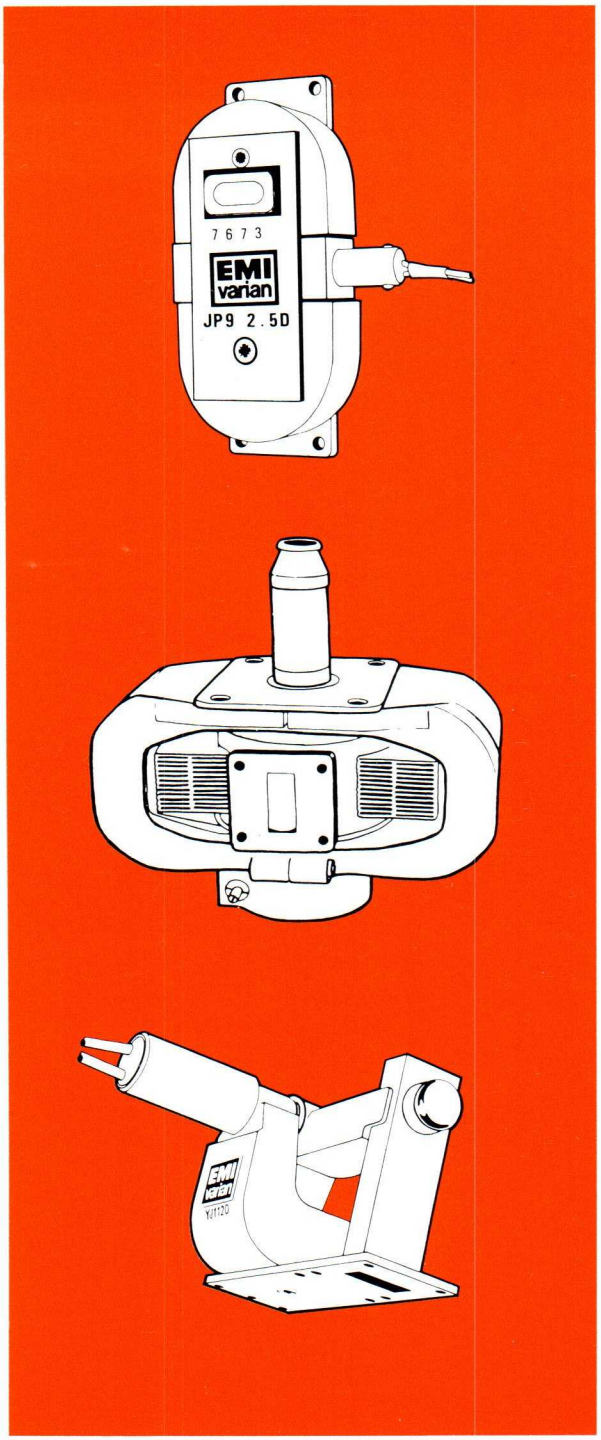
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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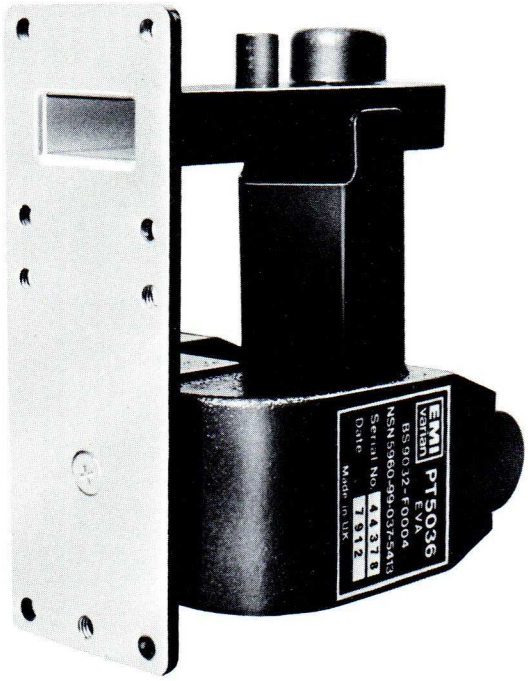
Magnetron
Fixed Frequency
PT5036

APPROVED TO BS 9031-F0008 & BS 9032-F0004
SERVICE TYPE CV6199 5960-99-037-5413

FOR AIRBORNE RADAR APPLICATIONS



Quick Reference

X-band fixed frequency pulsed magnetron

Frequency (fixed within the band)	9.210 to 9.270 GHz
Power output (peak)	22 kW
Output coupler	WG 16 waveguide UG-40B/U (5985-99-083-0051)
Construction	Packaged

Typical Operation

Operational Conditions

Heater voltage	6.3 V
Anode current (peak)	7.5 A
Pulse duration	0.5 μs
Pulse repetition rate	800 p.p.s.
Rate of rise of voltage pulse	75 kV/μs

Typical Performance

Anode voltage (peak)	7.5 kV
Power output (peak)	22 kW
Power output (mean)	8.8 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage	6.3 V
Heater current	0.5 A
Cathode heating time (minimum) (see note 1)	120 Sec

PHYSICAL

Mounting position	any
Weight of magnetron	1.3 kg
Weight of magnetron in storage carton	2.4 kg
Dimension of storage carton	205 x 195 x 240 mm

A minimum clearance of 50mm must be maintained between the magnet and any magnet materials.

Cooling	forced air

Test Conditions and Limits

Test conditions

Heater voltage (test)	6.3 V
Anode current (mean)	3.75 mA
Pulse duration t_p (note 2)	0.5 us
Duty factor	0.0005
v.s.w.r. at output coupler	1.05:1
Rate of rise of voltage pulse (see note 3)	105 kV/μs

Test limits	min.	max.
Anode voltage (peak)	7.0	7.7 kV
Power output (mean)	9.0	W
Frequency	9.210	9.270 GHz
r.f. bandwidth at ¼ power		$\frac{2.5}{t_p}$ MHz
Frequency pulling (see note 4)		25.0 MHz
Frequency pushing (see notes 7 & 8)		1.5 MHz/A
Stability (see note 5)		0.5 %
Heater current (see note 9)		
Frequency temperature coefficient (see notes 7 & 10)		
Input capacitance (see notes 7 & 11)		

Operating Altitude

The magnetron is constructed with a vacuum tight window sealed to the output waveguide to permit operation up to 20,000 ft provided a choke coupling type UG-40B/U (5985-99-083-0051) is used.

Under no circumstances should the output window be pressurised. During storage the window should be protected by the cover supplied.

Maximum and Minimum Ratings

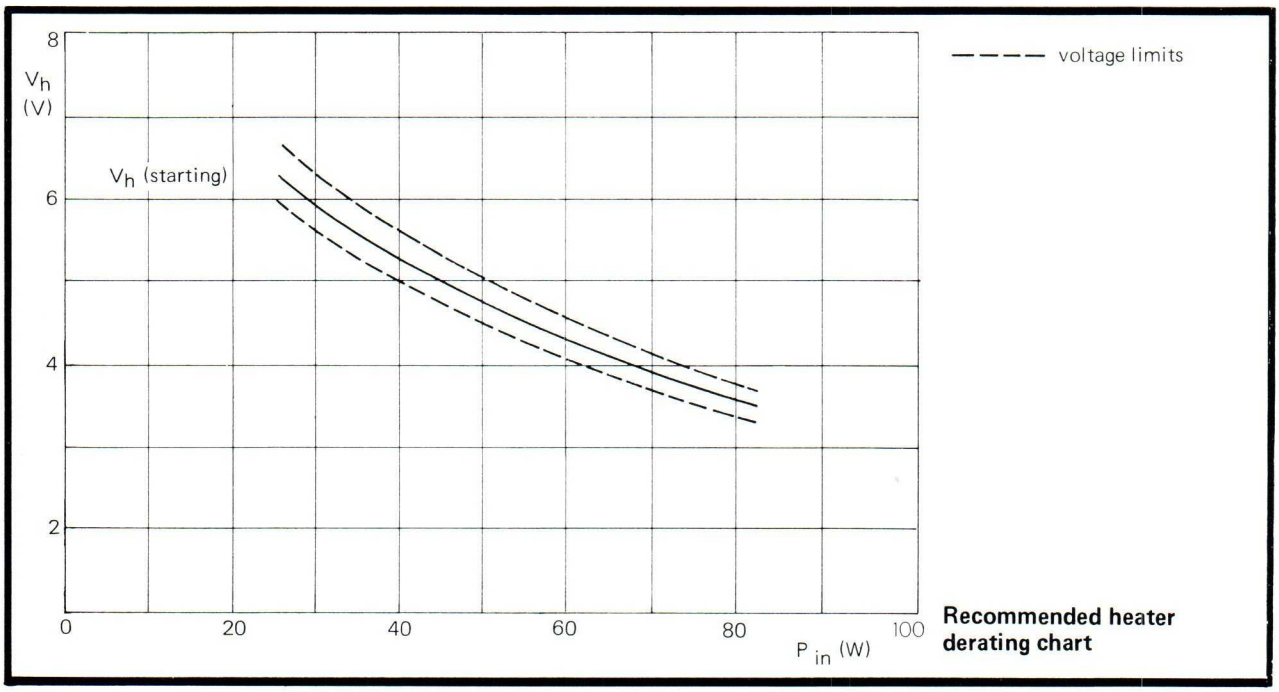
These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.
Heater voltage (see note 13)	5.7	6.9 V
Heater starting current (peak)		5.0 A
Anode voltage (peak)	7.0	7.7 kV
Anode current (peak)	6.0	9.0 A
Power input (peak)		71 kW
Power input (mean)		71 W
Duty factor		0.0015
Pulse duration (see note 2)		1.0 us
Rate of rise of voltage pulse (see note 3)		100 kV/us
Anode temperature (see note 12)		120 °C
v.s.w.r. at output connection		1.5:1
Altitude	See note on operating altitude below	

End of Life Performance

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test conditions above.

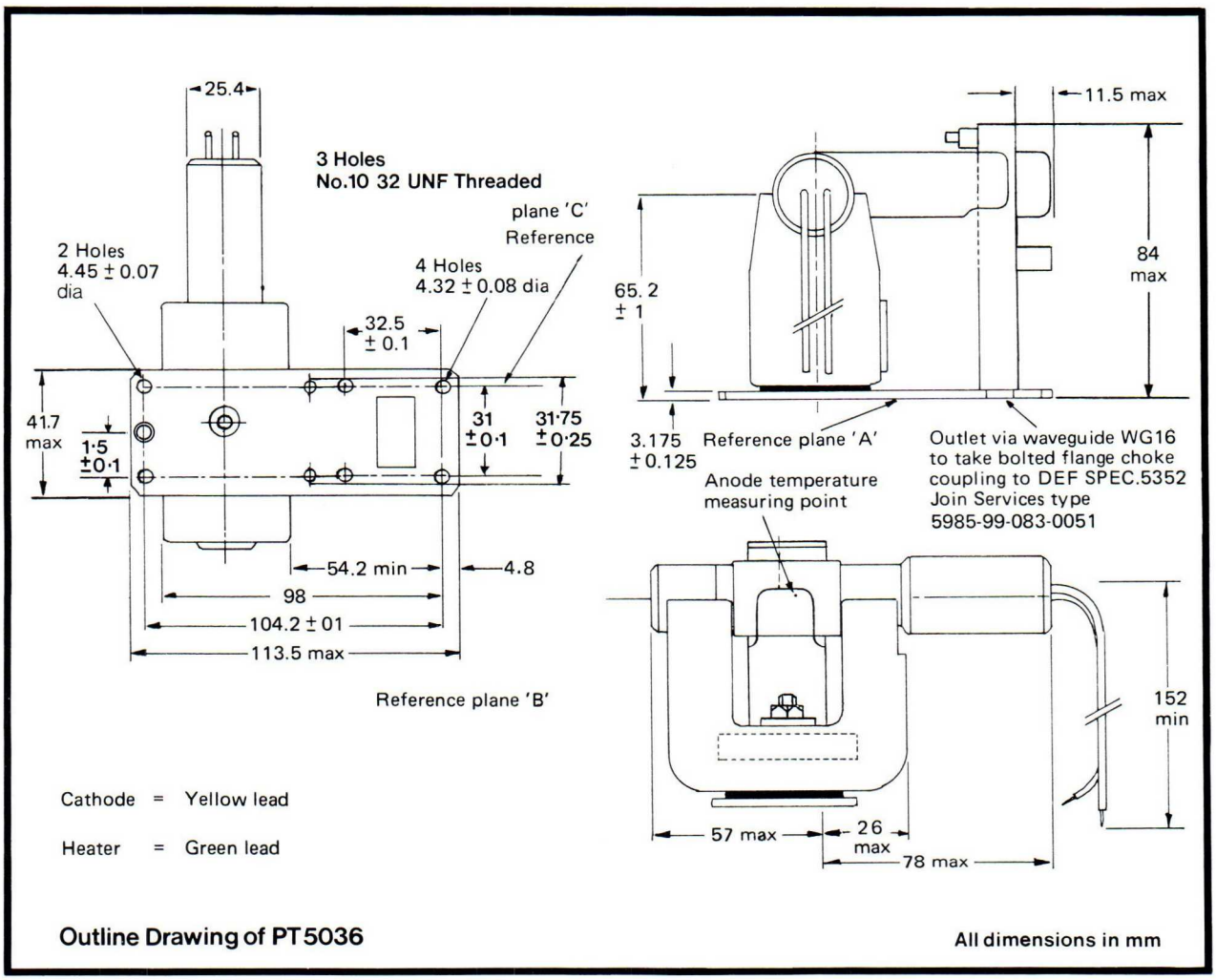
Anode voltage (peak)	7.0	7.7 kV
Power output (peak)	14.0	kW
r.f. bandwidth at ¼ power		$\frac{3.0}{t_p}$ MHz
Stability (note 6)		1.0 %
Frequency	9.210	9.270 GHz



Recommended heater derating chart

Notes

1. For ambient temperatures between 0°C and −40°C.
2. The tolerance on pulse current duration at the 50% amplitude points is ± 10%.
3. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. For calculating the rate of rise of anode voltage the 100% valve must be taken as 7.6kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
4. A peak anode current of 7.5 A is set under matched conditions. A mismatch with a v.s.w.r. of 1.5:1 is then introduced and varied through all phases.
5. Measured with the magnetron operating into a v.s.w.r. of 1.5:1 varied through all phases over the anode current range of 6.0 to 9.0 A peak.
6. Measured with the conditions described in Note 5. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes has elapsed.
7. Design test only.
8. Measured over the anode current range 6.0 to 9.0 A peak.
9. Measured with a heater voltage of 6.3 volts and no anode input power, the heater current limits are 0.43 to 0.6 A.
10. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25 MHz/°C.
11. The maximum input capacitance is 9 pF.
12. Measured at the point indicated on the outline drawing.
13. The magnetron is normally tested with a sine-wave heater supply of 50 Hz and is suitable for operation from 50 Hz to 1 kHz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or waveform conditions.



