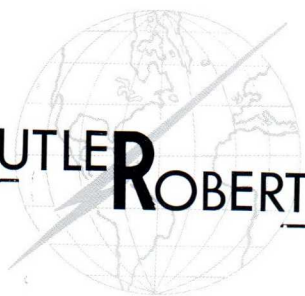
RADAR IMAGE
OF BALANCED BEAUTY

(High Resolution Power of Radar)

BUTLER ROBERTS ASSOCIATES, INC.
500 S. E. 24th STREET
FT. LAUDERDALE, FLORIDA 33316
(A Subsidiary of OKI Electronics of America, Inc.)



BUTLER ROBERTS ASSOCIATES INC.

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A Subsidiary of

ELECTRONICS OF AMERICA INC.

The Research Department of OKI Electric Industry Company, Ltd. of Japan has recently developed a radar of high resolution using a wavelength of 8.6 mm. Experimental demonstrations as far back as September 1959 confirmed the practicality of this wavelength for high definition radar purposes. This equipment, known as CPSH Radar, is now in production and among the many applications for which it has been used are the following:

(1) Harbor Radar
(2) Airport Surface Detection Equipment (ASDE)
(3) Railroad Marshalling Yard Control Radar
(4) Precision Survey Radar
(5) General Surveillance Radar for Restricted Areas

The purpose of this pamphlet is to demonstrate the difference between the OKI high-resolution radar image and images obtained with conventional radar operating at wavelengths of 10 cm. and 3.2 cm. respectively. For the purposes of comparison, two standard marine radar units were operated alongside the OKI CPSH Unit, on the roof of the OKI Shibaura factory. The three different radar images obtained are shown on the next page.

The first picture, showing the image obtained with 10 cm. is unsatisfactory. It is difficult to interpret the image; at this short range, radial aberration is considerable.

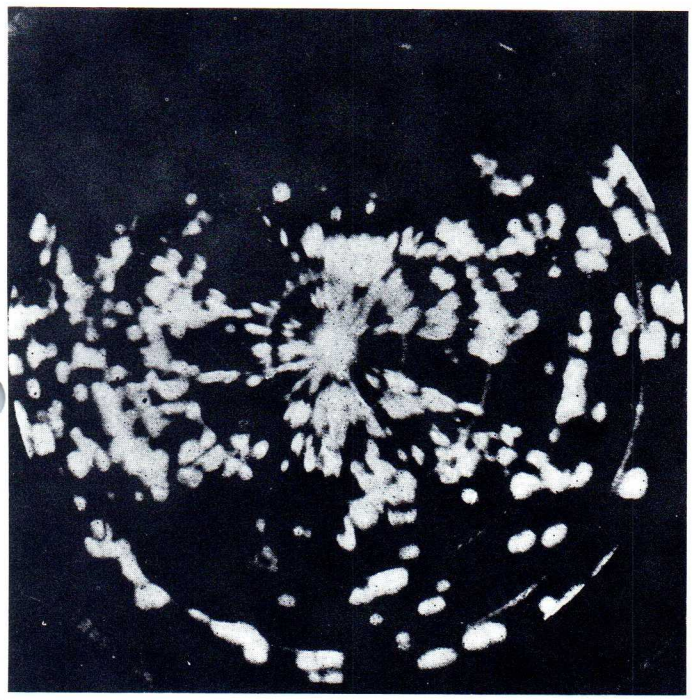
The second picture, showing the image obtained with 3.2 cm. is somewhat better, it now being possible to distinguish land areas from water areas and indications of ships anchored are just discernible. However, detail is lacking and the image is of doubtful practical value.

The third picture, however, shows the image obtained with the OKI 8.6 mm. radar. The clarity and detail are comparable to those of an infrared photograph. Details are especially clear and very small objects can be observed. Comparison with the Reference Chart showing the same area enables the railroad to be clearly seen. At the lower left part of the picture there is a stretch of land covered with grass. Note that the entire surface of this grassy area is bright, as millimeter waves are reflected even by such minute objects as individual blades of grass. At the extreme lower right corner of the picture, three rows of ships in Tokyo Harbor can be clearly seen. Even the buoys to which many of these ships are secured can be distinguished.

On a following page appears an enlargement of the image obtained with the OKI 8.6 mm. radar showing Yokohama Harbor. Following this photograph is the Reference Chart showing the plan of the Harbor. Please note the extreme detail visible in this picture; in the upper right quadrant it is easily possible to discern the two smokestacks of a vessel, together with the buoy to which it is moored. (A separate photograph taken directly from the cathode ray tube is also enclosed herein; it also shows the Harbor at Yokohama, at the moment when a vessel is being assisted through the Harbor entrance by two tugs.)

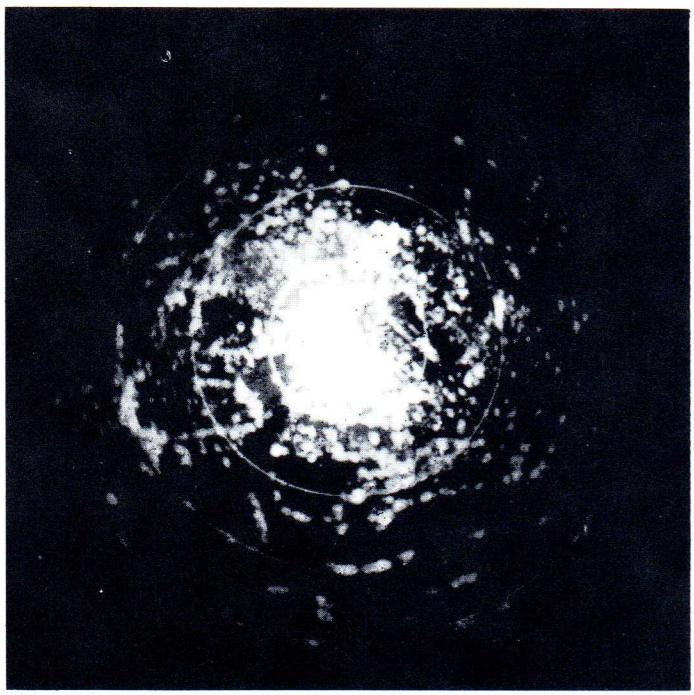
To gain this extremely high resolution, two essential factors must be considered. For high azimuth resolution, a sharp antenna beam is required, while for high range resolution, short length of transmitted pulse is vital. A balance of resolution of azimuth and range is obtained by regulating beam width and pulse length; the result is what we have called "A Radar Image of Balanced Beauty", as seen on the screen of the OKI millimeter wave radar.

