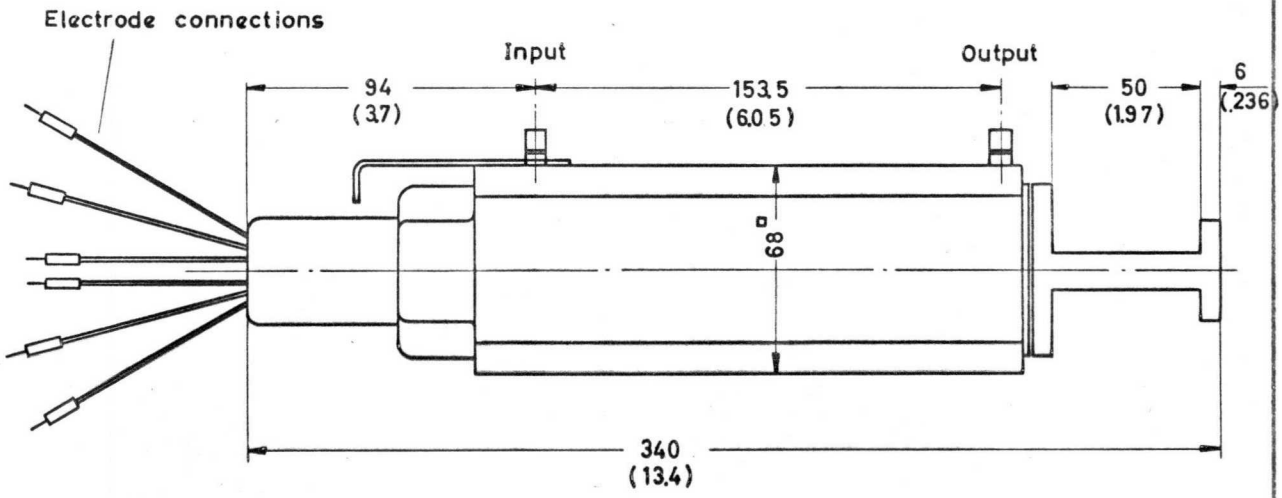
Power Traveling Wave Tube

F = 10.7 to 13.2 GHz

Design and Application

Conduction cooled power traveling wave tube for the frequency range 10.7 to 13.2 GHz with an average CW power output of 20 W and a minimum gain of 40 db.

The RW 1120 is focused by an integrated periodic permanent magnet; tube and magnet are arranged replaceable in its case. The tube is designed to operate with depressed collector. The rf power is coupled in and out by way of waveguides.



Dimensions in mm
in ( ) inches

Weight of tube with magnet	: 3.5 kg
Weight of tube with magnet and case	: 6.5 kg
Dimensions of the tube with case	: 400 mm x 110 mm x 80 mm
Waveguide	: WR 75, 19.05 mm x 9.53 mm
Flange	: see page 7 (M band)
Mounting position	: any (see Cooling, page 5)

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RW 1120

Heating

Heater voltage	Ef	6.3	Vac	1)
Heater current	If	≈ 0.8	Aac	
Cathode heating time	tk	> 45	sec	2)

indirekt by ac, parallel supply

Metal capillary dispenser cathode

Characteristics (f = 12 GHz, Ik = 60 mAdc)

		min	nom	max		
Pulse saturation power	Psat		40		W	
Gain (Po = 20 W)	G	40	43		db	
VSWR			2			3)
Cold attenuation	α		80		db	

Typical Operation

Operating frequency	F	12	GHz	
Power output	Po	20	W	
Gain	G	43	db	
Collector voltage	Eb	2500	Vdc	4)
Helix voltage	Eh	4200 ± 400	Vdc	5)
Grid No.2 voltage	Ec2	1250 ± 400	Vdc	5)
Grid No.1 voltage	Ec1	-70	Vdc	4)6)
Helix current	Ih	≈0,5	mAdc	
Grid Nr.2 current	Ic2	< 0.1	mAdc	
Cathode current	Ik	60	mAdc	4)
AM/PM conversion	kp	≈3,5	°/db	
Noise factor	NF	≈ 25	db	

All voltages are referred to the cathode

1) The voltage drop in the heater supply leads must be taken into account. The voltage must be set such that it is exactly 6.3 V at the socket. The total voltage drop in the cable is 0.1 V/m. If the maximum variation of the heater voltage exceeds the absolute limits of ± 3 %, the operating performance of the tube will be impaired and its life shortened.