Outline Drawing of PT5036

All dimensions in mm

Marine Radar Magnetrons

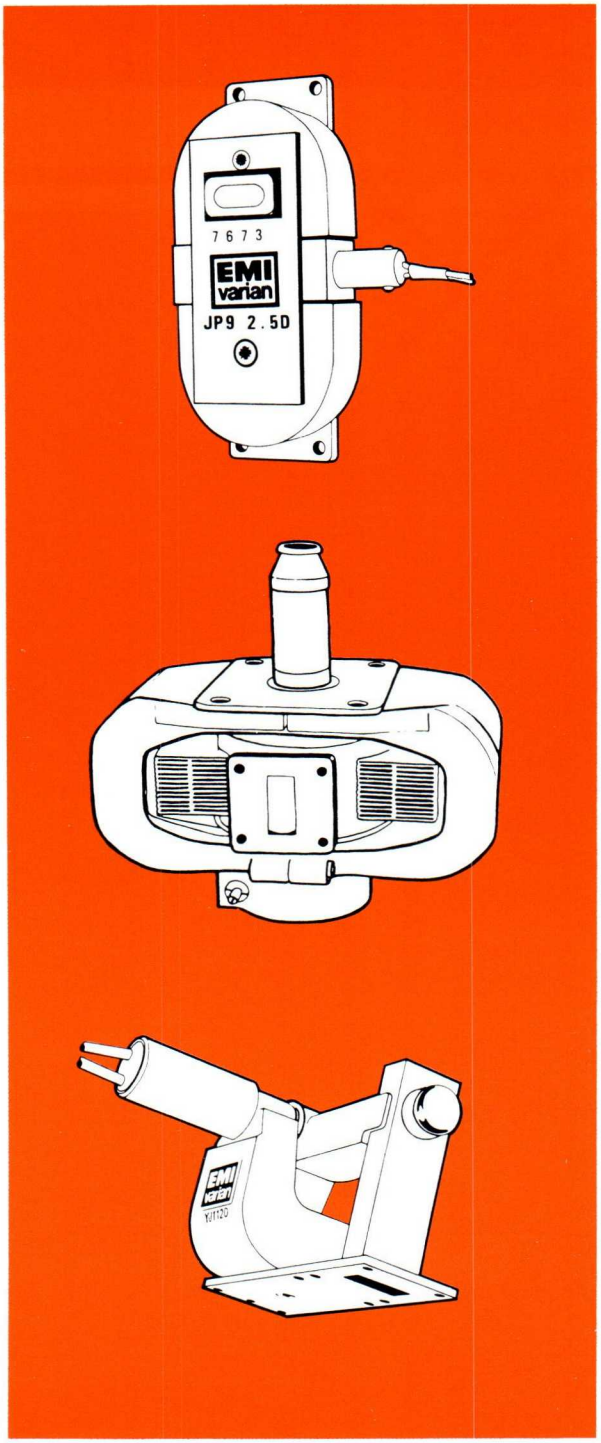
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency	Output power	Duty Cycle	Pulse length	Type Number
(GHz)	(kW)		(uS)	
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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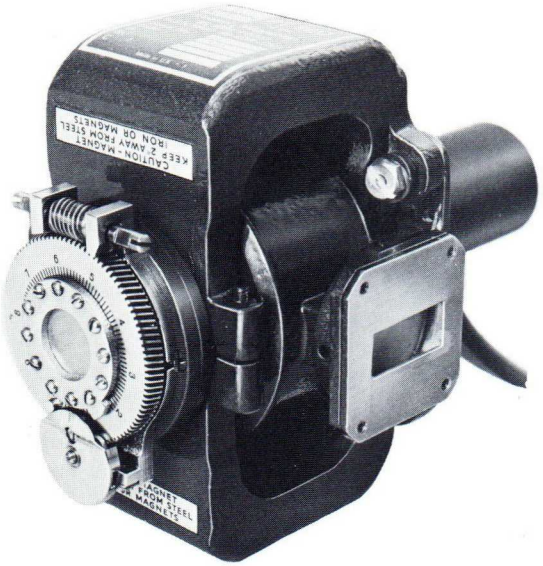
Magnetron

Tunable - Coaxial Construction

PT5017

APPROVED TO BS 9031-FOOO6
and BS 9032-FOOO3
SERVICE TYPE 5960-99-038-2201

FOR AIRBORNE RADAR APPLICATIONS



Quick Reference

X-band tunable frequency magnetron

Frequency tunable over the band	9.100 to 9.500 GHz
Output power (peak)	100 kW
Output	WG 15 waveguide
Coupler	Modified UG-52B/U
Construction	Packaged

Typical Operation

Operation conditions	Cond. 1	Cond. 2	
Heater voltage	11.8	7.5	V
Anode current (mean)	2.6	16	mA
Pulse duration	0.4	2.5	µs
Pulse repetition rate	400	400	pulse/s
Rate of rise of voltage pulse	110	110	kV/µsec

Typical Performance

Anode voltage (peak)	15	15 Kv
Output power (peak)	100	100 kW
Output power (mean)	16	100 W

General Data

ELECTRICAL

Cathode	indirectly heated
Heater voltage (note 1)	12.6 V
Heater current	2.2 A
Cathode heating time (minimum) (note 2)	120 S

PHYSICAL

Mounting position	any
Weight of magnetron	4 kg
Weight of magnetron in storage carton	6kg
Dimension of storage carton	350x350x350mm

A minimum clearance of 50 mm must be maintained between the magnet and any magnetic materials.

Cooling	natural or forced air

Magnetron PT5017 Specification

Test Conditions and Limits

Test conditions	Cond. 1	Cond. 2	
Heater voltage (test)	7.6	11.8	V
Anode current (mean)	16.0	2.6	mA
Pulse duration (t_p) (note 3)	2.5	0.4	μs
Duty factor	0.001	0.00016	
v.s.w.r. at output coupler	1.05:1	1.05:1	
Rate of rise of voltage pulse (note 4)	115	115	kV/μs

Test limits	Cond. 1		Cond. 2		
	Min.	Max.	Min.	Max.	
Anode voltage (peak)	14.0	16.0	14.0	16.0	kV
Output power (mean)	80		13		W
Frequency range	9.100	9.500	9.500	9.500	GHz
r.f. bandwidth at ¼ power	$\frac{2.5}{t_p}$		$\frac{2.5}{t_p}$		
Frequency pulling (note 5)		5		5	MHz
Frequency pushing (notes 6 & 8)		100		100	kHz/A
Stability (note 7)		0.1		0.1%	
Heater current (note 9)					
Frequency temperature coefficient (notes 8 & 10)					
Side lobes	10		10		dB
Tuner turns	40	60	40	60	

Maximum & Minimum Ratings

These ratings are absolute values and cannot necessarily be used simultaneously. No individual rating should be exceeded.

	Min.	Max.	
Heater voltage (notes 1 & 12)		13	V
Heater starting current (peak)		10	A
Anode voltage (peak)	14	16	kV
Anode current (peak)	5	18	A
Input power (peak)		280	kW
Input power (mean)		280	W
Duty factor		0.0012	
Pulse duration (note 3)	0.15	2.7	μs
Rate of rise of voltage pulse (note 4)	40	180	kV/μs
Anode temperature (note 11)		150	°C
v.s.w.r. at output connection		1.5:1	
Tuner Shaft rotation rate		800	RPM
Dynamic torque		0.85	Nm
Backlash		3	MHz

End of Life Performance

(Under test conditions)

The quality of all production is monitored by the random selection of magnetrons which are then life tested under the stated test conditions. If the magnetron is to be operated under different conditions from those specified above, EMI-Varian Limited should be consulted to verify that the life will not be affected. The magnetron is considered to have reached the end of its life when it fails to meet the following limits when operated as specified in test condition 2.

	Min.	Max.	
Anode voltage (peak)	14	16	kV
Output power (peak)	60		W
r.f. bandwidth at ¼ power		$\frac{3.0}{t_p}$	MHz
Stability (note 7)		0.5%	

Notes

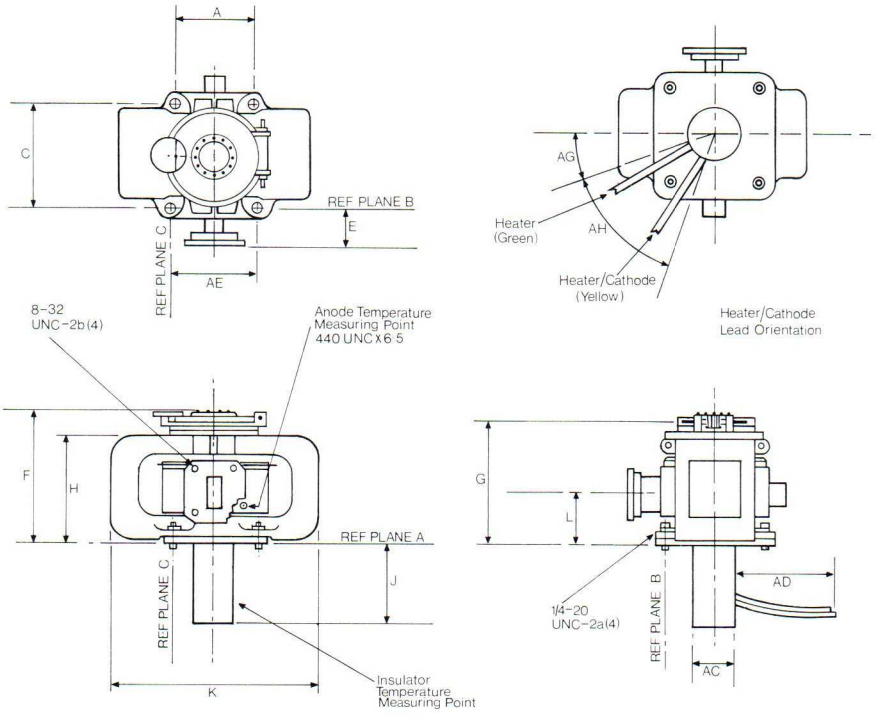
1. With no anode power. When tube is operating the heater voltage must be reduced to the appropriate value determined by the formula.

   $V_h = 12.6 - 0.021\ P_{in} \pm 10\%$

   Where P_{in} = mean anode current (mA) x peak anode voltage (kV)

   V_h = Heater voltage

2. For ambient temperatures between 0°C and −40°C the heating time is 180 seconds.
3. The tolerance on the pulse current duration at the 50% amplitude point is ± 10%.
4. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude measured with an anode voltage of 15 kV. The capacitance of any system used to measure this parameter must not exceed 6.0 pF.
5. A peak anode current of 16A is set under matched conditions. A mismatch with a v.s.w.r. of 1:5:1 is then introduced and varied through all phases.
6. Measured with the magnetron operating into a v.s.w.r. of 1:5:1 varied through all phases over the anode current range of 15 to 17A peak.
7. Measured with the conditions described in Note 6. Pulses are defined as missing when the r.f. energy level is less than 70% of the normal level in a 0.5% frequency band. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of ten minutes has elapsed.
8. Design test only.
9. Measured with a heater voltage of 12.5 volts and no anode input power, the heater current limits are 2.0 to 2.4A.
10. The maximum frequency change with anode temperature change after thermal equilibrium is reached between the magnetron and ambient temperature is −0.25MHz/°C.
11. Measured at the point indicated on the outline drawing.
12. The magnetron is normally tested with a sinewave heater supply of 50Hz and is suitable for operation from 50Hz to 400 Hz sine or square-wave supply. EMI-Varian Limited should be consulted if the magnetron is to be operated with a heater supply having different frequency or wave-form conditons.



PT5017 Dimensions

Letters	Dimensions +−	Letters	Dimensions +−
A	64·29 ± ·38	AG	20 ± ·5
E	25·78 ± ·64	AH	50 max
G	92 ± 3	C	70·64 ± 0·38
K	157 max	F	104 max
L	35·7 ± ·5	H	77 max
AD	305 min	J	90 max
AE	63·8 ± ·5	AC	40·6 max

Marine Radar Magnetrons

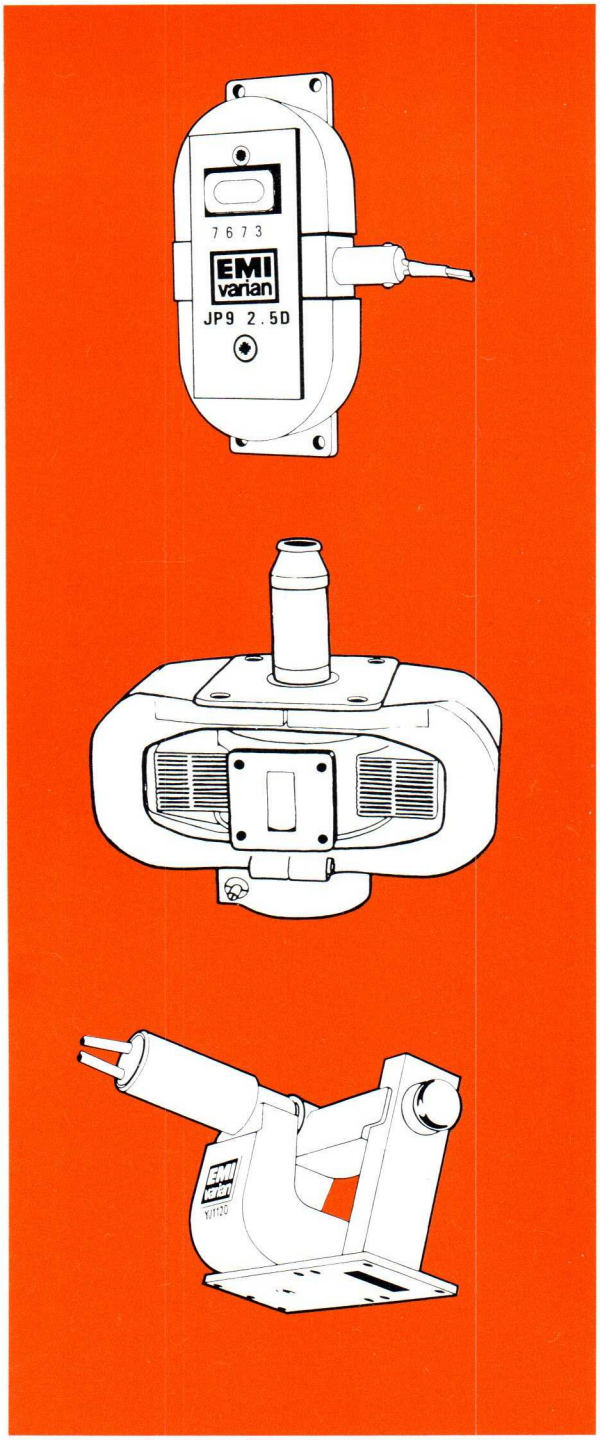
EMI-Varian manufactures magnetrons designed for commercial and small boat radars. These long-established designs of proven reliability have a fixed operating frequency.

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.375 ± 0.03	10	0.0025	2.5	2J42
9.375 ± 0.03	20	0.001	1.5	YJ1110
9.41 ± 0.065	3	0.0005	0.5	JP9-2.5
9.41 ± 0.03	21	0.001	2.5	JP9-18
9.41 ± 0.03	25	0.001	1.0	YJ1120
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5D
9.445 ± 0.03	3	0.0005	0.5	JP9-2.5E
9.445 ± 0.03	26	0.001	1.0	YJ1121

Airborne Radar Magnetrons

Frequency (GHz)	Output power (kW)	Duty Cycle	Pulse length (uS)	Type Number
9.24 ± 0.03	22	0.001	1.0	PT5036
9.375 ± 0.03	20	0.0015	1.5	YJ1112
TUNABLE COAXIAL MAGNETRONS				
9.1 – 9.5	100	0.001	2.5	PT5017
8.5 – 9.6	200	0.001	1.5	PT5016
16.6 – 16.8	40	0.001	2.0	PT5060
SPIN TUNED MAGNETRON				
8.7 – 9.7+	100	0.001	1.0	PT5024

+ SPIN TUNED OVER ANY 200 MHz band



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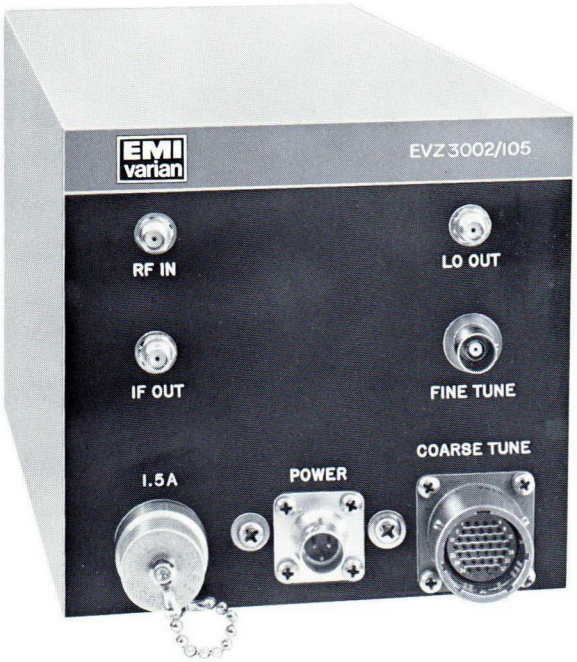
Microwave Tuners

EVZ-3002/105 Series

Features

* Small, lightweight
* Low Power Consumption
* Digital tuning control, 1 MHz resolution
* 20 MHz IF Bandwidth at 160 MHz
* High accuracy filter/oscillator tracking
* Analogue fine tuning capability
* Noise Figures 16 to 21 dB
* Local oscillator sample terminal
* Options: Phase lock facility
  Log video output



The EMI-Varian EVZ-3002/105 Series microwave tuners are digitally tuned superhet receiver front-ends covering the 0.5 to 18 GHz frequency range. Each tuner type uses a 4-stage YIG-tuned pre-selector filter and YIG-tuned local oscillator built within a common magnetic circuit with a single tuning coil. The integrated YIG filter/oscillator provides excellent frequency tracking at both high scanning rates and wide variations in operating temperature, thereby preserving the full IF bandwidth of 20 MHz under all conditions.