RADAR PICTURES and CHART
around OKI ELECTRIC INDUSTRY SHIBAURA FACTORY



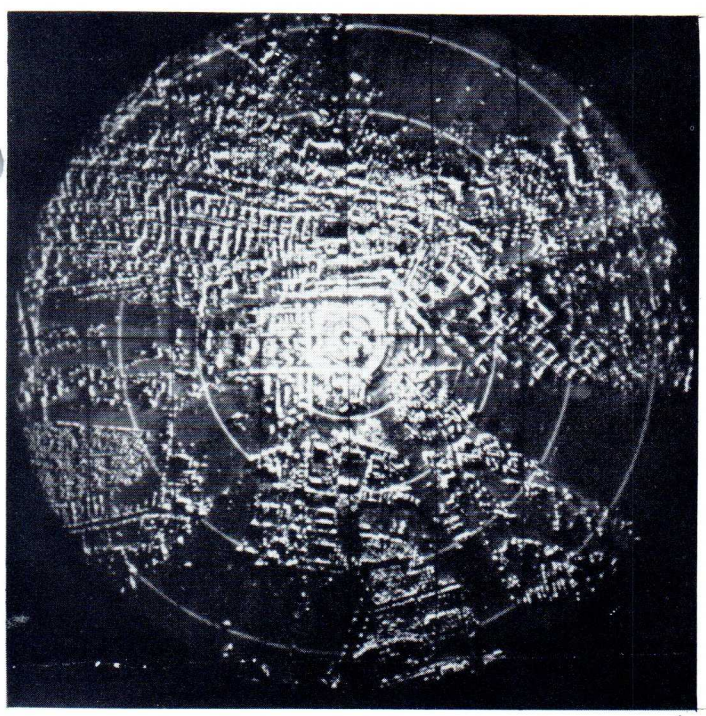
①

TYPE	WAVE LENGTH	RANGE	BEAM WIDTH	PULSE LENGTH
CX-1197	10 cm	1 mile	3¼°	0.4 μs



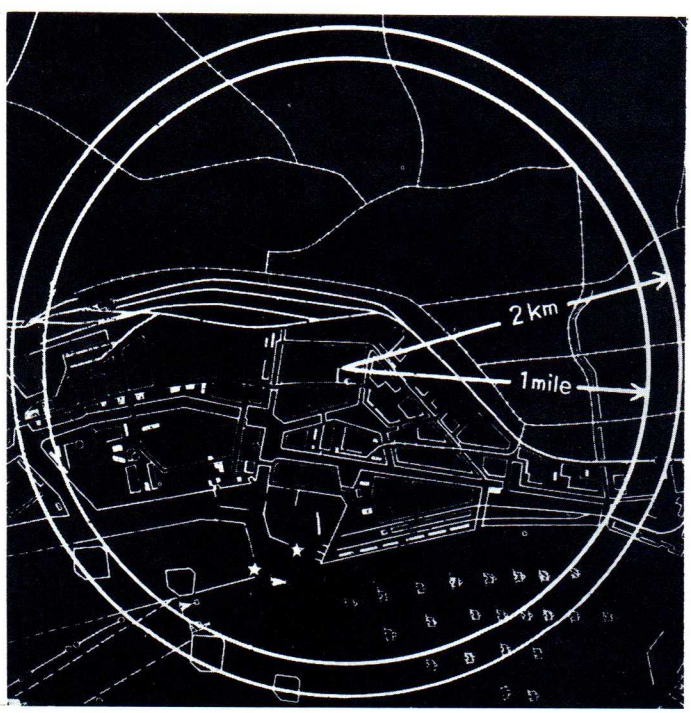
②

TYPE	WAVE LENGTH	RANGE	BEAM WIDTH	PULSE LENGTH
12	3.2 cm	1 mile	1.2°	0.1 μs



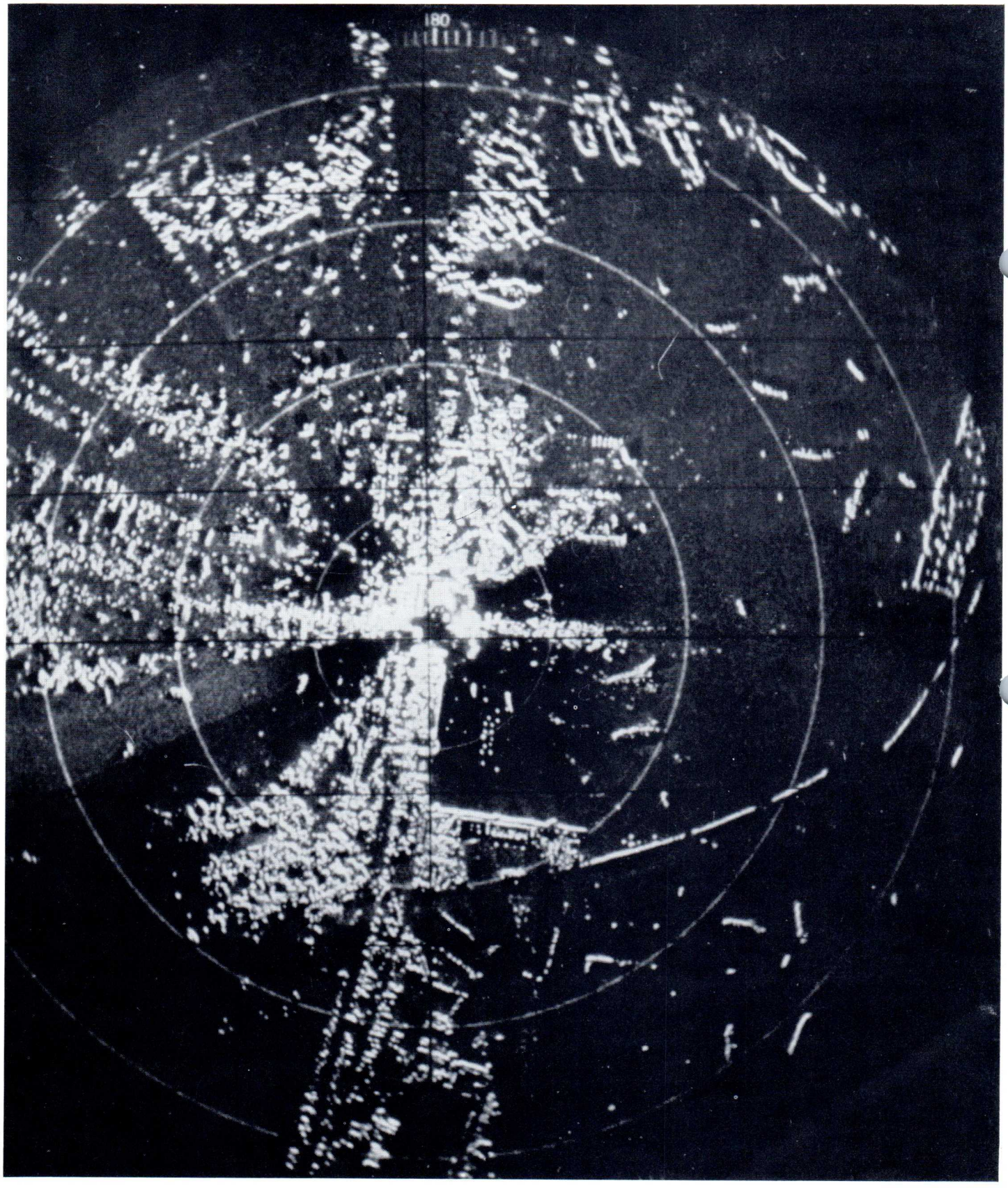
③

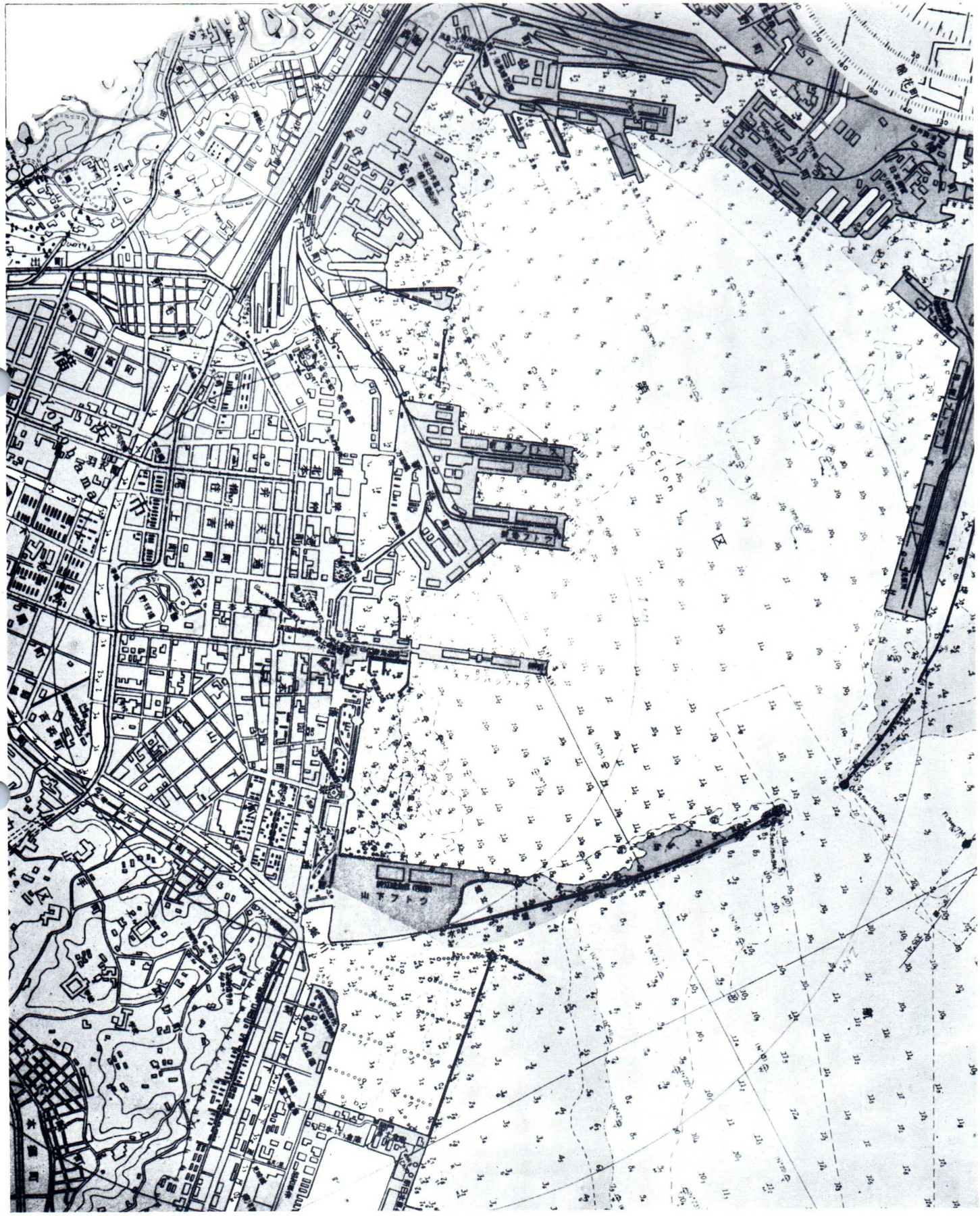
TYPE	WAVE LENGTH	RANGE	BEAM WIDTH	PULSE LENGTH
CPSH-1	8.6 mm	2 km	16′	0.05 μs



④ CHART

RADAR IMAGE OF BALANCED BEAUTY
of 8.6mm wave High-Resolution Radar CPSH-1
showing Yokohama Harbor, radar range 2km




Section I
山下フトウ

OKI ELECTRIC INDUSTRY COMPANY LTD.

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AUTHORIZED OKI DISTRIBUTOR

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MILLIMETER WAVE METEOROLOGICAL RADAR FOR MEASUREMENT OF CLOUD DENSITY

MODEL CPM-5

OKI ELECTRIC INDUSTRY CO., LTD.

TOKYO JAPAN

Fig. 1

MILLIMETER WAVE METEOROLOGICAL RADAR

FOR MEASUREMENT OF CLOUD DENSITY, MODEL CPM-5

1. PREFACE:

The radar has now become an indispensable means in the meteorological observation and research. The radar has enabled the meteorologist to make an exact forecast of hurricanes and contributed immensely to the prevention of calamities.

One of the greatest meteorological advances has been realized by the introduction of this powerful means which enabled the three-dimensional dynamic meteorological observation, and is led to the creation of a new branch of meteorology, radar meteorology.

So far the meteorological radars have been making use of the wave lengths of 3.2 cm, 5 cm and 10 cm being selected the optimum wave-length depending on the observed objects and the distance range.

These conventional radars aim at the observation of rainfall only, and it has been hardly possible to catch the cloud and the mist, since the far smaller particles of cloud and mist can only reflect the wave by such weak degree that the radars cannot sense the reflected wave.

However, by using a further shorter wave length, the reflection from the particles of cloud and mist increases in a steep speed. Suppose the wave length of 8.6 mm is used, the reflection factor is increased by about 200 times in comparison with the transmission by 3.2 cm wave length. In other words, the same effect is obtained as when the output of the 3.2 cm transmitter is multiplied by 200 times.

Since long has been known the fact that the use of millimeter wave will enable the observation of cloud, mist etc., but due to a lack of the stable millimeter wave generator a practical millimeter wave radar for observation has not been so far available.

Our company had made a first start of the development of millimeter wave technology in Japan and has being kept the leadership since then. And recently we have succeeded in the completion of 8.6 millimeter radar for measurement of cloud density for the first time in Japan, and is being put into service in National Meteorological Laboratory.

Specially designed for observing precipitation growth, the radar has some differences from the ordinary radars.

Namely, two antennas for transmitter and receiver are installed a few meters away from each other with the front face toward the sky. The gradual changes of the condition of clouds are automatically recorded on the papers with extreme exactness.

2. OUTLINE OF CPM-5 (DESIGNATED MRI-MR60-0 BY NATIONAL METEOROLOGICAL LABORATORY):

As shown in Fig. 2, this equipment is composed of two antennas, transmitter, receiver, modulator, and indicator units.

As they are installed outdoors, two antennas have each water-, snow- and dust-proofed covers made of polyester on the parabolic reflectors. At the under part of each antenna, water-proofed rack including transmitter or receiver is located as seen in the Fig. 1 at the rear of the front cover.