2) For the first starting the tube must be preheated a minimum of 2 minutes.

3) At input and output of the tube operated in the frequency range of 10.7 to 13.2 GHz.

4) Setting values

5) The spreads quoted are intended for use when designing the power supply.

6) It is advisable to obtain Ec1 by means of cathode resistor.

Maximum Ratings (absolute values)

Collector voltage	Eb	max	3500	Vdc	
Collector dissipation	Pp	max	200	W	
Helix voltage	Eh	max	4800	Vdc	
Helix current	Ih	max	2	mAdc	1)
Grid No. 2 voltage	Ec2	max	2000	Vdc	
Grid No. 2 dissipation	Pc2	max	0.2	W	
Grid No. 1 voltage	-Ec1	max	150	Vdc	
Grid No. 1 voltage	+Ec1	max	0	Vdc	
Cathode current	Ik	max	80	mAdc	
Load VSWR		max	2		
Case temperature	T	max	115	°C	2)
Ambient temperature	TA	min	-20	°C	
Ambient temperature	TA	max	55	°C	2)

1) Switch-off value of the protection relay (see Operating Instructions, page 4).

2) See Cooling, page 5.

Operating Instructions

Mounting

The tube case must only be mounted by way of the fixing holes provided for this purpose. With operation in radio link systems, isolator should be connected to the tube input and output to avoid distortion due to multiple reflexions, The rf waveguide to the case should be flexible to prevent any mechanical stress on the input and output ports of the magnet system.

Power supply

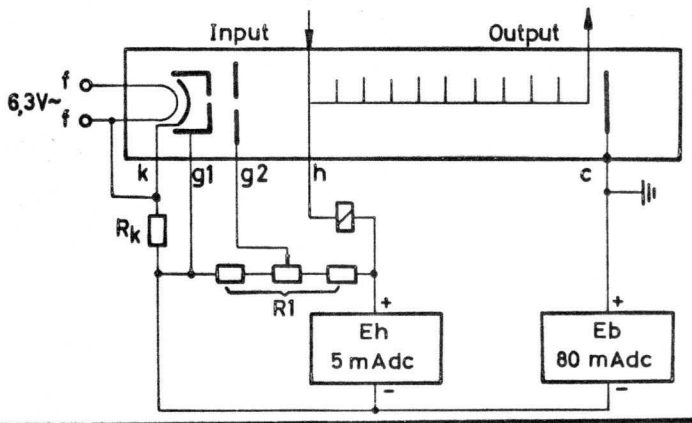
All voltages applied to the tube are referred to the cathode.

The Grid No. 1 voltage can be obtained from a cathode resistor Rk. The Grid No. 2 voltage must be variable within the a/m range. It may be tapped from a voltage divider R1, the total resistance of which must not exceed 1 MΩ. Stability and residual hum of the helix voltage depend upon the equipment requirements. The helix supply must be designed such that the dynamic internal resistance of the power supply does not exceed approx. 20 kΩ. The collector voltage need not to be stabilized, but it must not fall more than 50 Vdc below the indicated operating value.

A protection relay must be incorporated in the helix supply line which automatically cuts off all electrode voltages if the helix current rises above the maximum limit. An integrator should be provided to prevent the relay tripping on short-duration overloads of up to 10 mAsec within the first two seconds. In order to avoid operation interruptions by the relay tripping, it is recommended to provide a warning device which indicates a helix current in excess of 1.8 mA. In this case there will be time anough to minimize the helix current well below the value of 1.8 mA again by means of readjusting the electrode voltages or - if this is impossible - to change the tube without breakdown.

When using an independent voltage source for Grid No.2, the voltage must be automatically switched off immediately if the helix voltage fails. This may be achieved by interlocking the protection circuits. When the collector voltage fails, the helix voltage and Grid No.2 voltage must be disconnected either by the overload relay in the helix circuit or by a voltage interlocking system.

The heater and cathode are at a potential of approximately 3500 Vdc with respect to ground and the insulation of the heater supply must therefore be designed accordingly.



Cooling

The RW 1120 is conduction cooled. In order not to exceed the maximum permissible temperature of the tube case of 115 °C (see page 6) it is necessary to mount additional heat sinks to the tube case (on the mounting planes) or to cool the case by a slight air flow.