An analogue fine tuning control provides adjustments of plus/minus 12 to 80 MHz, dependent upon nominal frequency, for correction of long term frequency drift.

Frequency Options

Frequency Band	Tuner Type Number
0.5 – 1 GHz	EVZP-3002/105
1 – 2 GHz	EVZL-3002/105
2 – 4 GHz	EVZS-3002/105
4 – 8 GHz	EVZC-3002/105
8 – 12 GHz	EVZX-3002/105
12 – 18 GHz	EVZU-3002/105

Physical Characteristics

Weight	12 lbs nom.
Connectors:	
RF Input	SMA Female
LO Monitor Output	SMA Female
IF Output	SMA Female
Fine Tune	Triaxial to DEFSTAN 532 Pattern 22
Coarse Tune	Amphenol M81511/ 21EDO1P1
Tuning Mode, Sweep/ Manual (note 6)	50 ohm BNC Female
Phase-lock Control	50 ohm BNC Female
Power Input	Deutsch DM9606-3P

EVZ-3002/105 Tuner Specifications

Frequency Range	0.5–1	1–2	2–4	4–8	8–12	12–18	GHz
Noise figure	16	16	16	18	18	21	dB max.
	13	13	13	14	14	18	dB typ.
Bandwidth (note 1)	15	20	20	20	20	20	MHz min.
Incidental FM, RMS (note 2)	5	10	10	10	15	20	kHz max.
Input Powers (115V AC, 48–420 Hz)	30	30	35	45	55	70	Watts max.
RF selectivity	24 dB/octave, nom.						
Image rejection	70 dB min.						

Performance Characteristics

Local Oscillator Characteristics:

Output level at monitor terminal	–10 dBm min.
Output level variation over full frequency band	6 dB max.
Spurious and harmonics	–15 dB max.
Output at RF input terminal	–80 dBm max.
Output at IF output terminal	–60 dBm max.
Frequency accuracy (note 3)	±0.2% max.
Frequency stability (note 2)	1 part in 10^4/hr nom.
Tuning resolution	1 MHz nom.
IF rejection	80 dB min.
RF to IF gain	20 – 25 dB
RF to IF gain variation over frequency band	3 dB max.
RF to IF gain ripple in IF bandwidth	1.5 dB max.
Single signal spurious-free dynamic range (note 4)	60 dB min.
Frequency step response time (to 98% of step change)	10 millisecs max.
Analogue fine tuning range	±(10 MHz + 0.4% of LO frequency)
1 dB gain compression point (RF input level, no preamp fitted)	–10 dBm min.
Tuning control (note 5)	Digital
RF input VSWR	1.5:1 max.
IF output VSWR	2.0:1 max.
Fine tuning terminal impedance	10 kilohms min.

Environmental Characteristics

Temperature, operating	0°C to +55°C
Temperature, storage	–62°C to +85°C
Humidity	95% at 50°C
Vibration	MIL-E-5400M (Curve 1)
Shock	MIL-E-5400M (15G x 11 millisecs 18 times)

Operating temperature range may be extended to –50°C to +55°C if a heater is incorporated in the baseplate upon which the YIG-tuned filter/oscillator is mounted. Additional power consumption is 100 watts maximum.

Optional Features Available

S : Local Oscillator phase-lock stabiliser
V : Log Video output
P : External RF pre-amplifier

L.O. Phase-Lock (Option 'S')

A front panel terminal provides access to a circuit for effecting frequency modulation of the local oscillator when a correcting signal is injected from a phase-lock stabiliser.

Log Video Output (Option 'V')

The 160 MHz IF signal is fed to an internal power divider from one arm of which the normal 160 MHz linear IF output is taken. The second arm of the divider feeds a logarithmic IF amplifier to provide a 50 nanosec. risetime DC coupled video output of 0.2 to 2.0V into 93 ohms. The logarithmic IF amplifier used has an input dynamic range of 60 dB referenced to a nominal 0 dBm at the high end. Linearity of ±1 dB is achieved over this range.

An additional IF output can be supplied on request to provide a power limited signal at 0 dBm nominal to drive an external discriminator for detection of FM signals.

External Pre-Amplifier (Option 'P')

The 4-pole pre-selector YIG filter normally used is replaced by a twin-channel 2-pole filter with front panel access to input and output of the pre-selector and to the input of the post-selector. When an RF pre-amplifier is not being used a rigid jumper cable is connected between the output of the pre-selector and the input to the post-selector. The RF pre-amplifier will reduce tuner noise figure about 10 dB at the possible expense of a reduction in dynamic range.

Notes

1 Bandwidth figures indicate overall RF to IF bandwidth centred at 160 MHz and measured at –3 dB points at any sweep rate up to 30 Hz.

2 Figures quoted are without the use of a local oscillator phase-lock stabiliser, but with the capacitor switched across the main tuning coil – see note 6.

3 Peak deviation from straight line relationship of oscillator frequency to control voltage referred to digital input word.

4 Measured from 8 dB above noise level for a 1 MHz effective bandwidth.

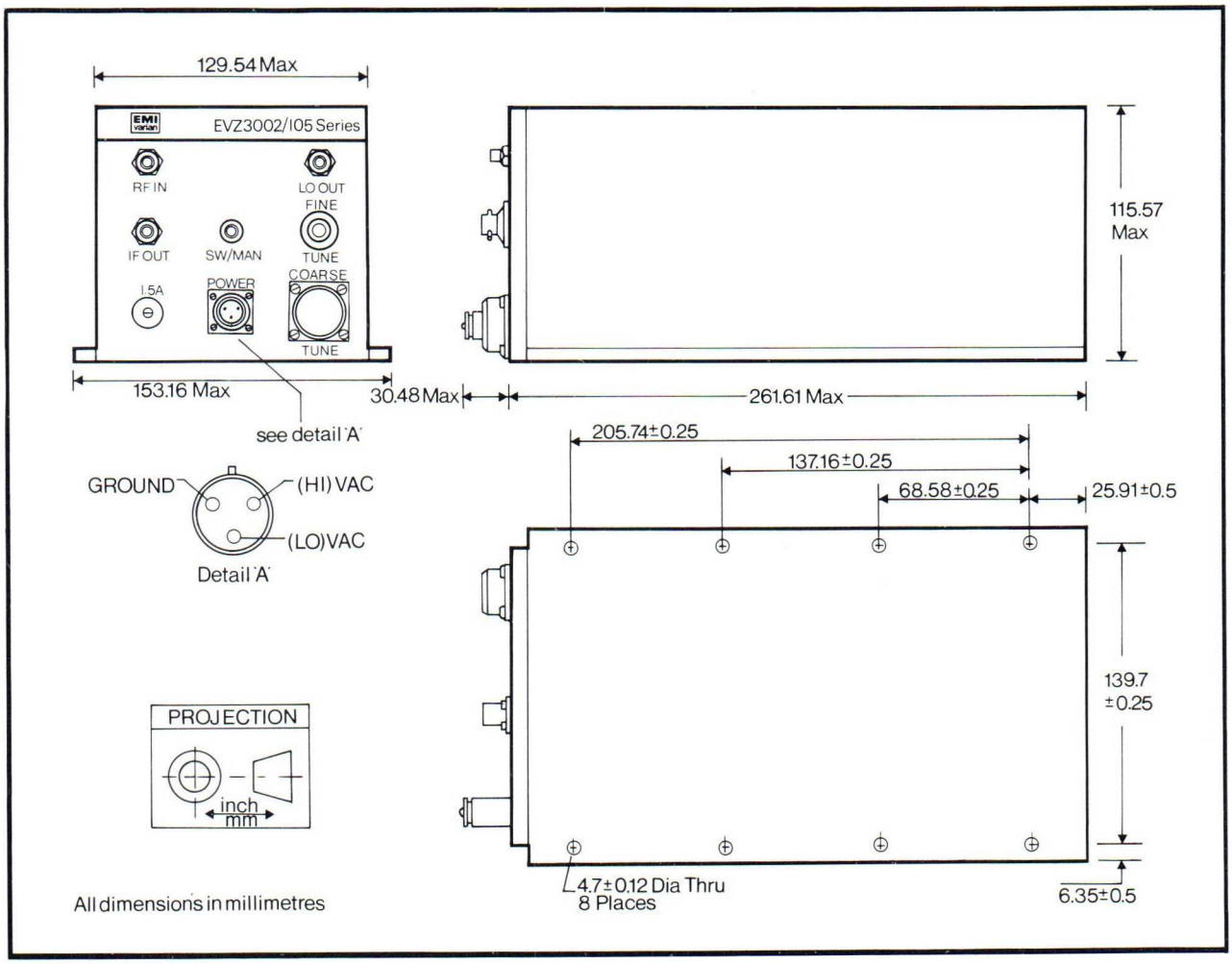
5 Digital binary code with parallel frequency word, via 13 TTL compatible twisted pair lines, plus 1 twisted pair as strobe.

6 In the Manual Tuning mode provision is made for switching in a capacitor which reduces incidental frequency modulation from the local oscillator. A front panel connector is provided for injection of an externally generated +5 VDC signal which serves to switch in this capacitor.

7 When ordering, specify as follows:-

EVZ( )-3002/105 Option X

e.g. EVZS-3002/105 SV specifies an S-band tuner with facilities for phase-locking the local oscillator and with a log video output in addition to the 160 MHz IF output.



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Microwave Tuners

EVZ 3002/10 Series

Features

* Small, lightweight
* Low Power consumption
* Excellent Preselector – Oscillator tracking
* Octave Scan Rates to 100 Hz
* 20 MHz I.F. Bandwidth
* Optional Log Video output
* Analogue tuning High CMR
* Noise Figures 15 to 18 dB
* Optional Phase-lock facility

The EMI-Varian EVZ-3002/10 Series microwave tuners are electronically tuned superhet receiver front-ends covering the 0.5 to 18 GHz frequency range. Each tuner type uses a 4-stage YIG-tuned preselector filter and YIG-tuned local oscillator built within a common magnetic circuit with a single tuning coil. The integrated YIG filter/oscillator provides excellent frequency tracking at both high scanning rates and wide variations in operating temperature, thereby preserving the full I.F. bandwidth of 20 MHz under all conditions.

Tuning is by analogue control using a 0 to 10 volt signal fed to the YIG coil current driver via a high common mode rejection circuit. EVZ-3002/105 Series tuners are available for applications necessitating digital control of frequency.

Frequency Options

Frequency Band	Tuner Type Number
0.5 – 1 GHz	EVZP–3002/10
1 – 2 GHz	EVZL–3002/10
2 – 4 GHz	EVZS–3002/10
4 – 8 GHz	EVZC–3002/10
8 – 12 GHz	EVZX–3002/10
12 – 18 GHz	EVZU–3002/10

WEIGHT

0.5–1, 1–2, 2–4 GHz units	10 lbs. max.
4–8, 8–12, 12–18 GHz units	13 lbs. max.
RF and IF Connectors	SMA Female

EVZ3002/10 Tuner Specifications

Performance Characteristics

Frequency Range						
0.5–1	1–2	2–4	4–8	8–12	12–18	GHz
Noise Figure						
16	15	15	17	18	20	dB max.
13	13	13	14	15	17	dB typ.
Bandwidth (note 1)						
15	20	20	20	20	20	MHz min.
Incidental FM, RMS (note 2)						
5	5	7	7	8	8	KHz max.
Input Power (115/230VAC, 48–420Hz)						
20	20	25	35	50	70	Watts, max.

RF Selectivity	24dB/octave, nom.
Image Rejection	70dB min.
Local Oscillator Output (at RF Input)	–80dBm
Local Oscillator Output (at IF Output)	–60dBm
IF Rejection	80dB min
RF to IF Gain	25–35dB
RF to IF Gain Variation in IF Bandwidth	1.5dB max.
Single Signal Spurious-free Dynamic Range (note 3)	60dB min.
Frequency Step Response Time (to 99% of step change)	3 millisecs max.
1dB Gain Compression Point (IF output level)	0dBm min.
3rd Order Intermodulation Products (note 4)	–90dBm
Frequency Control Voltage, Full Range	0 to +10 Volts
Tuning Voltage Terminal Input Impedance	10 kilohms min.
L.O. Frequency Accuracy (note 5)	± 0.2% max.
L.O. Frequency Stability (after 1 hour operation) (note 2)	1MHz/hour max.
Input VSWR (at passband centre)	1.5:1 max.
Input Impedance	50 ohms nominal
IF Output Impedances	50 ohms nominal

Environmental Characteristics

Temperature, Operating	–30°C to +71°C
Temperature, Storage	–62°C to +85°C
Humidity	95% at 50°C
Vibration	MIL-E-5400M Curve 1
Shock	MIL-E-5400M (15G x 11 millisecs. 18 times)

Optional Features Available

S: Local Oscillator Phase-Lock Stabiliser

V: Log Video Output

L: Local Oscillator sample

P: External RF pre-amplifier connected between YIG pre-selector and post-selector filters.

L.O. PHASE-LOCK (Option "S")

A front panel terminal provides access to a circuit for effecting frequency modulation of the local oscillator when a correcting signal is injected from a phase-lock stabiliser. A sample of the L.O. signal is required for the stabiliser so tuners supplied for phase-lock operation also have a front panel terminal from which an L.O. signal can be taken.

LOG VIDEO OUTPUT (Option "V")

The 160MHz IF signal is fed to an internal power divider from one arm of which the normal 160MHz linear IF output is taken. The second arm of the divider feeds a logarithmic IF amplifier to provide a 50 nanosec. risetime DC coupled video output of 0.2 to 2.0V into 93 ohms. The logarithmic IF amplifier used has an input dynamic range of 60dB referenced to a nominal 0dBm at the high end. Linearity of ±1dB is achieved over this range.

An additional IF output can be supplied on request to provide a power limited signal at 0dBm nominal to drive an external discriminator for detection of FM signals.

LOCAL OSCILLATOR SAMPLE (Option "L")

A front panel connector provides an L.O. signal of –5dBm minimum for use with a frequency counter and/or phase-lock stabiliser.

EXTERNAL PRE-AMPLIFIER (Option "P")

The 4-pole pre-selector YIG filter normally used is replaced by a twin-channel 2-pole filter with front panel access to input and output of the pre-selector and to the input of the post-selector. When an RF pre-amplifier is not being used a rigid jumper cable is connected between the output of the pre-selector and the input to the post-selector. The RF pre-amplifier will reduce tuner noise figure about 8dB at the possible expense of a reduction in dynamic range. This option is not available in the band 0.5–1 GHz. For this band an internally fitted pre-amplifier can be provided; details on request.