The modulator is designed to be installed on the floor indoors and the indicator is located on the floor of the observation room.

The former is used to pulse-modulate the transmission wave and the latter, to make exact quantative measurement of reflected waves from the clouds.

And the indicator self-contains logarithmic amplifier, range-correction circuit, AGC circuit and iso-echo circuit, in addition to facsimile recorder.

The AGC circuit is provided in order to keep constant the overall gain including the transmitting power and the receiver gain.

The most outstanding feature of this equipment is its recording method. By using this, we can record any one of the signals obtained from the linear amplifier, the logarithmic amplifier, the range correction circuit, or iso-echo circuit. Each of such signals can also be automatically shifted by turns at the interval of 30 seconds.

The effective range of measuring height can be selected to 5, 10, and 20 kilo-meters and the fixed height markers are indicated by dividing the height into 5 portions.

All of these observing conditions are automatically and distinctly recorded on the sides of the facsimile paper by means of the index markers, which enables us to obtain continuous recording automatically without any confusions about the data for subsequent studies.

3. PARAMETERS OF RADAR, MODEL CPM-5:

Frequency	35,000 Mc (wave length 8.6 mm, K-band)
Peak output power	32 kW
Antenna	Parabolic
Diameter	2.6 m
Effective area	1.2 m^2 (corrected by cover and wave-guide losses)
Beam width	15 minutes (between half power points)
Gain	53 db (corrected by cover and wave-guide losses)
Transmitter	
Magnetron	35 M1 0 (manufactured by Oki)
Pulse width	0.5 μs
Pulse repetition	500 p.p.s.
Overall VSWR	1.5
Modulator	Line type pulser
Receiver	
Minimum detectable power	-87 dbm
Noise figure	19 db
Mixer	Balanced type
Overall VSWR	1.6
Klystron	35V11 (manufactured by Oki)
Frequency control	Automatic
Gain control	Automatically controlled by transmitter pulse
Iso-echo	
Slicing levels	7 levels at intervals of 6 db (holding time per step is 30 second when operated automatically)
Limits of the height range correction	0.2 - 5 km (height - 5 km) 0.2 - 10 km (height - 10 km) 0.4 - 20 km (height - 20 km)
Fixed hight markers	1 km intervals (height - 5 km) 2 km intervals (height - 1 0 km) 5 km intervals (height - 20 km)
Recorder	
Type	Facsimile
Sweep convertor	Travelling gate method
Fascimile sweep speed	25 cm/sec.
Sending speed of paper	5 mm/min. (6 lines/mm)
Width of paper	28 cm
Length of paper	15 m per role

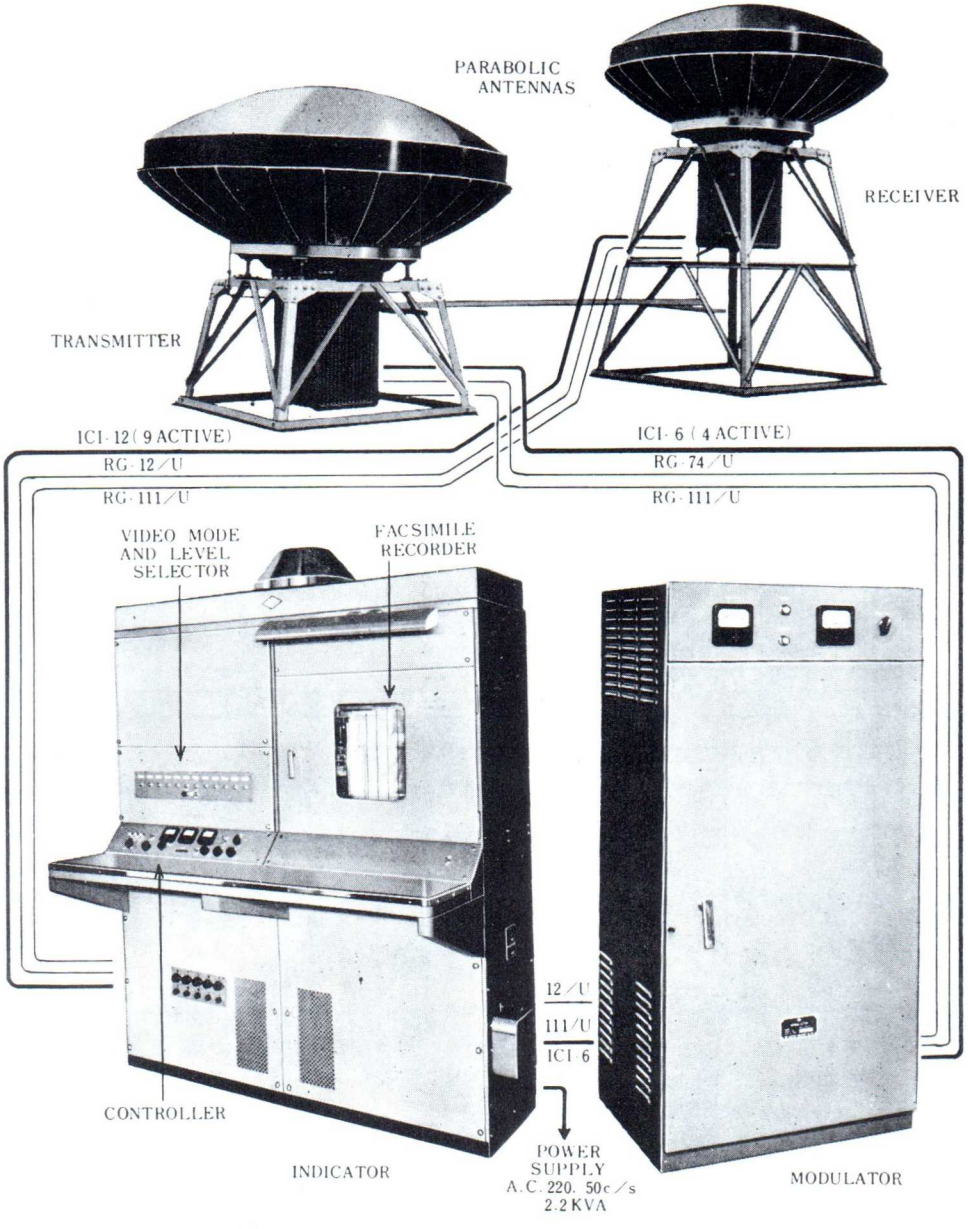
Recording unit:

System	Facsimile
Scanning speed change	Uses running gate
Paper feeding speed	5 mm/p.min.
Facimile scanning speed	25 cm p.sec.
Recorded paper	15 m (a roll)

4. DETECTABILITY OF CLOUD AND SOME EXAMPLES OF RECORDS:

Fig. 2 shows the detectability of this equipment, and Figs. 3, 4 and 5 show some examples of records.

In particular, the Fig. 5 indicates the representative mechanism of precipitation growth. In the case, the line drawn at 2500 meters in altitude shows the zero zone in temperature.



MRI-MR60-O/CPM-5

Fig. 2

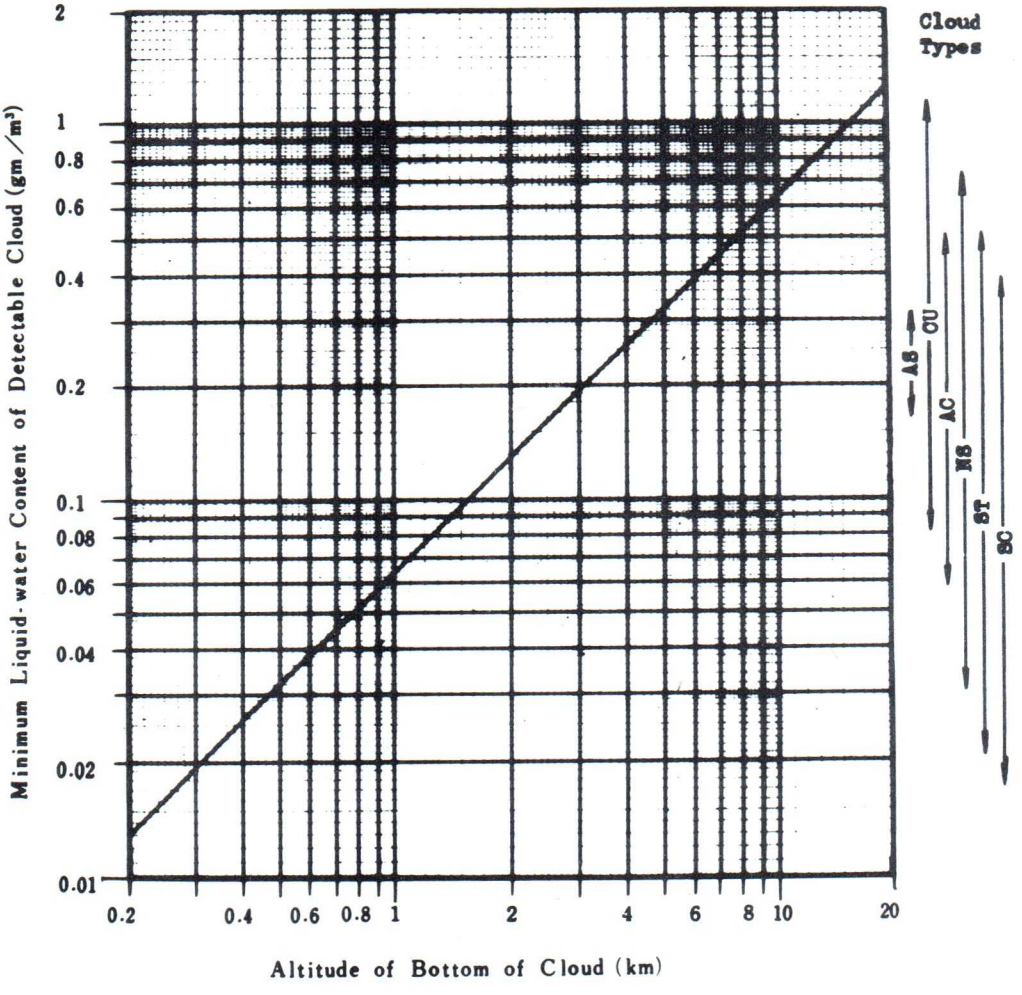

Minimum Liquid-water Content of Detectable Cloud (gm/m³)
2
1
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
Altitude of Bottom of Cloud (km)
Cloud Types
AS
CU
AC
NS
ST
SC