Starting

For safe handling of the equipment, the tube case must be properly grounded.

1. Connect of supply leads.
   The collector connection is soldered to the tag of the tube case. The other voltages are applied to the tube case via the supply cable. The individual leads are color-coded as follows:

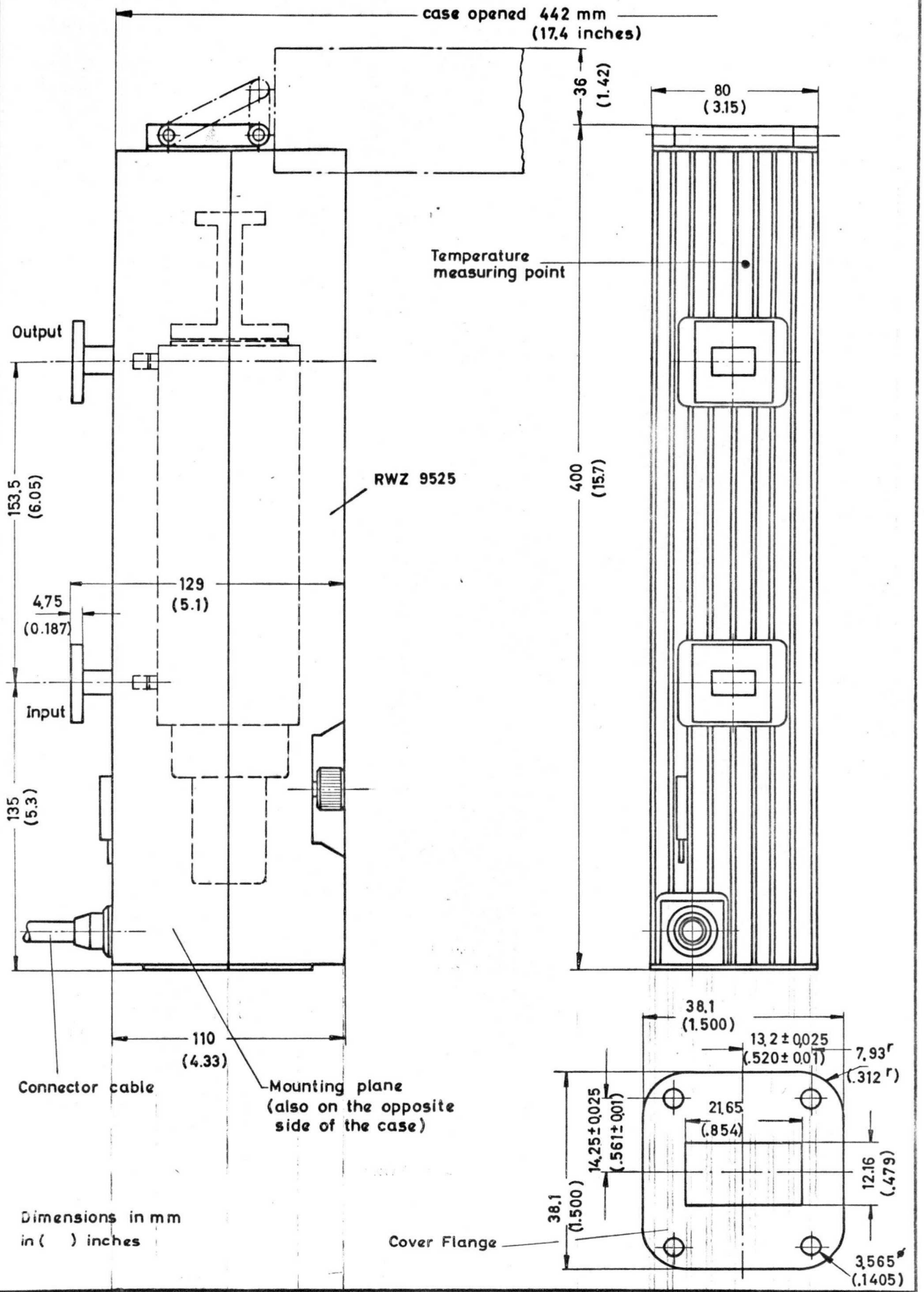
Heater	f	:	brown	
Heater	f	:	brown-yellow	+)
Cathode	k	:	yellow	+)
Grid No. 1	g1	:	green	
Grid No. 2	g2	:	blue	
Helix	h	:	orange	

+) connect heater to cathode!