Notes

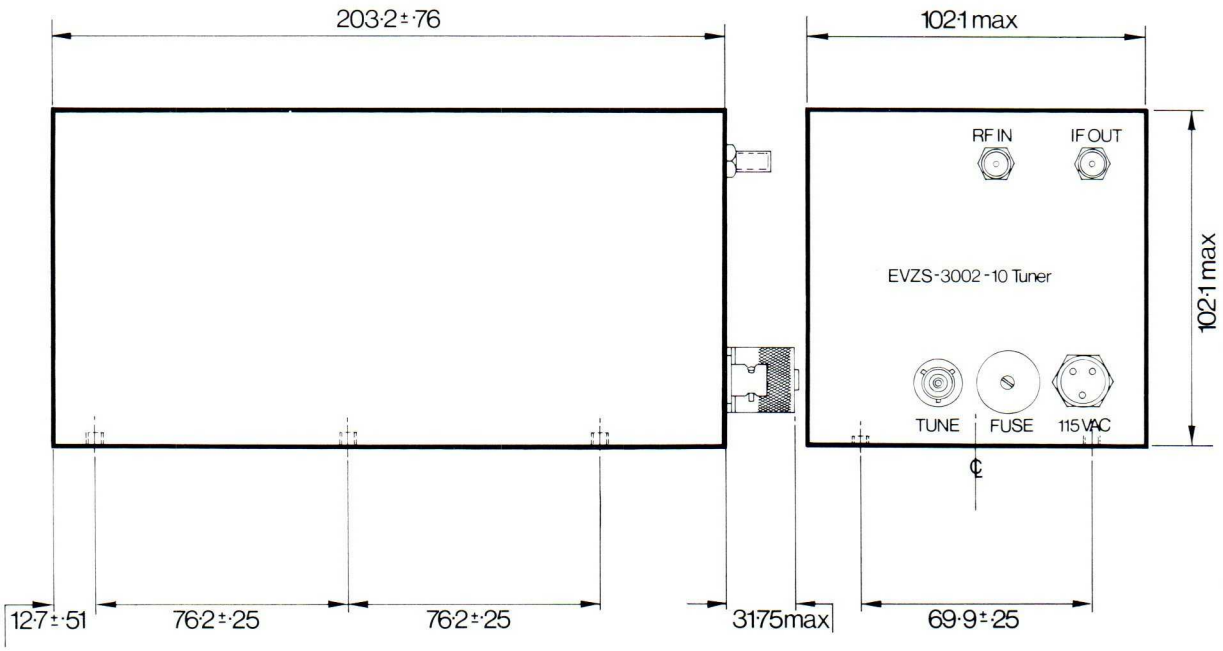
1. Bandwidth figures indicate overall RF to IF signal bandwidth centred at 160 MHz and measured at −3dB points at any sweep rate up to 50 Hz.
2. Figures quoted are without use of a local oscillator phase-lock stabiliser.
3. Measured from 8dB above noise level for a 1 MHz effective bandwidth.
4. Maximum equivalent input signal power for 2 signals at −30dBm each.
5. Peak deviation from straight line relationship of oscillator frequency to control voltage.
6. When ordering, specify as follows:−

   EVZ( )−3002/10 Option X

   e.g. EVZS−3002/10 SV specifies an S-band tuner with facilities for phase-locking the local oscillator and with a log video output in addition to the 160MHz IF output.

Physical Charactistics

Tuner Type No. EVZS-3002-10



All Dimensions in Millimetres

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Microwave Tuners
EVZ-3003/1 Series

Features

* Ultra-broad bandwidth
* Small, lightweight
* Low Power consumption
* Noise Figures 15 to 18dB
* Octave Scan Rates to 100Hz
* Analogue control, high CMR
* 300MHz I.F.
* Options: Phase-lock facility
  Log Video output
  Internal RF pre-amplifier

The EMI-Varian EVZ-3003/1 Series microwave tuners are ultrabroad bandwidth electronically tuned superhet receiver front-ends covering the 2 to 18 GHz frequency range. Each tuner type uses a 4-stage YIG-tuned preselector filter and YIG-tuned local oscillator matched to provide superior frequency tracking over wide ranges of both scanning rate and operating temperature. A local oscillator sample signal is available at the front panel for operation with a frequency counter and/or stabiliser.

Tuning is by analogue control using a 0 to 10 volt signal fed to the YIG coil current drivers via a high common mode rejection circuit.

Receiver bandwidths of 140 to 175 MHz are obtained using a 300 MHz Intermediate Frequency. These tuners are intended for use in receivers for the reception of spread spectrum communications signals and frequency agile radar pulses. The EVZ-3005 Series of tuners provide scanning superhet performance at instantaneous bandwidths up to 300 MHz.

Frequency Options

Frequency Band	Tuner Type Number
2 – 4 GHz	EVZS–3003/1
4 – 8 GHz	EVZC–3003/1
8 – 12 GHz	EVZX–3003/1
8 – 18 GHz	EVZM–3003/1
12 – 18 GHz	EVZU–3003/1

WEIGHT

2–4 GHz and 4–8 GHz units	12 lbs. max.
8–12 GHz and 12–18 GHz units	14 lbs. max.
RF and IF Connectors	SMA female

EVZ-3003/1 Tuner Specifications

Performance Characteristics

Frequency Range	2–4	4–8	8–12	8–18	12–18	GHz
Noise Figure	17	17	18	20	20	dB max.
	15	15	15	17	17	dB typ.
Bandwidth (note 1)	140	160	175	175	175	MHz min.
Incidental FM, RMS (note 2)	7	7	8	8	8	KHz max.
Input Power (115/230VAC, 48–420Hz)	50	80	100	130	130	Watts, max.

RF Selectivity	24dB/octave, nom.
Image Rejection	70dB min.

Local Oscillator Characteristics:

Output Level at Monitor Terminal	–10 to 0dBm
Output Leveal Variation over full Frequency Band	6dB max.
Spurious and Harmonics	–30dB max.
Output at RF Input Terminal	–80dBm max.
Output at IF Output Terminal	–60dBm max.
Frequency Accuracy (note 5)	± 0.2% max.
Frequency Stability (after 1 hour operation, note 2)	3 parts in 10^4/hour nominal
IF Rejection	80dB min.
RF to IF Gain	25–35dB
RF to IF Gain Variation over Frequency Band	5dB max.
RF to IF Gain Ripple in IF Bandwidth	1.5dB max.
Single Signal Spurious-free Dynamic Range (note 3)	60dB min.
Frequency Step Response Time (to 99% of step change)	10 millisecs. max.
1dB Gain Compression Point (IF output level)	0dBm min.
3rd Order Intermodulation Products (note 4)	–90dBm
Frequency Control Voltage, Full Range	0 to +10 Volts
Tuning Voltage Terminal Input Impedance	10 kilohms min.
Input VSWR	1.5:1 max.
Input Impedance	50 ohms nominal
IF Output Impedance	50 ohms nominal

Environmental Characteristics

Temperature, Operating (note 1)	0°C to + 50°C
Temperature, Storage	–62°C to +85°C
Humidity	95% at 50°C
Vibration	MIL-E-5400M Figure 2, Curve 1
Shock	MIL-E-5400M (15G x 11 millisecs, 18 times)

NOTE 1:
Operating temperature range may be extended to –54°C to +71°C if a heater is incorporated in the baseplate upon which filter and oscillator are mounted. Max. additional power consumption is 100 watts.

Optional Features Available

S: Local Oscillator Phase-Lock Stabiliser

V: Log Video Output

P1: External RF pre-amplifier connected between YIG pre-selector and post-selector filters.

P2: Internally fitted RF pre-amplifier connected between input isolator and YIG pre-selector filter.

F: Alternative IF centre frequency.

L.O. PHASE-LOCK (Option "S")
A front panel terminal provides access to a circuit for effecting frequency modulation of the local oscillator when a correcting signal is injected from a phase-lock stabiliser

LOG VIDEO OUTPUT (Option "V")
The 160MHz IF signal is fed to an internal power divider from one arm of which the normal 160MHz linear IF output is taken. The second arm of the divider feeds a logarithmic IF amplifier to provide a 50 nanosec. risetime DC coupled video output of 0.2 to 2.0V into 93 ohms. The logarithmic IF amplifier used has an input dynamic range of 60dB referenced to a nominal 0dBm at the high end. Linearity of ±1dB is achieved over this range.

An additional IF output can be supplied on request to provide a power limited signal at 0dBm nominal to drive an external discriminator for detection of FM signals.

EXTERNAL PRE-AMPLIFIER (Option "P1")
The 4-pole pre-selector YIG filter normally used is replaced by a twin-channel 2-pole filter with front panel access to input and output of the pre-selector and to the input of the post-selector. When an RF pre-amplifier is not being used a rigid jumper cable is connected between the output of the pre-selector and the input to the post-selector. The RF pre-amplifer will reduce tuner noise figure about 8dB at the possible expense of a reduction in dynamic range.

INTERNAL PRE-AMPLIFIER (Option "P2")
An RF pre-amplifier is fitted between the input isolator and the 4-pole YIG pre-selector filter. Noise figure performance is improved by about 8dB at the possible expense of a reduction in dynamic range.

ALTERNATIVE IF CENTRE FREQUENCY (Option "F")
Centre frequencies between 300MHz and 1000MHz can be provided. For signal frequencies above 8GHz receiver bandwidths up to 300MHz are available necessitating the use of an IF centre frequency of at least 600MHz.

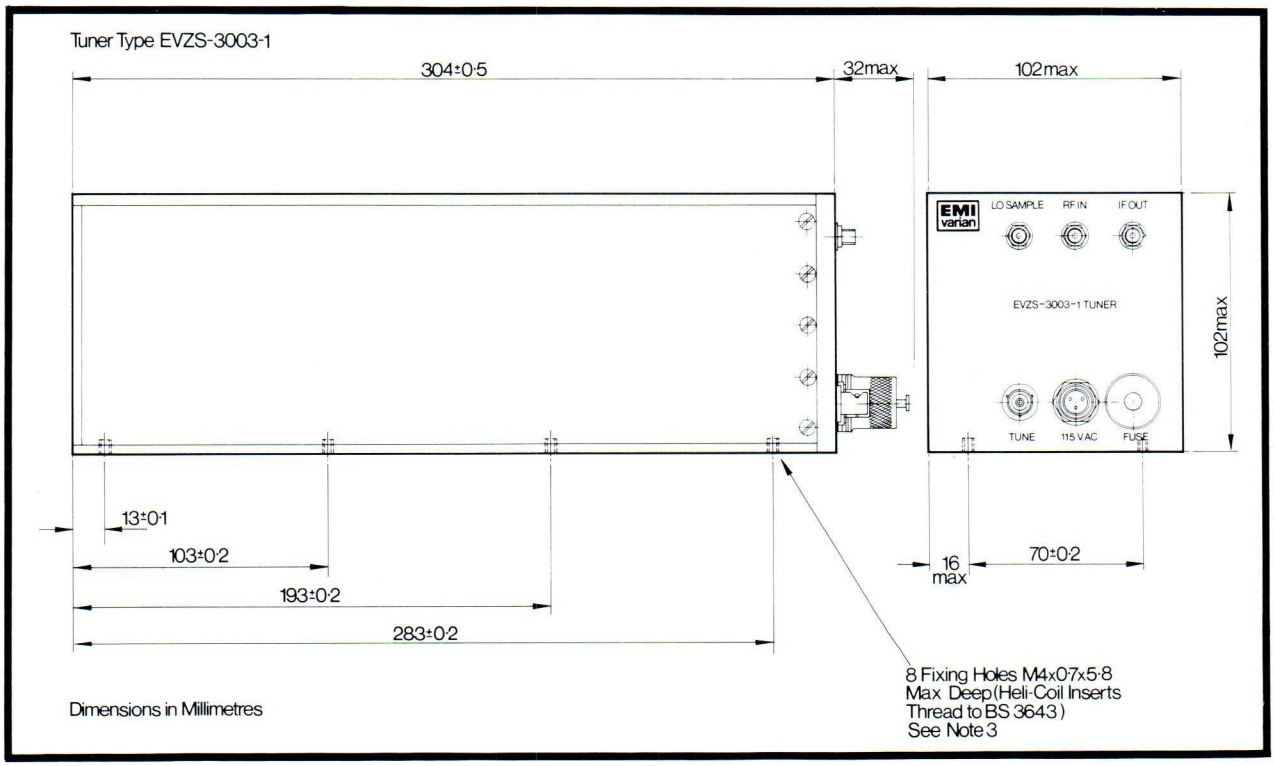
Notes

1. Bandwidth figures indicate overall RF to IF signal bandwidth centred at 300MHz and measured at −3dB points at any sweep rate up to 50Hz. See Option "F" regarding alternative IF centre frequencies.
2. Figures quoted are without use of a local oscillator phase-lock stabiliser.
3. Measured from 8dB above noise level for a 1MHz effective bandwidth.
4. Maximum equivalent input signal power for 2 signals at −30dBm each.
5. Peak deviation from straight line relationship of oscillator frequency to control voltage.
6. When ordering, specify as follows:−

   EVZ( )−3003/1 Option X

   e.g. EVZS−3003/1 SF600 specifies an S-band tuner with facilities for phase-locking the local oscillator and having an IF centre frequency of 600MHz.

Physical Characteristics



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Microwave Tuners

EVZ-3002/12A Series

Features

* Pre- and Post-selection Filtering
* RF Amplifier Add-on Facility
* Noise Figures 16 to 21dB
* Low Power Consumption
* Phase-lock Facility
* Excellent Pre-selector-oscillator tracking
* Analogue control, High CMR
* 20MHz IF Bandwidth at 160MHz
* RFI-screened ½ ATR Case
* Options: Internal RF Pre-amplifier
  Log Video Output

The EMI-Varian EVZ-3002/12A Series microwave tuners are electronically tuned superhet front-ends covering the 0.5 to 18GHz frequency range. Tuners for bands 1–18GHz use a dual 2-stage YIG-tuned filter with provision for use of an external RF pre-amplifier. The 0.5 to 1.0GHz tuner has the amplifier built into the tuner but front panel access is provided direct to the input of the post-selector filter for applications not requiring use of the amplifier.

All tuners incorporate an integral YIG filter/oscillator to ensure excellent frequency tracking at both high scanning rates and wide variations in operating temperature, thereby preserving the full IF bandwidth of 20MHz under all conditions.

Tuning is by analogue control using a 0 to 10 volt signal fed to the YIG coil current driver via a high common mode rejection circuit. EVZ-3002/105 Series tuners are available for applications necessitating digital control of frequency.

Frequency Options

Frequency Band	Tuner Type Number
0.5– 1 GHz	EVZP-3002/12A
1– 2 GHz	EVZL-3002/12A
2– 4 GHz	EVZS-3002/12A
4– 8 GHz	EVZC-3002/12A
8–12 GHz	EVZX-3002/12A
12–18 GHz	EVZU-3002/12A

(See note 9)

Physical Characteristics

Weight	13 lbs. nom.
Case	Standard ½ ATR "Short", with hold-down hooks. RFI screened.

Connectors:

RF Inputs 1 and 2	SMA Female
RF Preselector output	SMA Female
LO monitor output	SMA Female
IF output	50 ohm BNC Female
Phase-lock control	50 ohm BNC Female
Tuning mode, sweep/ manual (see note 8)	50 ohm BNC Female
Tuning input	Triaxial to DEFSTAN 532 Pattern 22
Power input	Hi-Rel Type 27003-10-6P

EVZ 3002/12A Tuner Specifications

Performance Characteristics

Frequency range	0.5–1	1–2	2–4	4–8	8–12	12–18	GHz
Noise figure (note 1)	16	16	16	18	18	21	dB max.
Bandwidth (note 2)	16	20	20	20	20	20	MHz min.
Incidental FM, RMS (note 3)	5	10	10	10	15	20	kHz max.
Input power	50	45	45	50	55	60	Watts max.

(115/230VAC, 48–420Hz. Figures exclude 100W heater used in X and Ku-band units)

RF selectivity (note 4)	24dB/octave, nom.
Image rejection	70dB min.
Local oscillator characteristics	
Output level at monitor terminal	–5 to 0dBm
Output level variation over full frequency band	7dB max.
Spurious and harmonics	–15dB max.
Output at RF input terminal	–80dBm max.
Output at IF output terminal	–60dBm max.
Frequency accuracy (note 5)	± 0.2% max.
Frequency stability (after 1 hour operation, note 3)	1 part in 10^4/hour nominal
IF rejection	80dB min.
RF to IF gain	20–25dB
RF to IF gain variation over frequency band	3dB max.
RF to IF gain ripple in IF bandwidth	1.5dB max.
Single signal spurious-free dynamic range (note 6)	60dB min.
Time for linear unidirectional sweep across full frequency band	0.02–100 secs.
Retrace time to 0.2% frequency accuracy	5 millisecs. max.
1dB gain compression point (RF input level, note 7)	–10dBm min.
Frequency control voltage, full range	0 to +10 Volts
Tuning voltage terminal input impedance	10 kilohms min.
RF input VSWR	1.5:1 max.
IF output VSWR	2.0:1 max.
RF input and IF output impedance	50 ohms nom.
Phase-lock control terminal input impedance	10 kilohms, min.
Phase-lock control voltage required	±10 volts, max.