Fig. 3

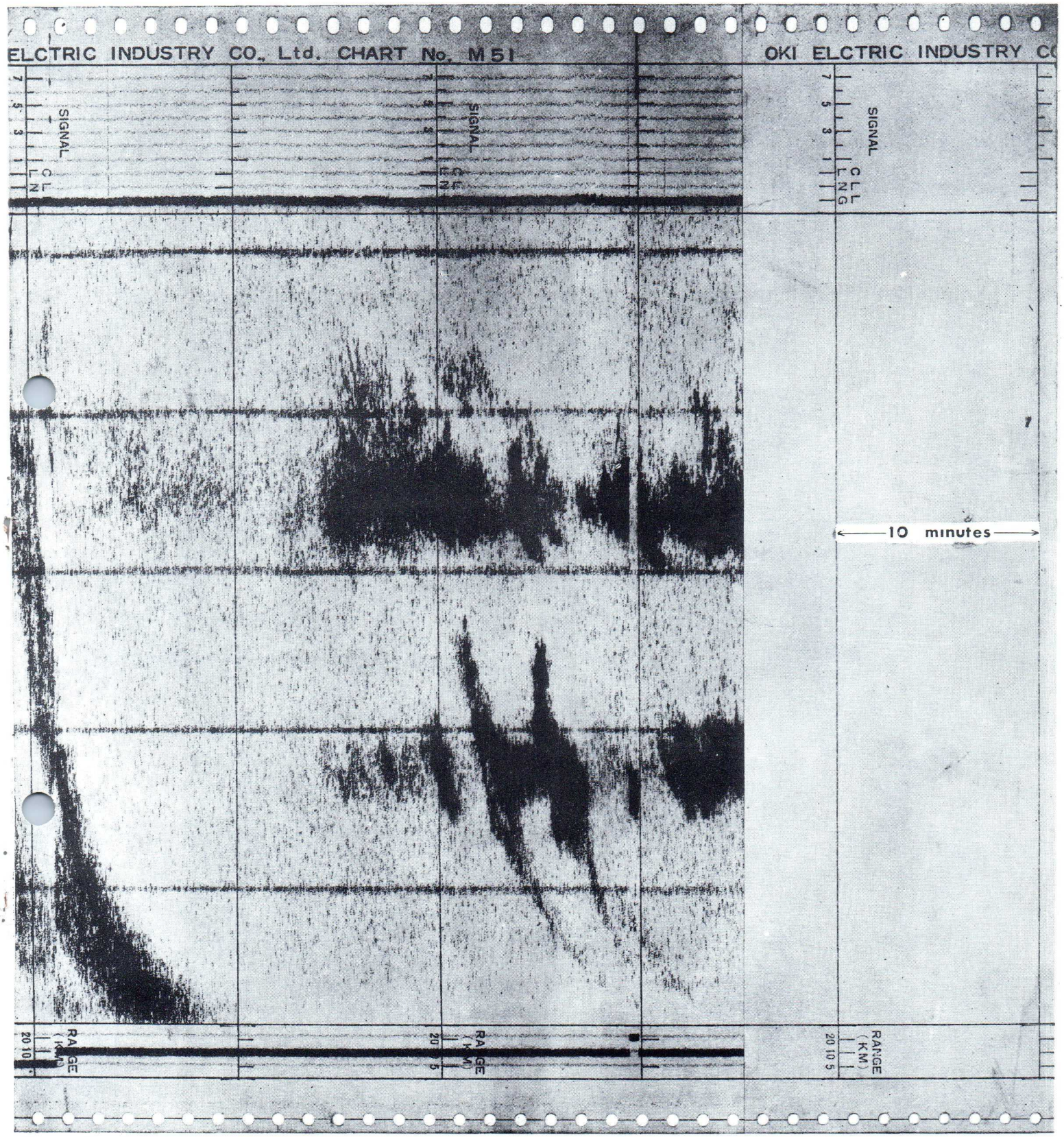

ELCTRIC INDUSTRY CO., Ltd. CHART No. M51
OKI ELCTRIC INDUSTRY C
SIGNAL
SIGNAL
SIGNAL
10 minutes
RANGE (KM)
RANGE (KM)
RANGE (KM)

Fig. 4

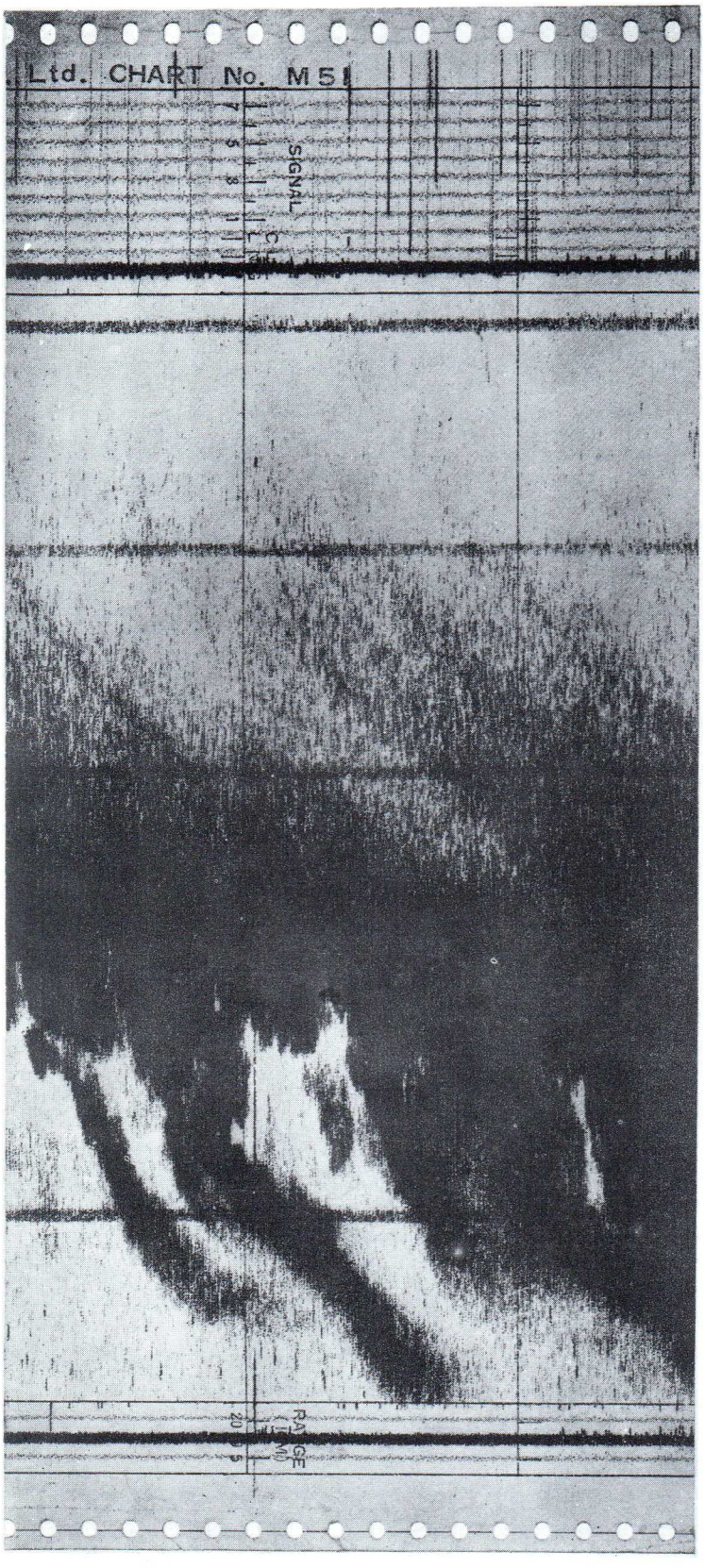


Fig. 5

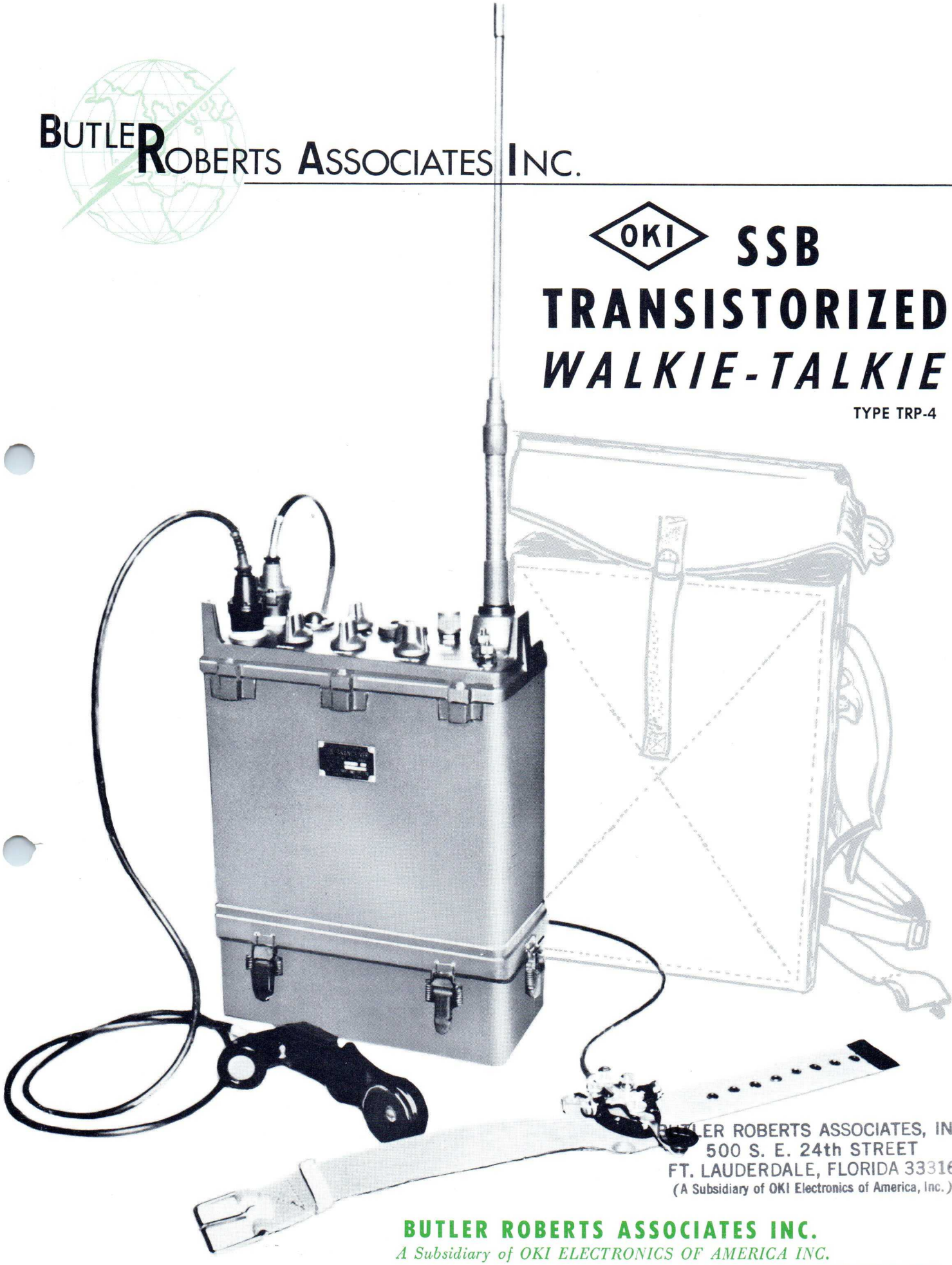
Fig. 6

BUTLER ROBERTS ASSOCIATES INC.