2. Insert the tube in tube case. Connect the plugs of the tube leads to the appertaining sockets.
3. Apply heater voltage and preheat tube.
4. Apply collector voltage.
5. Switch-on helix voltage before grid No.2 voltage (or both voltages simultaneously). Make sure that full voltagesare applied immediately and not increased gradualy to full value .
6. Adjust cathode current by varying Grid No. 2 voltage.
7. Apply rf input signal and readjust helix voltage for optimum gain at specified power output.

Switching off

The operating voltages can be switched off either simultaneously or in the reverse order to that in which they were applied.



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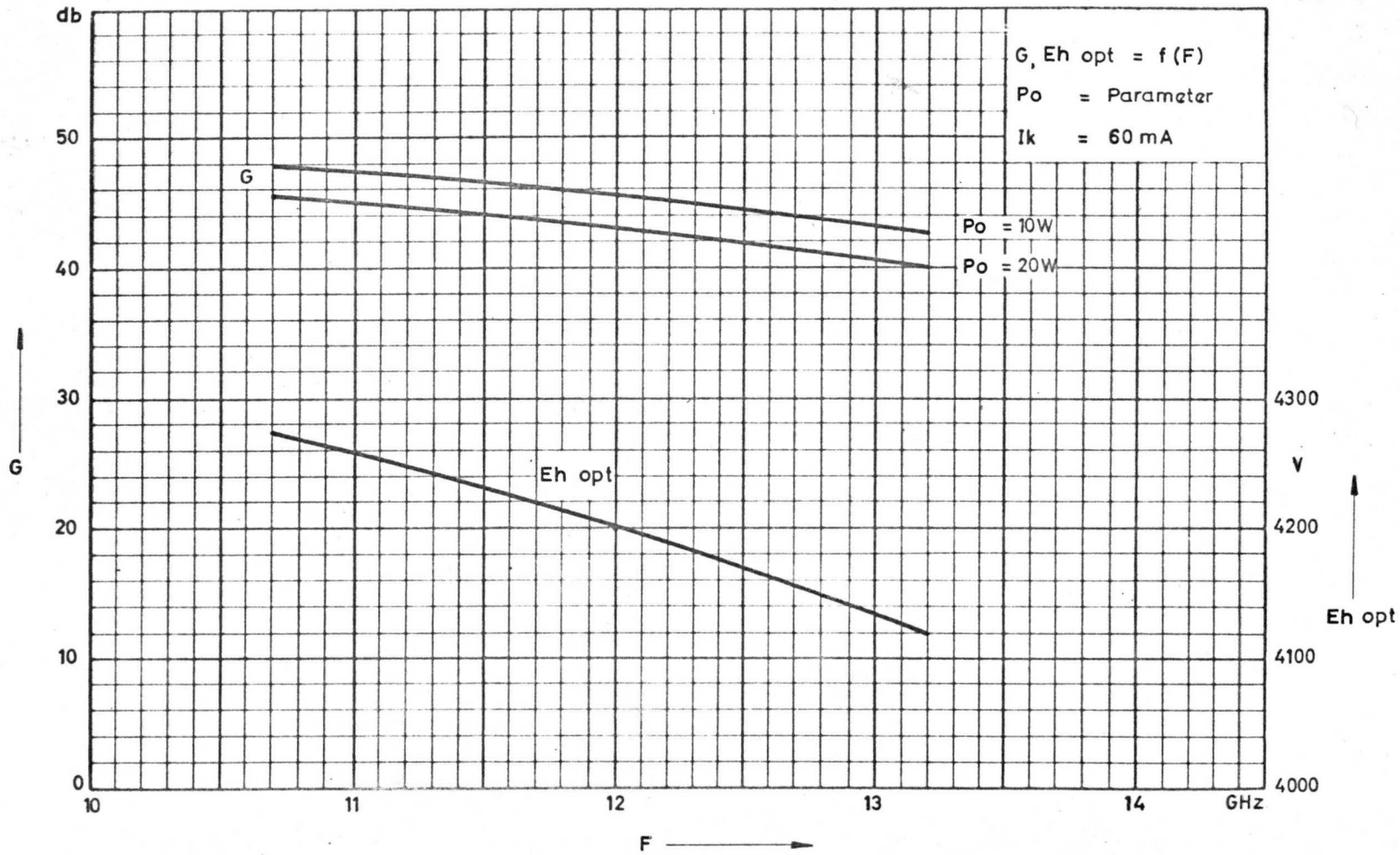