Environmental Characteristics

Temperature, operating	0°C to +50°C
Humidity	95% at +30°C
Vibration	± 0.5G peak in each plane, 10Hz to 1000Hz
Shock	10G x 11 millisecs in any direction

Optional Features Available

V: Log Video Output
P: Internally fitted solid state RF pre-amplifier

Log Video Output (Option 'V')

The 160MHz IF signal is fed to an internal power divider from one arm of which the normal 160MHz linear IF output is taken. The second arm of the divider feeds a logarithmic IF amplifier to provide a 50 nanosec. rise-time DC coupled video output of 0.2 to 2.0V into 93 ohms. The logarithmic IF amplifier used has an input dynamic range of 60dB referenced to a nominal 0dBm at the high end. Linearity of ±1dB is achieved over this range.

An additional IF output can be supplied on request to provide a power limited signal at 0dBm nominal to drive an external discriminator for detection of FM signals.

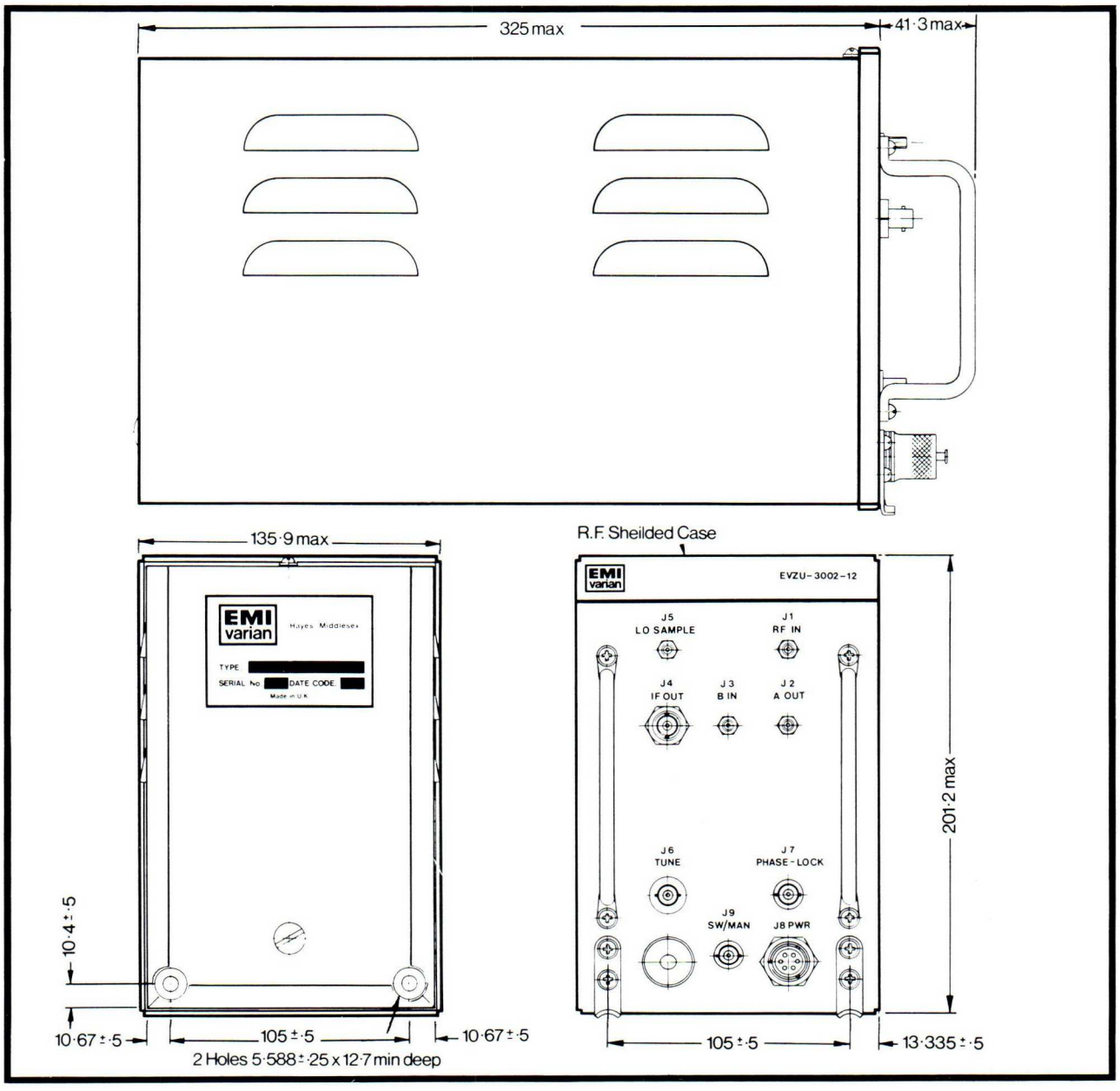
Internal Pre-Amplifier (Option 'P')

A solid state low noise RF pre-amplifier is fitted internally between pre-selector and post-selector filter channels, eliminating the need for two of the RF connectors fitted on the front panel of the standard tuner. Noise figure performance is improved by about 8dB over that obtained without pre-amplification and by about 2dB over that obtained when a similar pre-amplifier is used externally. Dynamic range will usually be reduced when a pre-amplifier is fitted.

Facilities can be provided upon request for short-circuiting the internal pre-amplifier by remote control.

Notes

1. Measured without RF pre-amplifier fitted; rigid jumper coaxial cable connected between output of pre-selector and input of post-selector filters. A cable is supplied with each tuner.
2. Bandwidth figures indicate overall RF to IF signal bandwidth centred at 160MHz and measured at −1dB points at any sweep rate up to 50Hz.
3. Figures quoted are without use of a local oscillator phase-lock stabiliser, but with the capacitor switched across the main tuning coil — see Note 8.
4. For the 0.5–1GHz tuner only the selectivity is 18dB/octave when the RF input signal is connected direct to the RF post-selector filter and the pre-amplifier is not in use.
5. Peak deviation from straight line relationship of oscillator frequency to control voltage.
6. Measured from 8dB above noise level for a 1MHz effective bandwidth.
7. RF pre-amplifier not fitted.
8. In the Manual Tuning mode provision is made for switching in a capacitor which reduces incidental frequency modulation from the local oscillator. A front panel connector is provided for injection of an externally generated +5VDC signal which serves to switch in this capacitor.
9. When ordering, specify as follows:—
   EVZ( )-3002/12A Option X
   e.g. EVZC-3002/12AVP specifies a C-band tuner with a log video output in addition to the 160MHz IF output, also an internal RF pre-amplifier.



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Microwave Tuners

EVZ-3002/105 Series

Features

* Small, lightweight
* Low Power Consumption
* Digital tuning control, 1 MHz resolution
* 20 MHz IF Bandwidth at 160 MHz
* High accuracy filter/oscillator tracking
* Analogue fine tuning capability
* Noise Figures 16 to 21 dB
* Local oscillator sample terminal
* Options: Phase lock facility
  Log video output

The EMI-Varian EVZ-3002/105 Series microwave tuners are digitally tuned superhet receiver front-ends covering the 0.5 to 18 GHz frequency range. Each tuner type uses a 4-stage YIG-tuned pre-selector filter and YIG-tuned local oscillator built within a common magnetic circuit with a single tuning coil. The integrated YIG filter/oscillator provides excellent frequency tracking at both high scanning rates and wide variations in operating temperature, thereby preserving the full IF bandwidth of 20 MHz under all conditions.

An analogue fine tuning control provides adjustments of plus/minus 12 to 80 MHz, dependent upon nominal frequency, for correction of long term frequency drift.

Frequency Options

Frequency Band	Tuner Type Number
0.5 – 1 GHz	EVZP-3002/105
1 – 2 GHz	EVZL-3002/105
2 – 4 GHz	EVZS-3002/105
4 – 8 GHz	EVZC-3002/105
8 – 12 GHz	EVZX-3002/105
12 – 18 GHz	EVZU-3002/105

Physical Characteristics

Weight	12 lbs nom.
Connectors:	
RF Input	SMA Female
LO Monitor Output	SMA Female
IF Output	SMA Female
Fine Tune	Triaxial to DEFSTAN 532 Pattern 22
Coarse Tune	Amphenol M81511/ 21EDO1P1
Tuning Mode, Sweep/ Manual (note 6)	50 ohm BNC Female
Phase-lock Control	50 ohm BNC Female
Power Input	Deutsch DM9606-3P

EVZ-3002/105 Tuner Specifications

Frequency Range	0.5–1	1–2	2–4	4–8	8–12	12–18	GHz
Noise figure	16	16	16	18	18	21	dB max.
	13	13	13	14	14	18	dB typ.
Bandwidth (note 1)	15	20	20	20	20	20	MHz min.
Incidental FM, RMS (note 2)	5	10	10	10	15	20	kHz max.
Input Powers (115V AC, 48–420 Hz)	30	30	35	45	55	70	Watts max.
RF selectivity	24 dB/octave, nom.						
Image rejection	70 dB min.						

Performance Characteristics

Local Oscillator Characteristics:

Output level at monitor terminal	–10 dBm min.
Output level variation over full frequency band	6 dB max.
Spurious and harmonics	–15 dB max.
Output at RF input terminal	–80 dBm max.
Output at IF output terminal	–60 dBm max.
Frequency accuracy (note 3)	±0.2% max.
Frequency stability (note 2)	1 part in 10^4/hr nom.
Tuning resolution	1 MHz nom.
IF rejection	80 dB min.
RF to IF gain	20 – 25 dB
RF to IF gain variation over frequency band	3 dB max.
RF to IF gain ripple in IF bandwidth	1.5 dB max.
Single signal spurious-free dynamic range (note 4)	60 dB min.
Frequency step response time (to 98% of step change)	10 millisecs max.
Analogue fine tuning range	±(10 MHz + 0.4% of LO frequency)
1 dB gain compression point (RF input level, no preamp fitted)	–10 dBm min.
Tuning control (note 5)	Digital
RF input VSWR	1.5:1 max.
IF output VSWR	2.0:1 max.
Fine tuning terminal impedance	10 kilohms min.

Environmental Characteristics

Temperature, operating	0°C to +55°C
Temperature, storage	–62°C to +85°C
Humidity	95% at 50°C
Vibration	MIL-E-5400M (Curve 1)
Shock	MIL-E-5400M (15G x 11 millisecs 18 times)

Operating temperature range may be extended to –50°C to +55°C if a heater is incorporated in the baseplate upon which the YIG-tuned filter/oscillator is mounted. Additional power consumption is 100 watts maximum.

Optional Features Available

S : Local Oscillator phase-lock stabiliser
V : Log Video output
P : External RF pre-amplifier

L.O. Phase-Lock (Option 'S')

A front panel terminal provides access to a circuit for effecting frequency modulation of the local oscillator when a correcting signal is injected from a phase-lock stabiliser.

Log Video Output (Option 'V')

The 160 MHz IF signal is fed to an internal power divider from one arm of which the normal 160 MHz linear IF output is taken. The second arm of the divider feeds a logarithmic IF amplifier to provide a 50 nanosec. risetime DC coupled video output of 0.2 to 2.0V into 93 ohms. The logarithmic IF amplifier used has an input dynamic range of 60 dB referenced to a nominal 0 dBm at the high end. Linearity of ±1 dB is achieved over this range.

An additional IF output can be supplied on request to provide a power limited signal at 0 dBm nominal to drive an external discriminator for detection of FM signals.

External Pre-Amplifier(Option'P')

The 4-pole pre-selector YIG filter normally used is replaced by a twin-channel 2-pole filter with front panel access to input and output of the pre-selector and to the input of the post-selector. When an RF pre-amplifier is not being used a rigid jumper cable is connected between the output of the pre-selector and the input to the post-selector. The RF pre-amplifier will reduce tuner noise figure about 10 dB at the possible expense of a reduction in dynamic range.

Notes

1 Bandwidth figures indicate overall RF to IF bandwidth centred at 160 MHz and measured at –3 dB points at any sweep rate up to 30 Hz.

2 Figures quoted are without the use of a local oscillator phase-lock stabiliser, but with the capacitor switched across the main tuning coil — see note 6.

3 Peak deviation from straight line relationship of oscillator frequency to control voltage referred to digital input word.

4 Measured from 8 dB above noise level for a 1 MHz effective bandwidth.

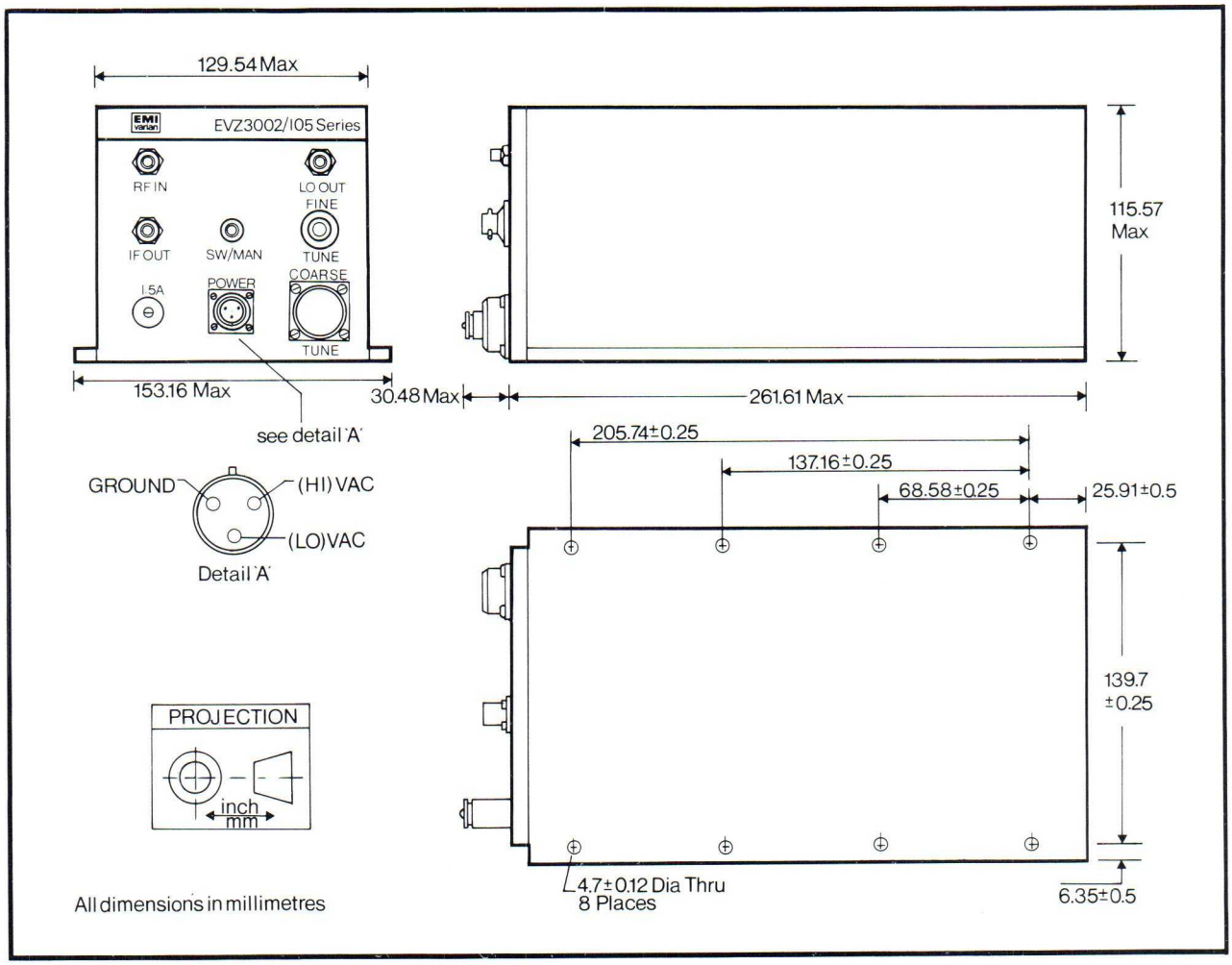
5 Digital binary code with parallel frequency word, via 13 TTL compatible twisted pair lines, plus 1 twisted pair as strobe.