OKI

SSB TRANSISTORIZED *WALKIE-TALKIE*

TYPE TRP-4



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MIAMI SPRINGS, FLORIDA

Radio set Type TRP-4 is a newly developed HF band single sideband walkie-talkie type transmitter/receiver which has introduced totally new concepts into portable radio communication services.

Originally designed and intended for military use, it is housed in a rugged, compact case, and is designed for maximum ease of operation and high standards of performance. However, it is also proving highly successfully in other fields of service, such as police, survey, exploration, forestry, and the like. The set is small in size (about $5^1/_2'' \times 10^1/_2'' \times 15^1/_3''$) and is light in weight, the complete set weighing only 30 pounds. Following are some of the outstanding features of the TRP-4.

1. **Use of High Frequency Single Sideband in Portable Communication Service :**

   Use of the SSB system for portable service extends the operating range very considerably. In radio telephony a range of about 20 kilometers can be covered when using the whip antenna, while 100 kilometers or more can be expected when using the dipole, doublet or quarter-wave antenna.

2. **Six Preset Channels :**

   The TRP-4 permits the use of up to six preset telephone / telegraph channels in the frequency range of 2.5 to 7.5 megacycles, these channel usually being factory tuned to customer's frequencies. Crystal control assures " big set " sensitivity and frequency changes can be made rapidly by means of the channel switch on the control panel.

3. **Easy Tuning :**

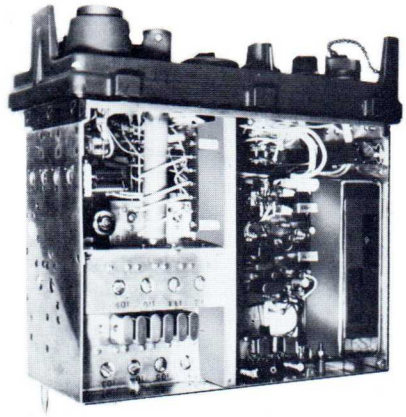
   Antenna tuning is provided automatically by operation of the channel switch, when using the whip antenna. When a dipole or quarter-wave antenna is used, the antenna length is adjusted by connecting or disconnecting the antenna plug and jack cannectors for optimum performance (See " Antenna Installation "). A meter on the control panel provides dual functions, usually serving as an indicator of battery condition. However, when the system switch is turned to " tuning " position, it then serves as an antenna tuning indicator for use in conjunction with the antenna tuning knob.

4. **Transistorized Circuits :**

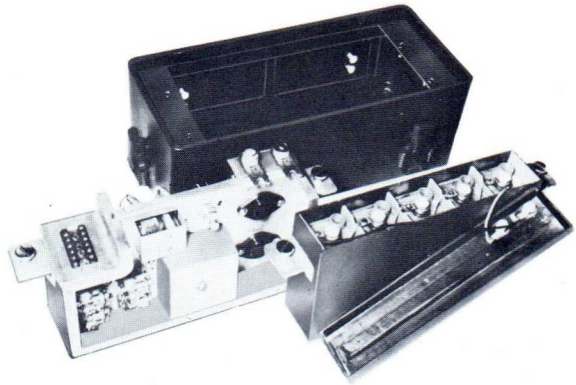
   The set uses transistors in all but the power amplifier stage. Main circuits are print-wired. Combined with other carefully selected miniaturized high-quality parts, the use of transistors substantially reduces size and weight, at the same time ensuring high reliability and low power drain.

5. **Heat Insulation :**

   To protect transistors, the set is insulated from heat by a bag (shown on front cover) which guarantees normal operation in ambient temperatures of up to 90°C. This heat-shielding bag also serves to absorb impact and vibration and is, in addition, water-repellent.



RF/AF UNIT



TRANSISTOR POWER AND BATTERY UNITS

6. Tropicalized Finish :

The TRP–4 is especially designed for use in tropical areas, where combinations of extreme heat, high humidity, insects, etc. are prevalent. The unit is provided with moisture-absorbing chemicals inside the chassis section to ensure protection against sudden changes of ambient temperature in high humidity areas.

7. Rechargeable Long-Life Battery :

The battery is of the nickel-cadmium rechargeable type, of non-spillable construction. It can, therefore, be used in complete safety in any position. It provides up to 10 hours of continuous operation with a duty cycle of 1 transmit to 5 receive.

8. Wide Range of Accessories :

To accommodate the many and varied uses for the TRP–4, a number of specially designed accessories are available.

The standard TRP-4 consists of the following items :

Insulated carrying bag.
Press-to-talk handset. Type JH–33/PT.
Accessory bag. Type 5672–1.
Whip antenna, Type 5672–8
Whip antenna flexible mounting. Type 5672–7.
Instruction book.

Following are the optional accessories also available at extra cost :

Monitoring handset, identical to above. Type JH–33/PT (for second operator etc.).
Headset. Type JH–63/U and JAN–CSA–6.
Morse key on belt. Type JJ–37.
Half-wave doublet antenna and feeder. Type TRX–435.
Quarter-wave antenna and counterpoise on reel. Type TRX–436.
Bags for above items.
Battery charger. Type TRX–611

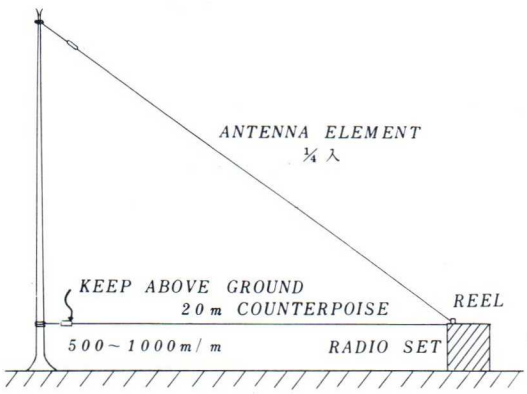
Operating Range and Antenna Installation :

The antenna system selected, combined with location of the set, will determine the effective range of the TRP–4.

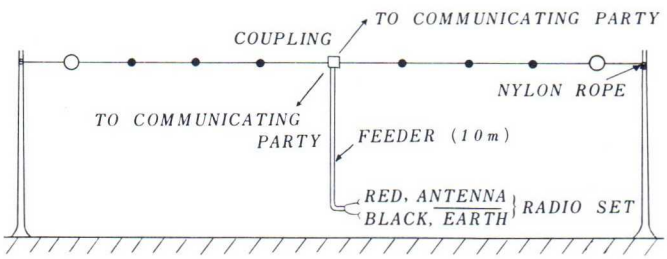
By using an inclined quarter-wave antenna or a half-wave doublet, range can be extended. Typical examples of suitable antenna installations are shown below.

As mentioned previously, when the TRP–4 is used as a portable unit with the whip antenna, the effective range is approximately 20 kms. However, when using a doublet antenna, as shown above in the second drawing, point-to-point communication can be obtained over distances up to 100 kilometers. Naturally this range can vary considerably depending upon propagation and topographical conditions.

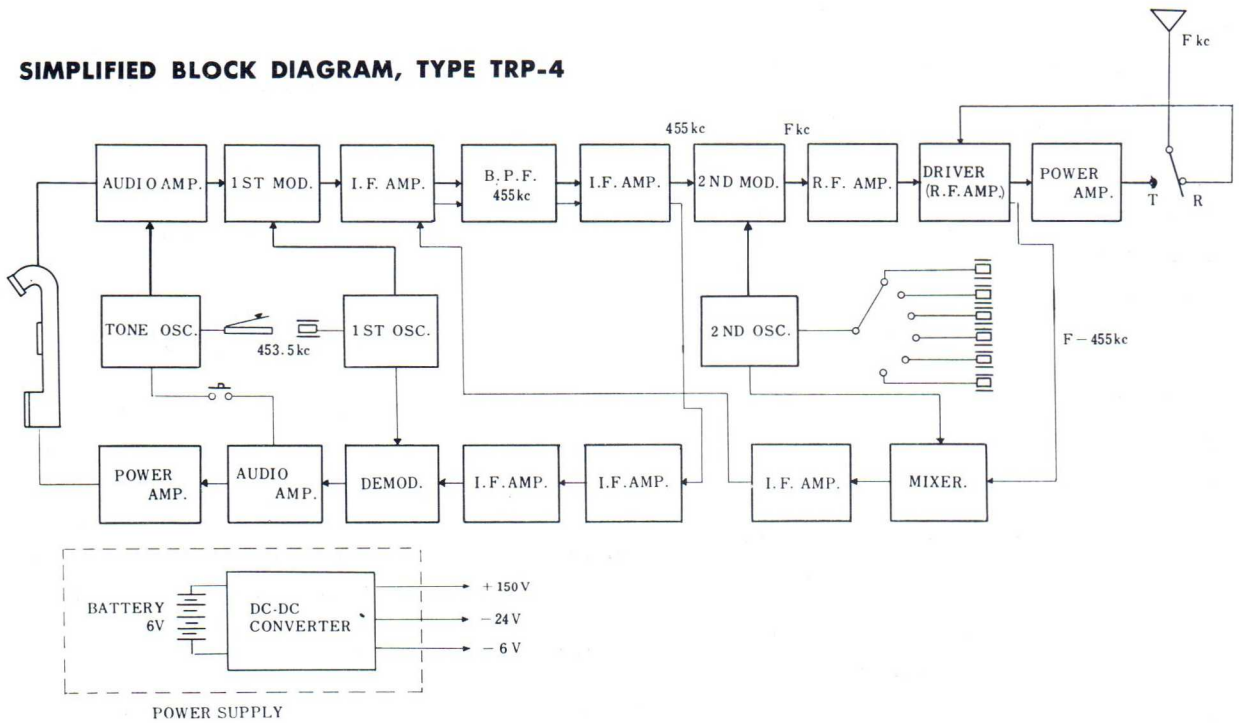
In using **inclined quarter-wave** antenna :