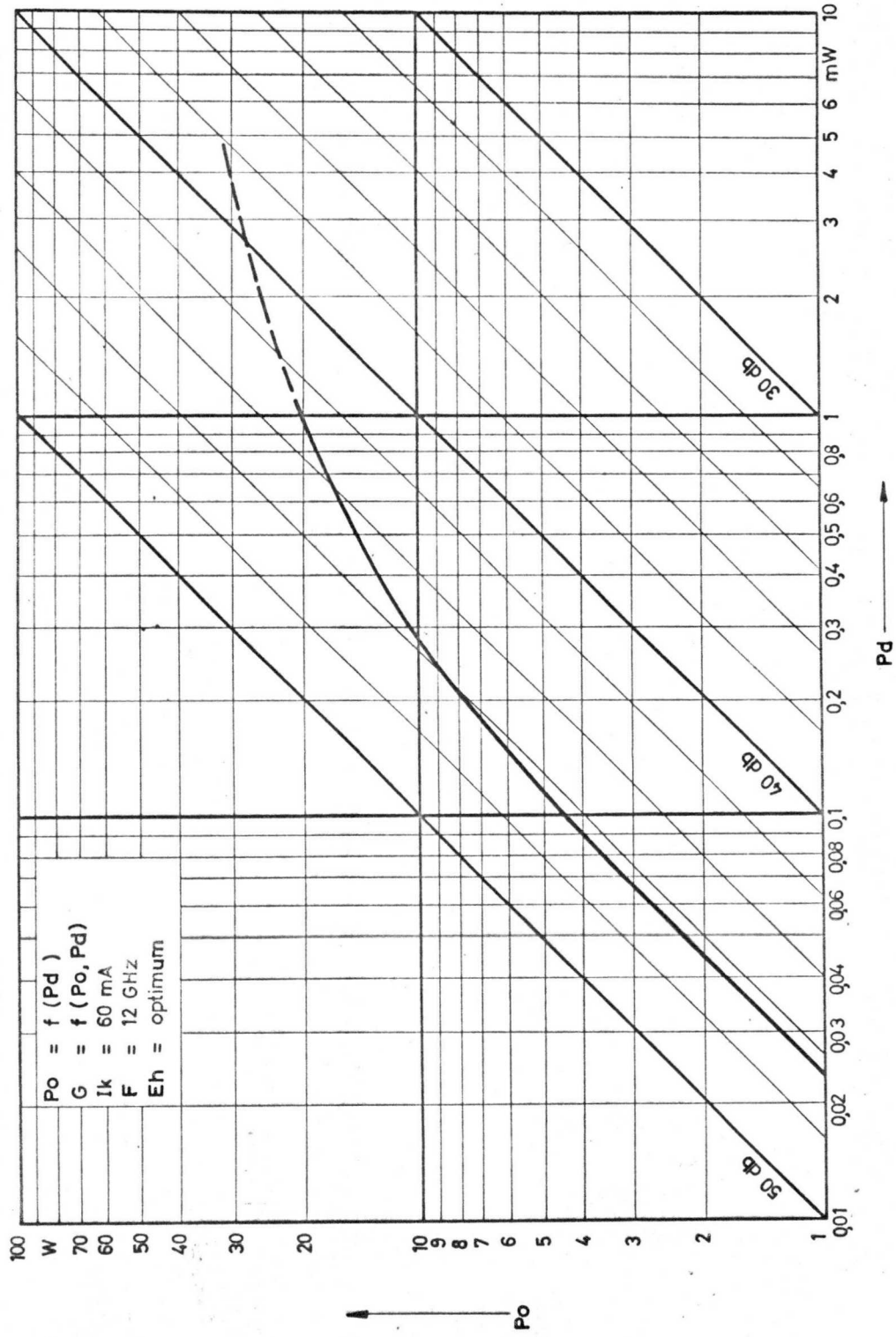

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RW 1120

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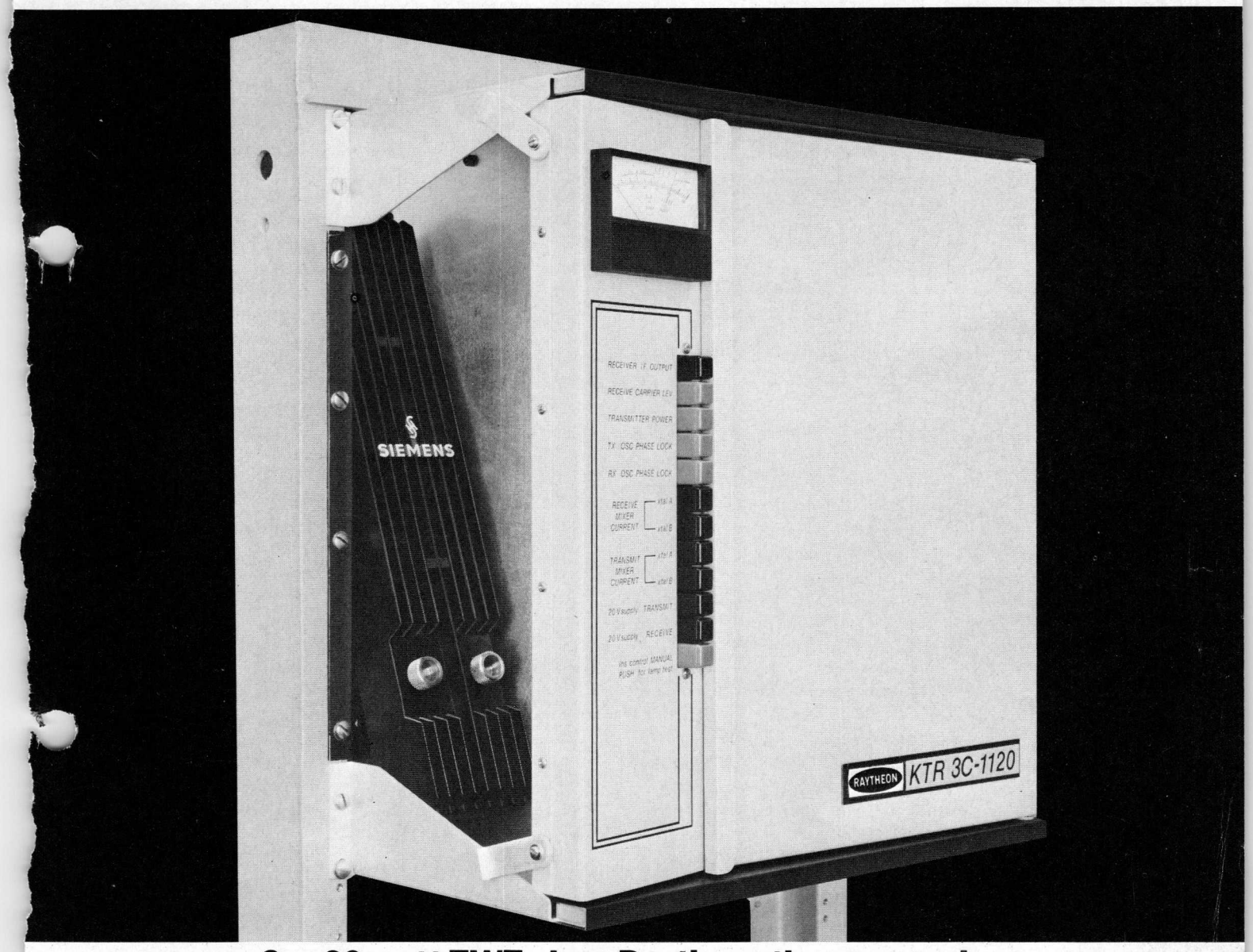

Our 20-watt TWT gives Raytheon the power edge in the 10.7 to 13.25 GHz bands.

RW 1120 Siemens 20-watt traveling wave tube.

For the most powerful microwave link system in the 10.7 to 11.7 GHz common carrier band, Raytheon selected the most powerful traveling wave tube, the Siemens RW 1120.

The new tube will handle up to 1800 voice channels. Has a noise figure of 25 db at 20 watts CW output. The average life is in excess of 20,000 hours.

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