6 In the Manual Tuning mode provision is made for switching in a capacitor which reduces incidental frequency modulation from the local oscillator. A front panel connector is provided for injection of an externally generated +5 VDC signal which serves to switch in this capacitor.

7 When ordering, specify as follows:-

EVZ( )-3002/105 Option X

e.g. EVZS-3002/105 SV specifies an S-band tuner with facilities for phase-locking the local oscillator and with a log video output in addition to the 160 MHz IF output.



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Pulsed Hybrid Amplifier

PT 1145

1.235 - 1.365 GHz
5 MW Peak

Quick Reference

L-band pulsed high power amplifier

Centre frequency	1.3 GHz
Instantaneous bandwidth	100 MHz
Peak output power	3–5 MW
Gain	30 dB
Cathode modulated	
Solenoid focused	
Liquid cooled	
Input r.f. connector	Type N
Output r.f. connector	WG6

Typical Operation

Heater voltage	18 Volts
Heater current	40 Amps
Beam voltage (peak)	140 kV
Beam current (peak)	95 Amps
Beam duty factor	0.0033
Efficiency (minimum)	24%

Typical Performance

Frequency range	1.25–1.35 GHz
Peak output power	3–5 MW
Bandwidth	100 MHz
Gain	30 dB
r.f. pulse length	10 μsecs.
Beam duty factor	0.0033
Noise output (relative to central spectral line)	Below 100 dB/Hz

General Data

ADDITIONAL ELECTRICAL REQUIREMENTS

Appendage pump voltage	3.5 kV
Appendage pump current	50 μA
Electromagnet voltage	100 Volts*
Electromagnet current	15 Amps*

*Each of 4 isolated coils

MECHANICAL FEATURES

Dimensions		See drawing
Weight	Amplifier	230 kg
	Electromagnet	320 kg
Electromagnet type		PTE 5028
Mounting position		Vertical (cathode down)

COOLING

Preferred coolant (normal temperatures)	De-ionised water
Preferred coolant (down to –40°C)	Ethylene Glycol and water mixture

Test Conditions and Limits

The amplifier is tested typically to comply with the following specification (but see Note 2).

TEST CONDITIONS

	Min.	Max.	Unit
Heater voltage	15	20	Volts
Heater current	35	45	Amps
Beam voltage (peak)	130	145	kV
Beam current (peak)	87	100	Amps
Pulse length (r.f.)	—	10	μsec.
Duty cycle (beam)	—	0.0033	
Frequency range	1.250	1.350	GHz
Electromagnet voltage*	—	100	Volts
Electromagnet current*	—	15	Amps

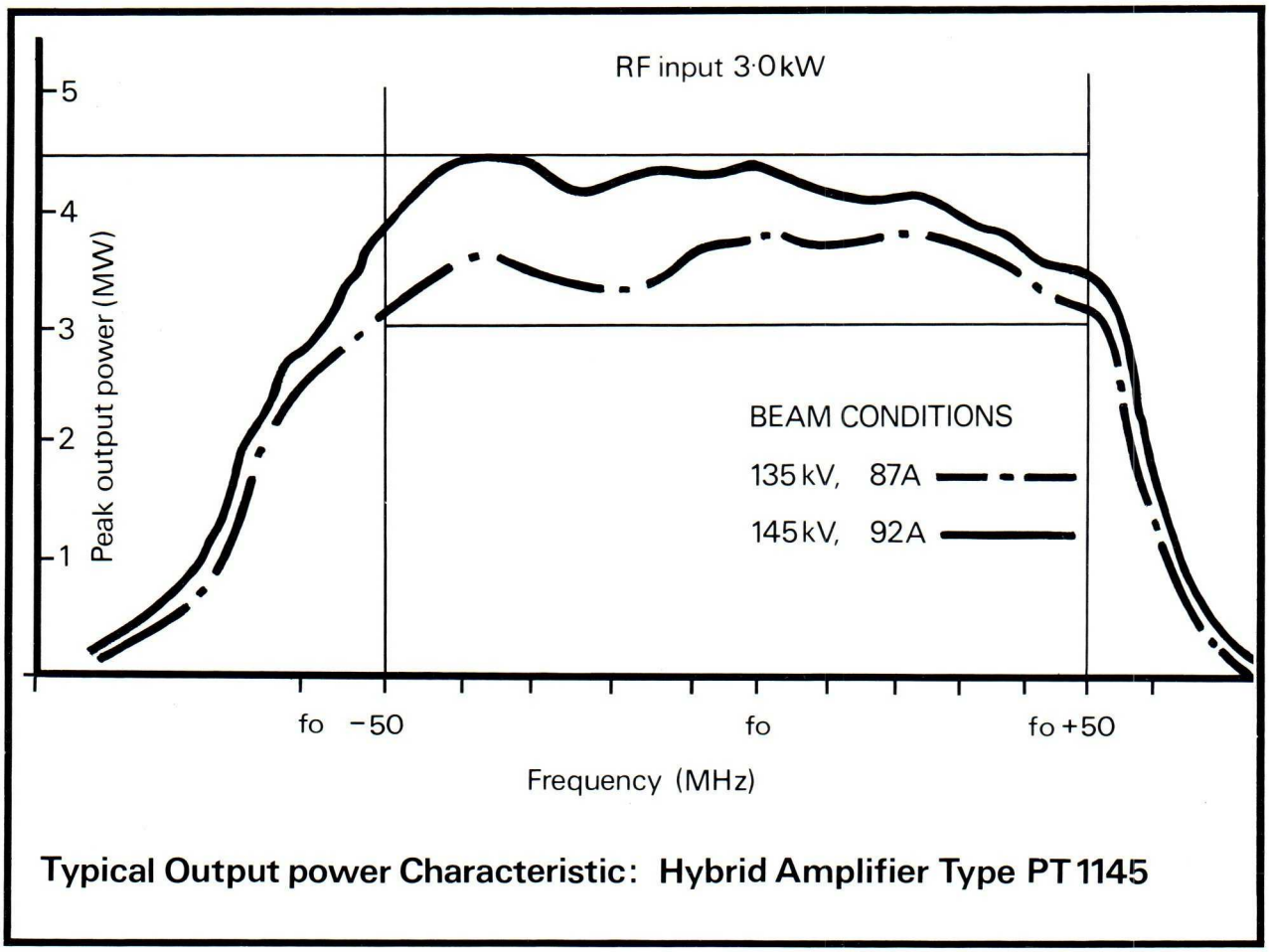
*Each of 4 supplies

TEST LIMITS

Output power (Pk)	3	5	MW
r.f. input power (Pk)	—	4	kW
Beam input power (Pk)	—	12.5	MW
Beam input power (mean)	—	42	kW
Instantaneous bandwidth	100	—	MHz
Noise output relative to central spectral line	—	100	dB/Hz

Maximum and Minimum Ratings

	Min.	Max.	Unit
Heater voltage	15	20	Volts
Heater current	—	50	Amps
Heater current surge	—	60	Amps
Heater warm-up time	15	—	Mins.
Collector voltage (peak)	—	160	kV
Cathode current (peak)	—	125	Amps
Collector dissipation	—	42	kW
Beam duty cycle	—	0.0033	
Ion pump current at application of EHT	—	15	μA
Ion pump current (surge)	—	50	μA
Load VSWR			
In operating band	—	1.5:1	
Outside operating band between 1.12 and 1.44 GHz	—	2.0:1	
Ambient temperature (operating)	0	55	°C
Storage temperature	−40	70	°C
Coolant inlet temperature		65	°C
Coolant outlet temperature		80	°C



Typical Output power Characteristic: Hybrid Amplifier Type PT1145

Notes

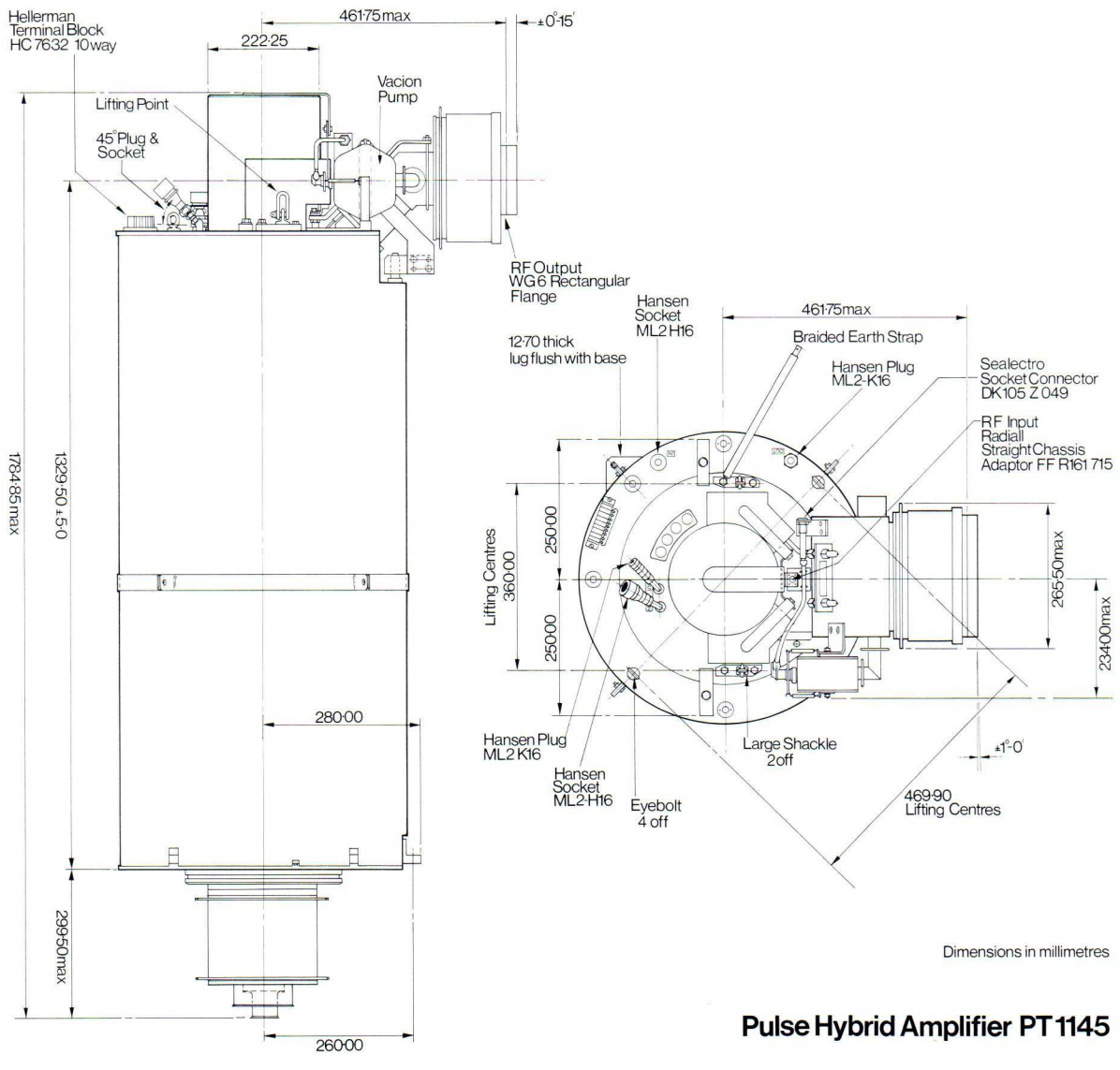
1. The PT 1145 is a hybrid amplifier which combines Klystron and Travelling Ware Tube techniques to maximise bandwidth and gain. A tuned 4 cavity Klystron buncher precedes a broadband slow wave structure of the "Centipede" type.

2. The performance indicated opposite represents one method of operation providing 100 MHz of instantaneous bandwidth. Amplifiers may be adjusted during manufacture to provide alternative characteristics, including peak power output in excess of 5 MW.

3. **Cooling Requirements**
   Cooling of the collector, amplifier body, and electromagnet is required. The requirements when water is used as the coolant are indicated below. Corresponding requirements for glycol-water mixtures are available on request.

	Flow rate (litres–min.)	Max. Pressure Drop (PSI)
Collector	40	90
Body	10	90
Electromagnet	7	40

A closed circuit cooling system designed to minimise scaling and corrosion should be used to obtain the maximum operating life. Any metal in the system should be close to copper on the Galvanic Scale. Oxygen, carbon dioxide, and other impurities should be continuously removed.



Dimensions in millimetres

Pulse Hybrid Amplifier PT 1145

4. To avoid damage to the amplifier and potentially hazardous microwave radiation it is essential that the r.f. input and output connections are correctly terminated during operation.
5. X-radiation can occur when the EHT voltage is applied. Appropriate caution signs should be attached to the operating equipments and the recommended safety precautions followed.
6. Interlocks for the protection of the amplifier and of maintenance personnel are recommended below. Interlocks should prevent the application of EHT voltages or r.f. input (when indicated). Advice on the provision of suitable interlocks is available on request.

   a) Protection of personnel against contact with high voltage.
   b) Correct coolant flow. All circuits.
   c) Correct focusing magnet current.
   d) Correct heater voltage and minimum heater warm-up time.
   e) Excess beam voltage.
   f) Excess ion pump current.
   g) Excess coolant temperature (inlet and outlet).
   h) Power reflected from output termination exceeds 600 Watts Mean. The r.f. drive should be removed within 10μsecs of this occurrence, but in this case it is not necessary to remove the beam voltage.