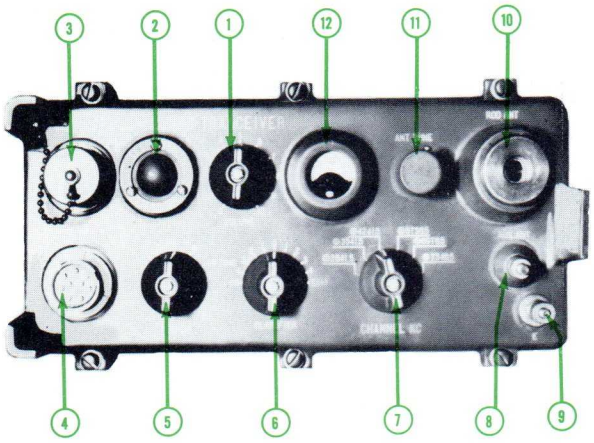
In using **horizontal half-wave doublet** antenna



SIMPLIFIED BLOCK DIAGRAM, TYPE TRP-4



Control Panel:



① Volume control

② Test tone switch ; keys 1500 CPS tone

③ Bayonet connector, monitor use

④ Bayonet connector, operator use (connected to headset and/or handset)

⑤ System switch. Permits selection of functions "OFF", "REC", "SEND A1", "RT", and "ANTENNA TUNING".

⑥ Clarifier ; adjusts receiver to obtain maximum clarity of signal.

⑦ Channel switch for selection of one of 6 channels.

⑧ Earth terminal.

⑨ Auxiliary antenna terminal ; used with doublet or quarter-wave antenna.

⑩ Whip antenna flexible mounting connector.

⑪ Antenna tuning control.

⑫ Meter ; a 10 volt DC voltmeter to show battery condition and antenna tuning.

Specifications :

General :	
Frequency range	2.5–7.5 Mc
Channel	6 preset channels
Communication System	Simplex ("Push-to-talk" telephone, r telegraph)
Transmitter :	
Power Output	A3J (PEP) 2w $^{+20\%}_{-50}$ A1 (PEP)
Frequency tolerance	50 c/s in 4 Mc or less 90 c/s in more than 4 Mc
Transmitted sideband	Upper sideband
Frequency bandwidth	Within 3 kc, A3J Within 0.5 kc, A1
Supurious radiation	More than 40 db
Overall distortion	less than −20 db at 25% of output.
Receiver :	
Receiving system	Superheterodyne
Sensitivity	Better than 3 μ V for 10 mw audi output with 20 db signal-to-noise ratio
Image ratio	More than 40 db at less than 5 Mc
Selectivity	6 db, bandwidth 2–3 kc 60 db, bandwidth 6.5 kc
Power Supply :	
Battery	6 volts. (1.2 volts × 5)
DC-DC converter	Input DC 6 volts. Output DC 150 volts. 30 mA DC 24 Volts. 10 mA
Battery drain	Reception 6 volts. 0.04 amps. Transmission 6 volts. 1 amp.
Dimensions : Weight :	$5^1/_2'' \times 10^1/_2'' \times 15^1/_3''$— (138 × 268 × 390 mm) 17.6 (lbs) (8 kgs) approx. (without accessories)

For improvement we reserve the right to change specifications without notice.

TOKYO OKI JAPAN

ESTABLISHED 1881

MAIN PRODUCTS & SERVICES

TELEPHONE EQUIPMENT	Ordinary Telephone : Automatic, Common Battery, Magneto Special Telephone : Portable, Marine, Anti-explosion, Sound Powered
TELEPHONE SMITCHING EQUIPMENT	Automatic & Manual for Private & Central Switching Equipment, Attendant Board, Toll Board, Information Board, Dispatching Telephone system
TELEGRAPH EQUIPMENT	Teletypewriter : Page & Tape Type Telex Subscriber's Set Office Equipment for Telegraph Service
TELEGRAPH SWITCHING FQUIPMENT	Telegraph Switching Equipment : Automatic & Semiautomatic type
BUSINESS MACHINES	Electronic Computer & Input-output Devices I. D. P. System Equipment P. C. S. Related Equipment Other Automation Fquipment
RADIO EQUIPMENT	HF Transmitter & Receiver : FS, SSB, DSB Type VHF, UHF Transmitter & Receiver : AM, FM Type Broadcasting Equipment : Transmitter, S. T. Link & Studio Equipment Radar Equipment : Marine Radar Millimeter Wave Radar
TRANSMISSION EQUIPMENT	Cable & Open Wire Carrier Equipment Microwave & Multiplex Equipment
OTHER EQUIPMENT	Tape Recorder Electron Tube : Klystron, Magnetron Interphone System Public Address System Echo Sounder & Listening Device Electric Clock System Automatic Fire Alarm System : Private & Public System Mesuring Equipment : Standard Signal Generator, Frequency Meters, Field Intensity Mesuring Set, etc.
INSTALLATION MATERIALS	Cable, Mire, Insulator, Terminal Box, Telephone Protector and Other Miscellaneous Materials

PLANNING AND INSTALLATION OF ABOVE PRODUCTS

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NEW YORK 17, NEW YORK

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500 S. E. 24th STREET
FT. LAUDERDALE, FLA.

MAGNETO FIELDSCOPE TYPE WX-601C

NEW GAUSS METER

OKI electric industry co., ltd. TOKYO JAPAN

GENERAL:

Proton or lithium, when placed in a static magnetic field, resonates with a high frequency magnetic field applied across the static field at a right angle.

In this case, the following equation is established between the strength of the magnetic field (H in gauss) and the frequency of the hf magnetic field (f in cycle / second):

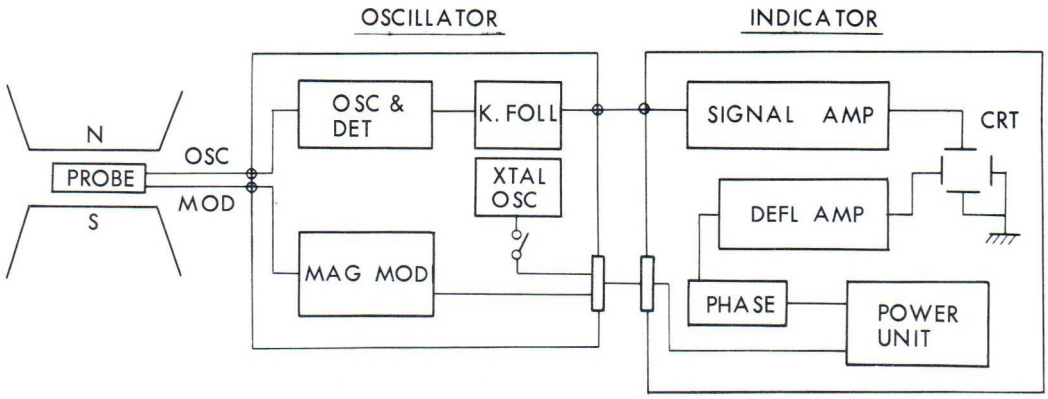
For proton resonance: $H = 2.3487 \times 10^{-4} f$

For lithium resonance $H = 6.0434 \times 10^{-4} f$

Magneto field scope is designed to measure the absolute strength of a magnetic field through the measurement of high frequency, making use of the nuclear resonance by proton or lithium.

This instrument is composed of probes, oscillator, indicator, and cable 2 meters (6 feet) long for interconnection.

Portable and easy to operate, this instrument is capable of measuring the strength of magnetic field with a high accuracy and free from magnetic influence.



OKI

ESTABLISHED 1881

10 SHIBA-KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN
TEL: TOKYO 501 3111 Cable Address: "OKIDENKI TOKYO"

DESCRIPTION:

1. Probe detects the magnetic strength. It contains sample (proton or lithium), and coils. Six probes are provided for ranges of magnetic strength.
2. Oscillator and detector feed a high frequency to the probe and detect the magnetic resonance. The probe is a part of the resonance circuit for the oscillator. The oscilllation frequency is changed by a vernier dial and is detected at the resonance.
3. Signal amplifier and CRT amplify the detected signal and display the absorption curve. Anexample of absorption Proton curve is shown below.
4. Crystal oscillator is used to calibrate the oscillation. For calibration, the calibration dial is adjusted to show on the CRT a zero beat pattern at respective calibration frequency.

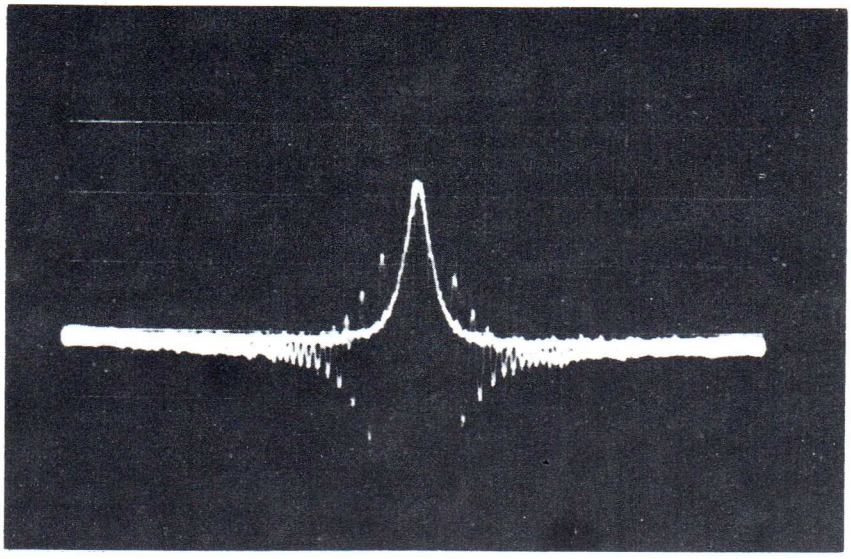
MEASUREMENT:

A probe is inserted in a magnetic field, and as the dial is adjusted, two absorption curves are displayed on the CRT. The curves are overlapped and moved to the CRT center, and the frequency is read from the dial.

The strength of the magnetic field is known from the frequency and the attached calibration charts.

SPECIFICATIONS:

1. Range of measurement 1,000 — 20,000 gausses
2. Oscillation frequency 4 — 33 mc / s
3. Accuracy 10^{-3} for measurement
   10^{-4} for calibration
4. Magnetic homogeneity
   required to be better than:
   5×10^{-2} (proton resonance)
   1×10^{-4} (lithium resonance)
5. Pole piece gap 10 mm (0.39″) minimum
6. Power requirement 115Vac 50 / 60 cps
7. Dimensions and weight
   Oscillator
   6.7″ X 6.7″ X 8.3″ 12 lbs
   Indicator
   6.7″ X 7.9″ X 11.0″ 17.7 lbs
8. Probe Dimensions
   3.0″ X 1.6″ X 0.39″
   Cable length
   37″ for #1—5 probes
   21″ for #6 probe
9. Display tubu CRT 3RP1A, 75 mm (3″) dia.



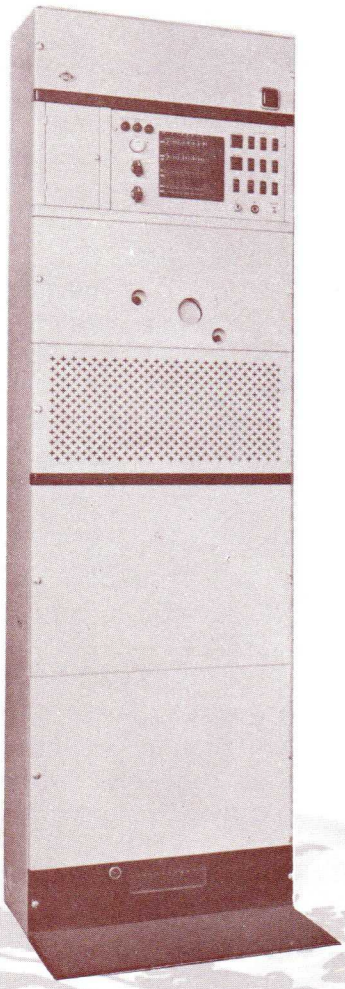
Proton Absorption Curve

BUTLER ROBERTS ASSOCIATES INC.

500 S.E. 24 Street Ft. Lauderdale, Fla. Telephone: 523-7202
202 East 44th Street New York 17, New York Telephone: MU 2-2989
Frank R. Thomas P.O. Box 1377 Santa Barbara, Calif. Telephone: WO 2-5917

BUTLER ROBERTS ASSOCIATES INC.

OKI 12,000 Mc. MICROWAVE SYSTEM



MODEL MRL-12P23 (12 VOICE CHANNELS)

BUTLER ROBERTS ASSOCIATES INC.

A Subsidiary of OKI ELECTRONICS OF AMERICA INC.

202 E. 44TH STREET
NEW YORK 17, NEW YORK

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA

OKI 12 Gc. BAND MICROWAVE COMMUNICATION EQUIPMENT

The 12 Gc. microwave equipment described herein has been developed by the OKI ELECTRIC INDUSTRY CO. LTD. to meet the requirements of government and industry for a relatively low-cost, limited-channel-capacity microwave system of dependable design and construction and capable of being installed, operated and maintained with a minimum of cost and inconvenience.

Selection of the 12,000 Mc. band offers many advantages, including availability of frequencies as compared to other crowded parts of the spectrum, and the feasibility of extremely high-gain antenna structures of reasonable physical dimensions.

The OKI Model MRL-12P23 system provides up to twelve telephone channels between any two points separated by as much as twenty miles, provided a clear "optical" path is available between the two antenna systems. Longer distances are possible with greater than normal elevation of the antenna systems by use of higher towers and/or natural topographic features. For all practical purposes however, twenty miles should be considered as the maximum desirable for any single "hop".

For longer circuit requirements, intermediate unattended relay stations may be installed utilizing normal microwave relay techniques.

EXPANDABLE CHANNEL CAPACITY

Although a maximum of twelve simultaneous voice channels may be used, lower channel equipment configurations are available, for eight, four or two channels. Furthermore, any one voice channel may be further subdivided to provide a number of separate teletypewriter circuits.

TRANSISTORIZED RELIABILITY

The complete carrier unit and all of the RF circuits excluding the higher power microwave tubes are transistorized for reliability, long life, compact design and ease of maintenance.

SIMPLIFIED CIRCUITRY

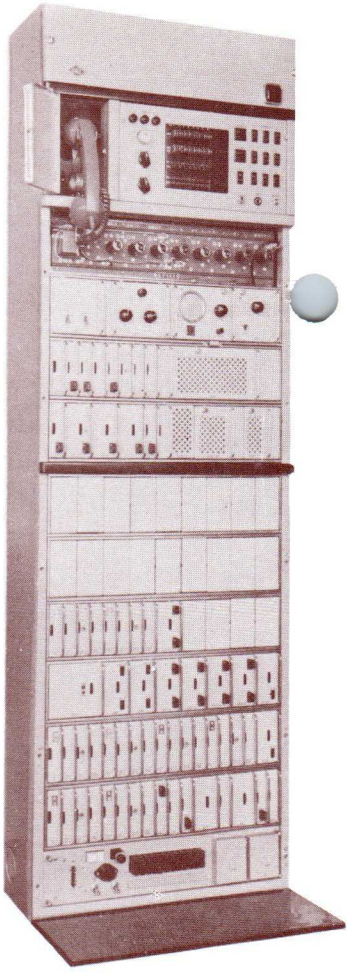
One tube serves both as the transmitter output and the receiver local oscillator. Separation of transmitted and received signals is improved by antenna polarization.

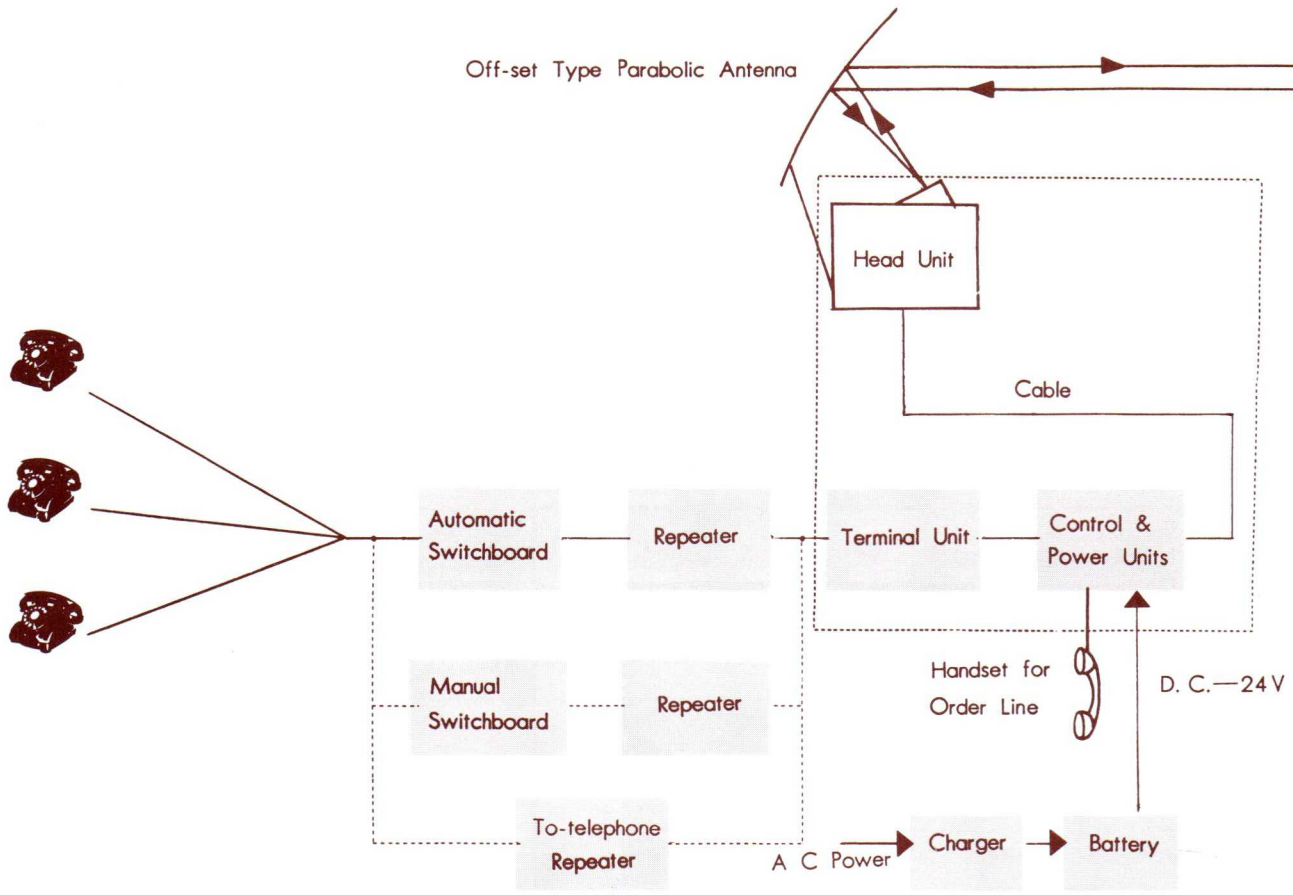
HIGH PERFORMANCE

Stabilized automatic frequency control (AFC) permits narrow band operation by precise monitoring of intermediate and center frequencies. Threshold suppression improves receiver sensitivity, lowering circuit drop-out level, minimizing down-time.

EMERGENCY OPERATION

Transistorization and lower power drain make operation possible from a 24 volt, DC battery which can be "floated" across the normal AC supply, to be used as a reserve in case of AC power failure.