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Pulsed Klystron Amplifier

PT1152

1.240 - 1.350 GHz
100 kW Peak

Quick Reference

L-band tunable pulsed high power klystron

Centre frequency	1.295 GHz
Instantaneous bandwidth	5 MHz
Peak output power	100 kW
Gain	47 dB
Cathode modulated	
Solenoid focused	
Liquid cooled	
Input rf connector	TYPE N
Output rf connector	3⅛" standard coaxial

Typical Operation

Heater voltage		7 Volts
Heater current		18 Amps
Beam voltage (peak)		30 kV
Beam current (peak)		10.5 Amps
Beam duty factor		0.05
Efficiency	Minimum	30%

Typical Performance

Tunable frequency range	1.240-1.350 GHz
Peak output power	100 kW
Bandwidth (to 3dB points)	5 MHz
Saturated gain	47 dB
Beam pulse length	7.5 μs
Beam duty factor	0.05
Spurious output power level	−80 dB

General Data

Additional Electrical Requirements

Ion pump voltage	3.5 kV
Ion pump current	50 μA
Electromagnet voltage	60 Volt
Electromagnet current	14 Amps

Mechanical Features

Dimensions		See drawing
Weight	Klystron	60 kg
	Electromagnet	195 kg

Mounting position
Vertical (cathode down) or horizontal

Electromagnetic type	PTE 5031

Cooling

Liquid cooled	
Preferred coolant	De-ionised water

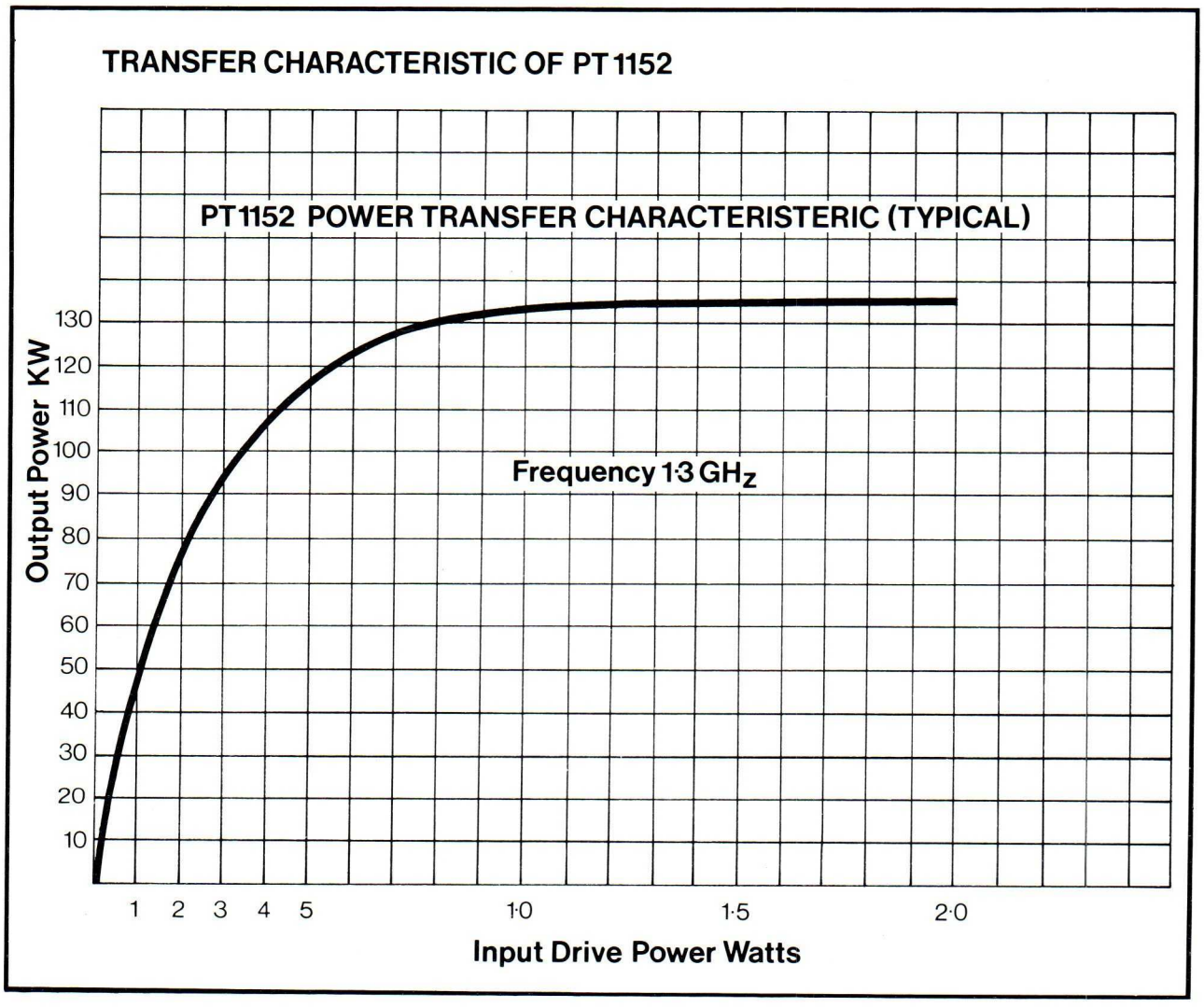
Test Conditions and Limit

The klystron is tested to comply with the following electrical specification.

Test conditions	Min	Max	Unit
Heater voltage	–	7.5	Volts
Heater current	–	20	Amps
Beam voltage (PK)	–	35	kV
Beam current (PK)	9.4	11.4	Amps
Pulse length (RF)	–	6.5	μsec
Duty cycle (Beam)	–	0.05	
Frequency range	1.240	1.350	GHz
Load VSWR	1.1:1	1.2:1	
Electromagnet voltage	55	60	Volts
Electromagnet current	11	14	Amps
Test limits			
Output power (PK)	100	–	kW
RF input (PK)	–	2	W
Beam input (PK)	–	0.33	MW
Power input (mean)	–	16.7	kW
Instantaneous bandwidth to 3dB points	5	–	MHz

Maximum and Minimum Ratings

	Min	Max	Unit
Heater voltage	6	8	Volts
Heater current	–	20	Amps
Heater current (surge)	–	30	Amps
Heater warm up time	10	–	Mins
Collector voltage (Peak)	–	35	kV
Cathode current (Peak)	–	16	Amps
Collector dissipation	–	25	kW
Beam duty cycle	–	0.05	
Ion pump current before EHT applied	–	10	μA
Ion pump current (surge)	–	1.5:1	
Ambient temperature (operating)	+1	+70	°C
Storage temperature	–40	+70	°C
Coolant inlet temperature	1	+50	°C
Coolant outlet temperature	–	+80	°C

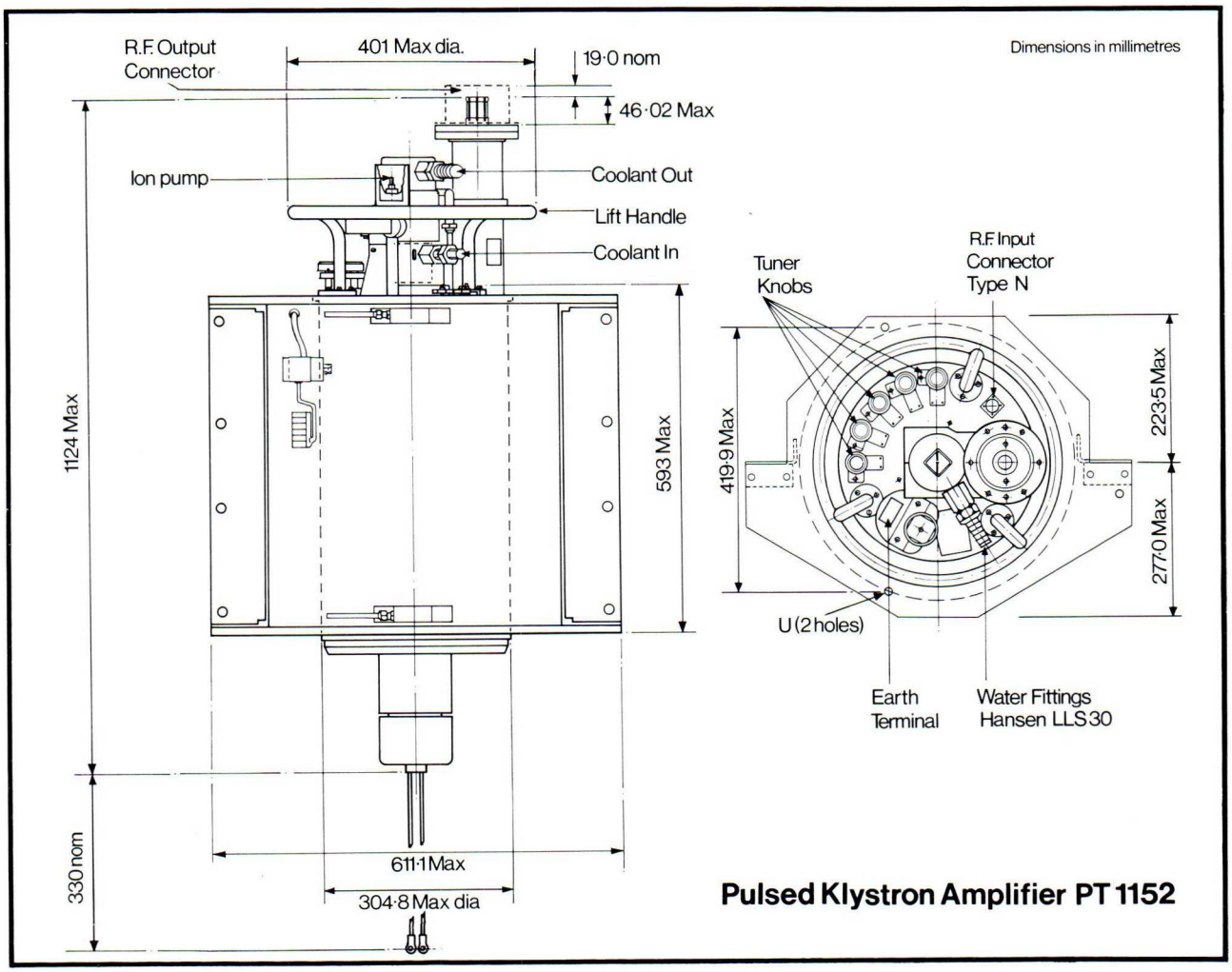


Notes

1. The PT1152 is a 5 cavity pulsed klystron tunable over its frequency range of 1.240 to 1.350 GHz. Tuner settings for designated spot frequencies within this band are supplied with each klystron.
2. **Cooling**
   Cooling of the klystron, and electromagnet is required at the following flow rates using de-ionised water as the coolant. If it is intended to use any other coolant prior reference should be made to the klystron manufacturer.

	Flow Rate (litres/min)	**Max. Pressure Drop (P.S.I.)**
Klystron	25	15
Electromagnet	4.5	30

   A closed circuit cooling system designed to minimise scaling and corrosion should be used to obtain the maximum operating life. Any metal in the system should be close to copper on the galvanic scale. Oxygen, carbon dioxide and other impurities should be continuously removed.
3. To avoid damage to the klystron and potentially hazardous microwave radiation it is essential that the rf input and output connections are correctly terminated during operation. Under certain tuning conditions regeneration or oscillation may occur if rf energy from the output is fed back externally to the input termination.
4. X-radiation can occur when the EHT voltage is applied. Appropriate caution signs should be attached to the operating equipments and the recommended safety precautions followed.
5. Interlocks for the protection of the amplifier and of maintenance personnel are recommended below. Interlocks should prevent the application of EHT voltages or rf drive input (when indicated). Advice on the provision of suitable interlocks is available on request.
   (a) Protection of personnel against contact with high voltage.
   (b) Correct coolant flow (klystron and electro-magnet).
   (c) Correct focusing magnet current.
   (d) Correct heater voltage and minimum heater warm up time.
   (e) Excess beam voltage.
   (f) Excess beam current.
   (g) Excess ion pump current.
   (h) Excess coolant temperature (inlet and outlet).
   (j) Power reflected from output termination exceeds 250 Watts mean. The rf drive should be removed within 10 μsecs of this occurrence but in this case it is not necessary to remove the beam voltage.



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UHF Klystron Amplifier

VA943B
VA944B
VA945B

Quick Reference

Frequency	VA 943B	470–574 MHz
	VA 944B	572–704 MHz
	VA 945B	702–860 MHz
Power output (peak of sync.)		10–13.5 kW
Construction		Integral cavity

Typical Operation & Performance (1)

Klystron output power, peak sync.	12.5 kW
Drive power for peak sync.	610 mW peak
Gain at peak sync.	43 dB
Efficiency[2] (peak sync.)	39%
1 dB bandwidth	8 MHz
Cathode voltage	−12.2 kV d.c.
Heater voltage	6.5 V
Heater current	16.5 A
Beam current	2.63 A
Modulating anode voltage	Body potential
Modulating anode current	0.5 mA
Collector temperature[3]	115°C
Electromagnet current	9 A

General Data

Weights

VA 943B	114 kg
VA 944B	102 kg
VA 945B	98 kg
VA 1943A	340 kg

Mounting position

Cathode down

Input

Type N, 50 ohm, coaxial panel jack

Output

3 1/8 inch, 50 ohm, coaxial line

Cooling

Minimum collector water flow	2 L/min
Minimum body and magnet air flow	3 m^3/min
Air pressure drop at minimum flow	13 cm H_2O
Minimum cathode air flow	1.5 m^3/min

Focusing

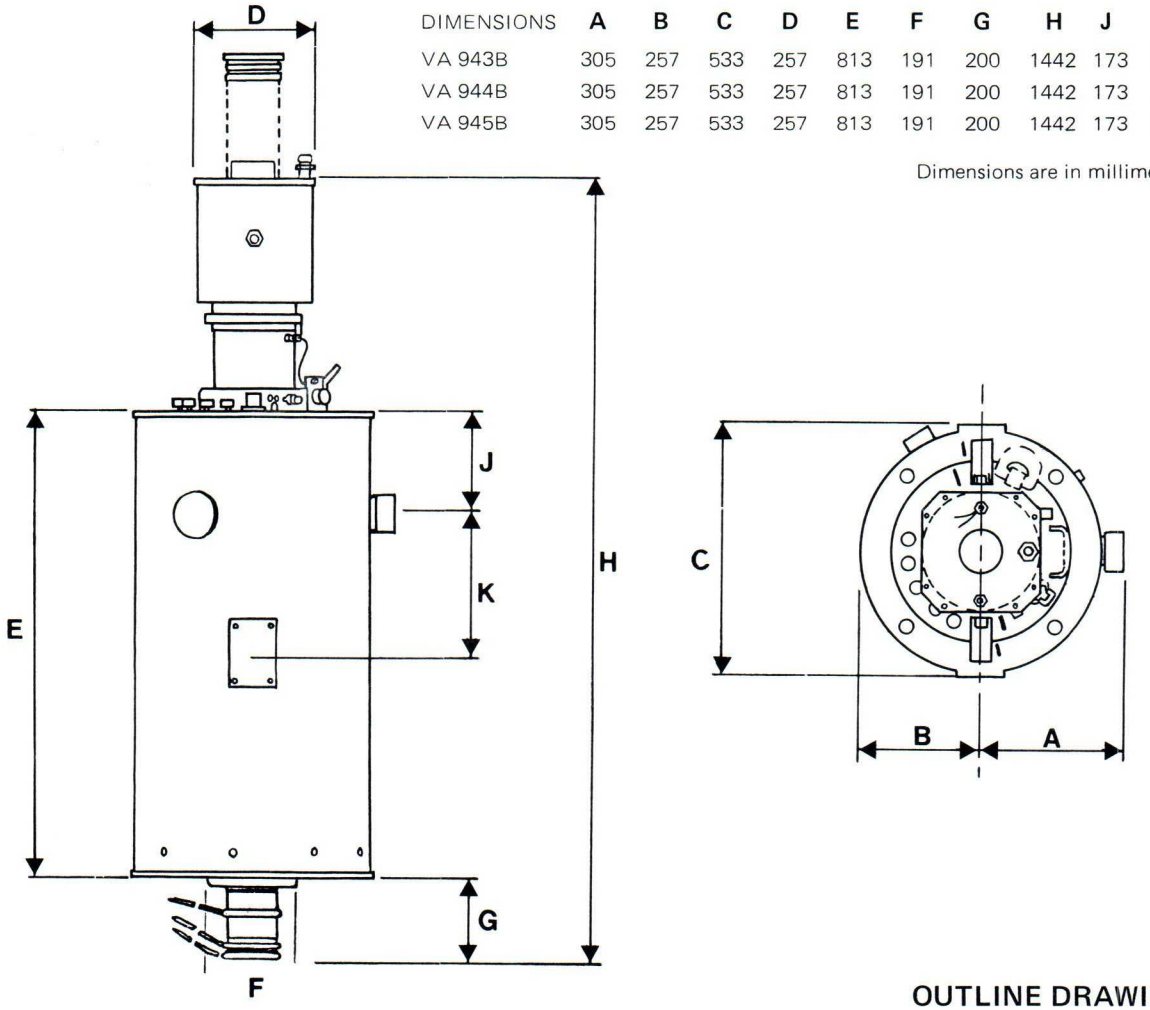
VA 943B	Electromagnet	VA 1943A
VA 944B	Electromagnet	VA 1943A
VA 945B	Electromagnet	VA 1943A

Notes

1. Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.
2. Efficiency at 12.5 kW output power (peak of sync.).
3. The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA 943B	305	257	533	257	813	191	200	1442	173	208
VA 944B	305	257	533	257	813	191	200	1442	173	208
VA 945B	305	257	533	257	813	191	200	1442	173	208

Dimensions are in millimetres



OUTLINE DRAWING

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UHF Klystron Amplifier

VA946HA
VA947HA
VA948HA

Quick Reference

Frequency	VA 946HA	470–566 MHz
	VA 947HA	566–698 MHz
	VA 948HA	694–890 MHz
Power output (peak of sync.)		22–32 kW
Construction		Integral cavity

Typical Operation & Performance (1)

Klystron output power, peak sync.	32 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	49 dB
Efficiency(2) (peak sync.)	39%
1 dB bandwidth	8 MHz
Cathode voltage	– 18 kV d.c.
Heater voltage	7.5 V
Heater current	18 A
Beam current	4.5 A
Body current	10 mA
Modulating anode voltage	Body potential
Modulating anode current	1.5 mA
Collector temperature(3)	105°C
Electromagnet current	27 A

General Data

Weights

VA 946HA	156 kg
VA 947HA	135 kg
VA 948HA	96 kg
VA 1950A	275 kg
VA 1951A	233 kg
VA 1952A	186 kg

Mounting position
Cathode down

Input
Type N, 50 ohm, coaxial panel jack

Output
3 1/8 inch, 50 ohm, coaxial line

Cooling

Minimum collector water flow	6 L/min
Minimum body water flow	7.5 L/min
Minimum electromagnet water flow	7.5 L/min
Maximum body water pressure drop at 7.5 L/min	275 k Pa
Maximum electromagnet water pressure drop at 7.5 L/min	240 k Pa
Maximum water inlet temperature(4)	70°C
Minimum cathode air flow	1.5 m^3/min

Focusing

VA 946HA	Electromagnet	VA 1950A
VA 947HA	Electromagnet	VA 1951A
VA 948HA	Electromagnet	VA 1952A

Notes

1. Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

2. Efficiency at 32 kW output power (peak of sync.).

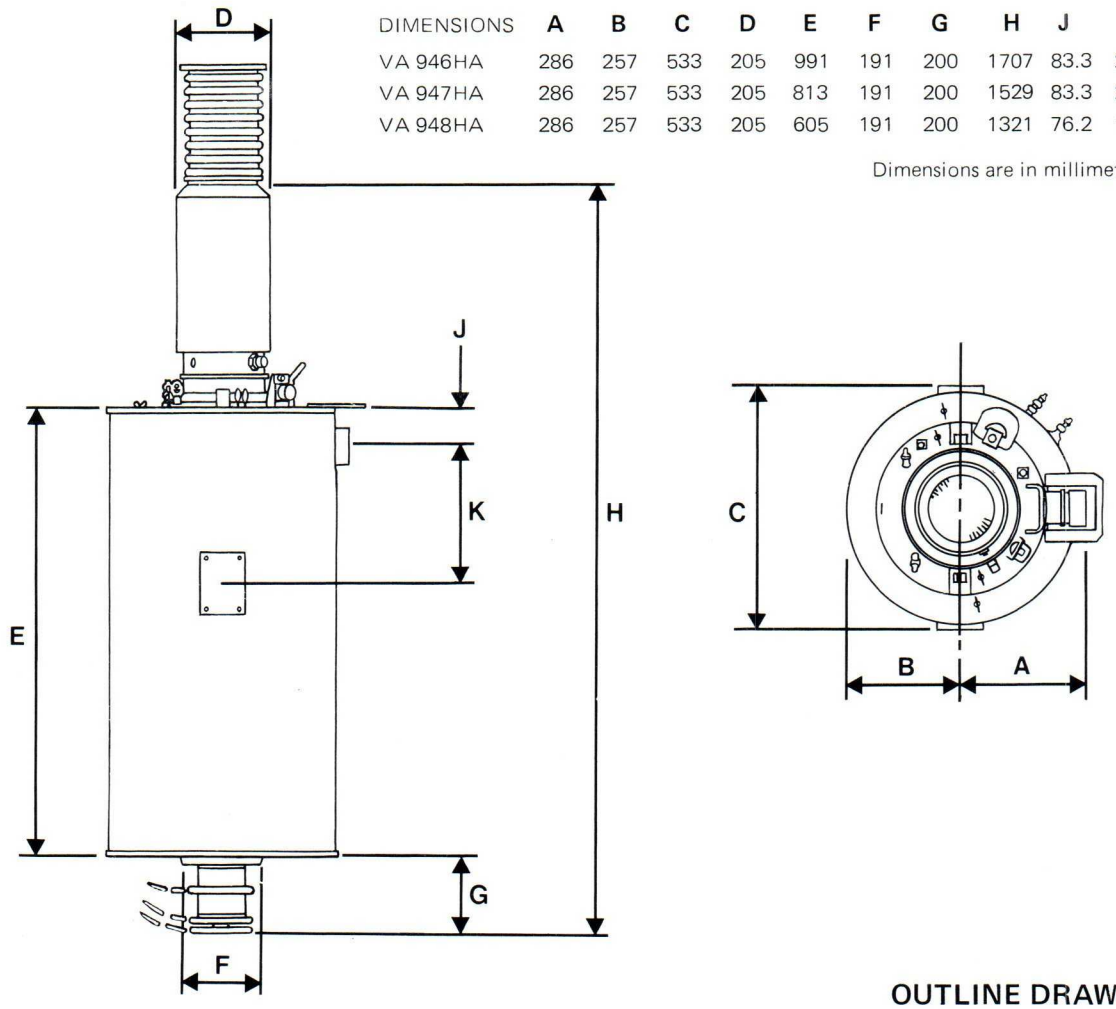
Notes (continued)

3. The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

4. For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA 946HA	286	257	533	205	991	191	200	1707	83.3	298
VA 947HA	286	257	533	205	813	191	200	1529	83.3	298
VA 948HA	286	257	533	205	605	191	200	1321	76.2	143

Dimensions are in millimetres



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UHF Klystron Amplifier

VA950HA
VA951HA
VA952HA

Quick Reference

Frequency	VA 950HA	470–566 MHz
	VA 951HA	566–698 MHz
	VA 952HA	694–890 MHz
Power output (peak of sync.)		32–45 kW
Construction		Integral cavity

Typical Operation & Performance (1)

Klystron output power, peak sync.	45 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	51 dB
Efficiency(2) (peak sync.)	39%
1 dB bandwidth	8 MHz
Cathode voltage	– 20 kV d.c.
Heater voltage	7.5 V
Heater current	18 A
Beam current	5.8 A
Modulating anode voltage	Body potential
Modulating anode current	1.0 mA
Collector temperature(3)	115°C
Electromagnet	27 A

General Data

Weights

VA 950HA	177 kg
VA 951HA	158 kg
VA 952HA	117 kg
VA 1950A	275 kg
VA 1951A	233 kg
VA 1952A	186kg

Mounting position
Cathode down

Input
Type N, 50 ohm coaxial panel jack

Output
3 1/8 inch, 50 ohm coaxial line

Cooling

Minimum collector water flow	8 L/min
Minimum body water flow	10 L/min
Minimum electromagnet water flow	7.5 L/min
Maximum body water pressure drop at 10 L/min	410 k Pa
Maximum magnet water pressure drop at 7.5 L/min	240 k Pa
Maximum water inlet temperature(4)	70°C
Minimum cathode air flow	1.5 m^3/min

Focusing

VA 950HA	Electromagnet	VA 1950A
VA 951HA	Electromagnet	VA 1951A
VA 952HA	Electromagnet	VA 1952A

Notes

1. Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.
2. Efficiency at 45 kW output power (peak of sync.).

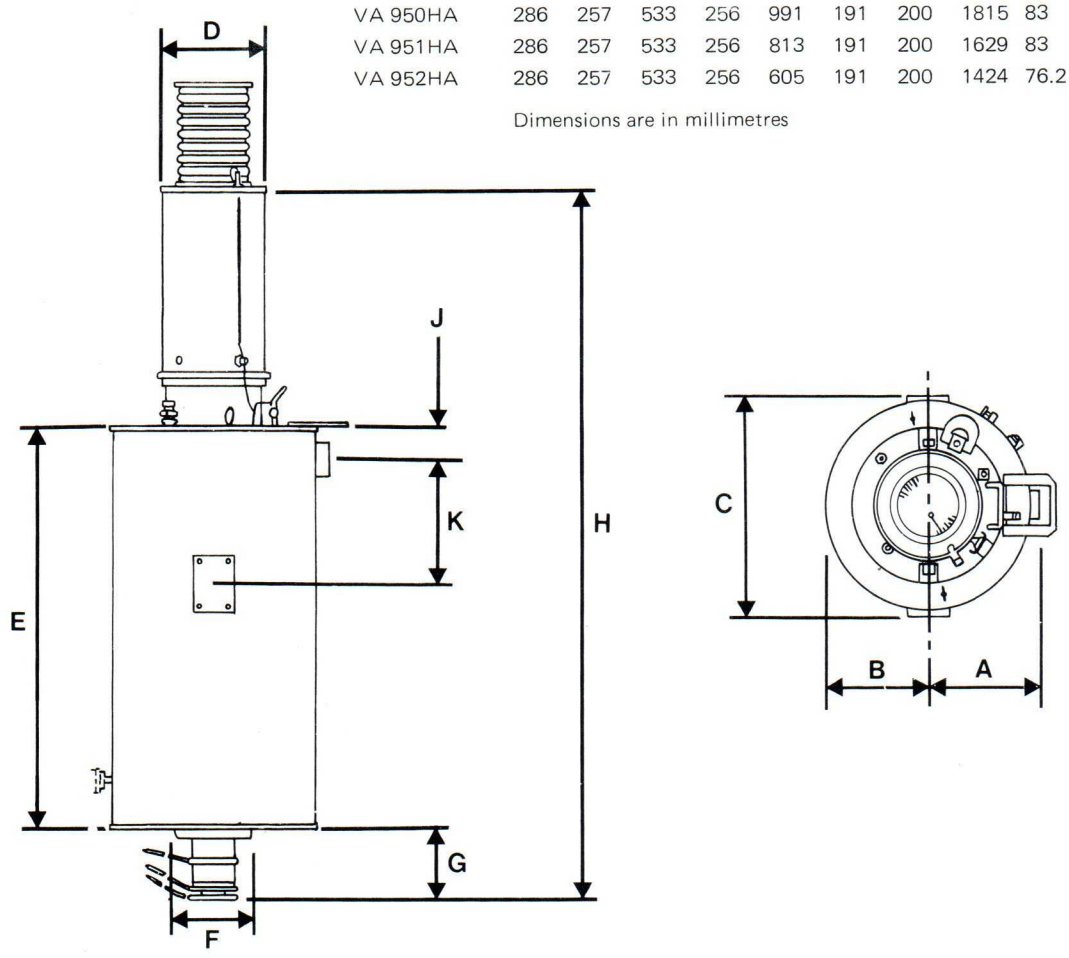
Notes (continued)

3. The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

4. For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA 950HA	286	257	533	256	991	191	200	1815	83	298
VA 951HA	286	257	533	256	813	191	200	1629	83	298
VA 952HA	286	257	533	256	605	191	200	1424	76.2	124

Dimensions are in millimetres



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UHF Klystron Amplifier

VA953HA
VA954HA
VA955HA

Quick Reference

Frequency	VA 953HA	470–566 MHz
	VA 954HA	566–698 MHz
	VA 955HA	694–890 MHz
Power output (peak of sync.)		45–65 kW
Construction		Integral cavity

Typical Operation & Performance (1)

Klystron output power, peak sync.	55 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	51 dB
Efficiency(2) (peak sync.)	39%
1 dB bandwidth	8 MHz
Cathode voltage	– 22 kV d.c.
Heater voltage	7.5 V
Heater current	18 A
Beam current	6.4 A
Modulating anode voltage	Body potential
Modulating anode current	1.0 mA
Collector temperature(3)	120°C
Electromagnet current	30 A

General Data

Weights

VA 953HA	177 kg
VA 954HA	158 kg
VA 955HA	117 kg
VA 1950A	275 kg
VA 1951A	233 kg
VA 1952A	186 kg

Mounting position

Cathode down

Input

Type N, 50 ohm, coaxial panel jack

Output

3 1/8 inch, 50 ohm, coaxial line

Cooling

Minimum collector water flow	8 L/min
Minimum body water flow	10 L/min
Minimum electromagnet water flow	7.5 L/min
Maximum body water pressure drop at 10 L/min	410 k Pa
Maximum electromagnet water pressure drop at 7.5 L/min	240 k Pa
Maximum water inlet temperature(4)	70°C
Minimum cathode air flow	1.5 m^3/min

Focusing

VA 953HA	Electromagnet	VA 1950A
VA 954HA	Electromagnet	VA 1951A
VA 955HA	Electromagnet	VA 1952A

Notes

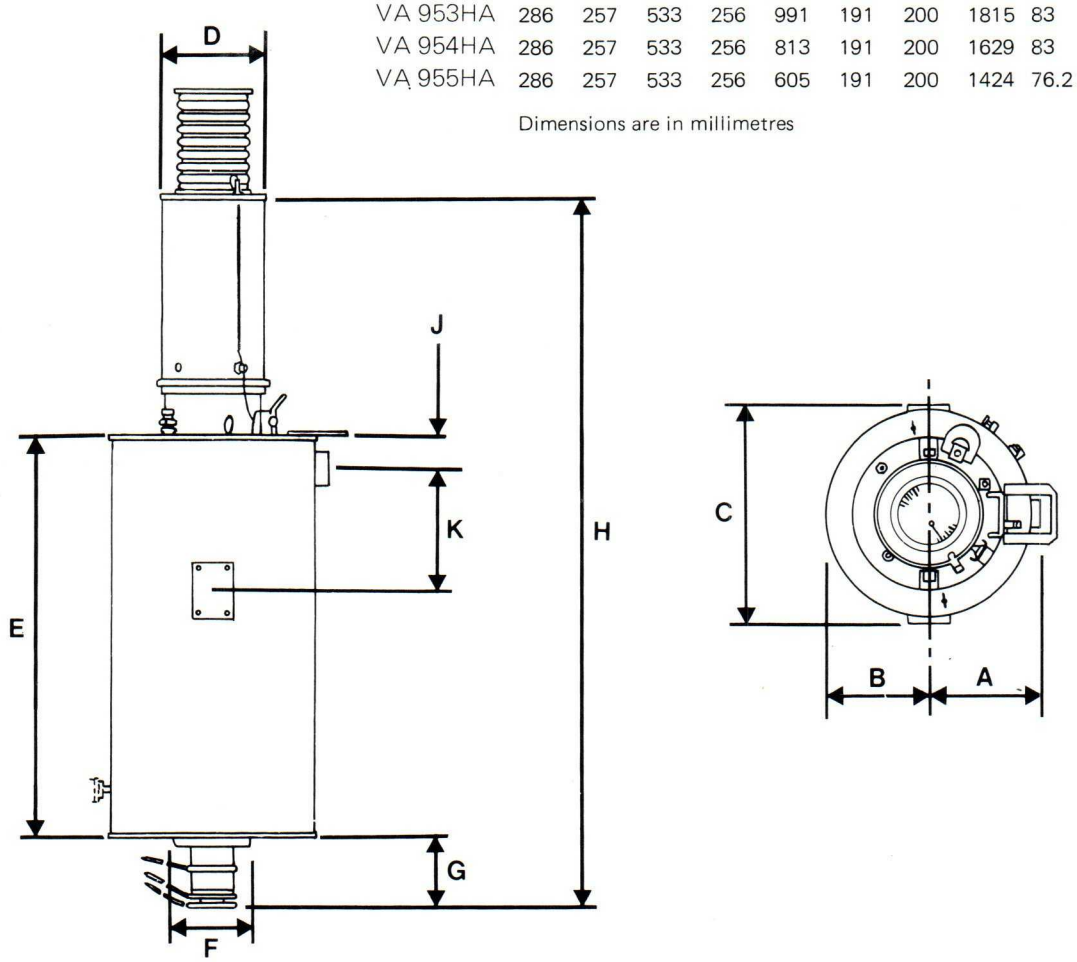
1. Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

Notes (continued)

2. Efficiency at 55 kW output power (peak of sync.).
3. The collector temperature is monitored by a thermocouple attached to the collector of each klystron.
4. For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA 953HA	286	257	533	256	991	191	200	1815	83	298
VA 954HA	286	257	533	256	813	191	200	1629	83	298
VA 955HA	286	257	533	256	605	191	200	1424	76.2	124

Dimensions are in millimetres



OUTLINE DRAWING

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