TELEPHONE CONNECTIONS

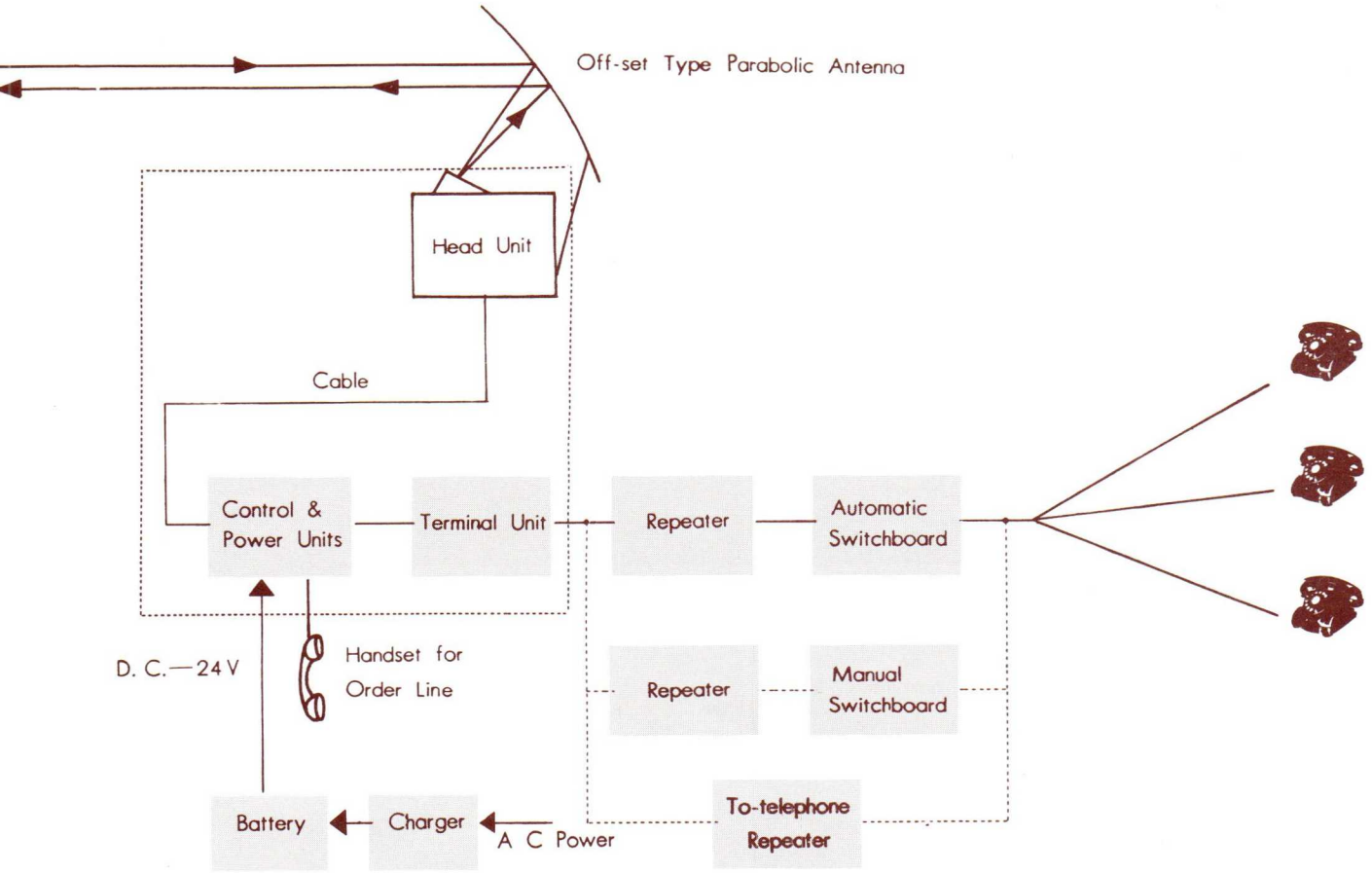
The above diagram shows in block form all the elements of the 12 Gc. Microwave System.

As shown, the microwave terminal unit may be connected directly to a number of different circuits:

Manual, automatic, common battery or magneto switchboards.

Common battery or magneto telephone instruments.

When designing the initial installation, separate telephone repeaters of the proper type must be chosen depending on which of the above will be employed with the terminal equipment. If a telephone instrument is connected directly to the microwave equipment, it can utilize the radio circuits without passing through a switchboard. However, it may also be used with the switchboard for local conversations not requiring the use of the Microwave system.



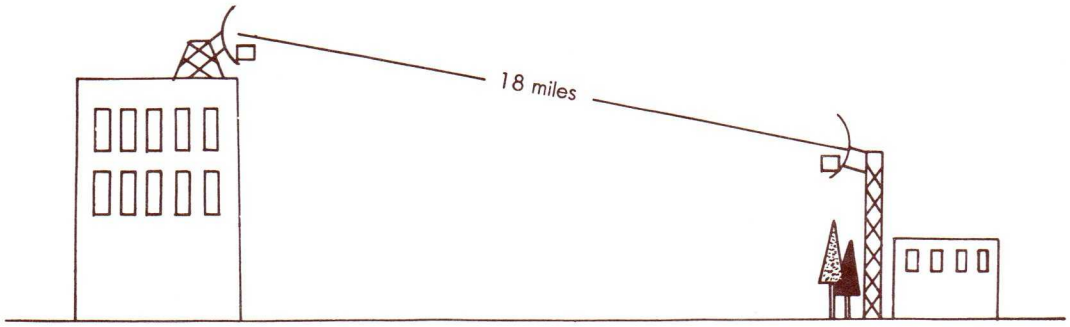
CARRIER TERMINAL UNIT

The carrier terminal unit forms part of the equipment, and is completely transistorized. It is housed with the transceiver IF and AFC circuits in a single compact cabinet. It provides up to 12 voice channels; when less than 12 channels are required, standard combinations are 8, 6 and 4.

For 12 channel operation the frequency spacing is 4 Kc., with the "eastward" transmission ranging from 12 to 60 Kc., and the "westward" transmission covering from 72 to 120 Kc.

For less than 12 channel operation the frequency spacing is 6 Kc., enabling a simplified speech path filter to be used, with a resultant saving in cost.

TYPICAL "CLEAR PATH" CIRCUIT

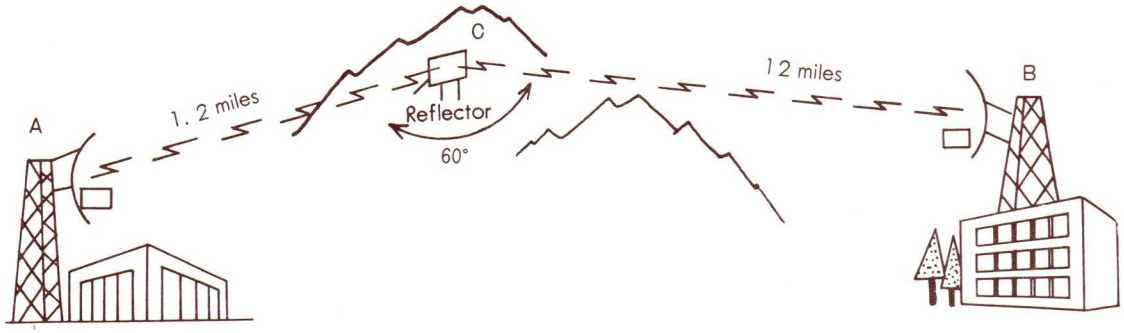


General Data: System is SS-FM, using a VA-92C Klystron both as transmitting tube and local oscillator for receiver. IF is 70 Mc., IF bandwidth is 3 Mc.

Direct Path:

Transmitting Output	17 dbm (50 mw)
Transmit-receive common circuit loss	0
Feeder loss	0
Transmitting Antenna Gain (4 ft. dia)	41 db
Free Space Loss	143.5 db (18 miles)
Receiving Antenna Gain (4 ft. dia)	41 db
Feeder Loss	0
Transmit-receive common circuit loss	0
Span Loss	61.5 db
Receiving standard input level	−44.5 dbm
Threshold level	−85 dbm
Drop Out Level	−88 dbm
Drop Out margin	45.5 db
S/N in Threshold level	42 db
S/N in Standard Propagation	82.5 db (in worst chan.)

TYPICAL INDIRECT PATH USING REFLECTOR



Indirect Path:

Transmitting Output	20 dbm (100 mw)
Transmit-receive common circuit loss	0
Feeder Loss	0
Transmitting Antenna Gain (4 ft. dia)	41 db
Free Space loss between A and C	122 db (1.2 miles)
Reflector Gain (6 ft. by 5 ft.)	94 db
Free Space loss between C and B	140 db (12 miles)
Receiving Antenna Gain (4 ft. dia)	41 db
Feeder Loss	0
Transmit-receive common circuit loss	0
Span Loss	84 db
Receiving standard input level	−64 dbm
Threshold level	−85 dbm
Drop Out level	−88 dbm
Drop Out margin	24 db
S/N in Threshold Level	42 db
S/N in Standard Propagation	63 db (in worst chan.)

TOKYO OKI JAPAN

ESTABLISHED 1881

MAIN PRODUCTS & SERVICES

TELEPHONE EQUIPMENT	Ordinary Telephone : Automatic, Common Battery; Magneto Special Telephone : Portable, Marine, Anti-explosion, Sound Powered
TELEPHONE SWITCHING EQUIPMENT	Automatic & Manual for Private & Central Switching Equipment, Attendant Board, Toll Board, Information Board, Dispatching Telephone system
TELEGRAPH EQUIPMENT	Teletypewriter : Page & Tape Type Telex Subscriber's Set Office Equipment for Telegraph Service
TELEGRAPH SWITCHING EQUIPMENT	Telegraph Switching Equipment : Automatic & Semiautomatic type
BUSINESS MACHINES	Electronic Computer & Input-output Devices I.D.P. System Equipment P.C.S. Related Equipment Other Automation Equipment
RADIO EQUIPMENT	HF Transmitter & Receiver : FS, SSB, DSB Type VHF, UHF Transmitter & Receiver : AM, FM Type Broadcasting Equipment : Transmitter, S.T. Link & Studio Equipment Radar Equipment : Marine Radar Millimeter Wave Radar
TRANSMISSION EQUIPMENT	Cable & Open Wire Carrier Equipment Microwave & Multiplex Equipment
OTHER EQUIPMENT	Tape Recorder Electron Tube : Klystron, Magnetron Interphone System Public Address System Echo Sounder & Listening Device Electric Clock System Automatic Fire Alarm System : Private & Public System Measuring Equipment : Standard Signal Generator, Frequency Meters, Field Intensity Measuring Set, etc.
INSTALLATION MATERIALS	Cable, Wire, Insulator, Terminal Box, Telephone Protector and Other Miscellaneous Materials
PLANNING AND INSTALLATION OF ABOVE PRODUCTS	

BUTLER ROBERTS ASSOCIATES INC. *A Subsidiary of OKI ELECTRONICS OF AMERICA INC.*

202 EAST 44TH STREET
NEW YORK 17, NEW YORK

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA

PRESS RELEASE 7-1-64

Fort Lauderdale, Florida
July 1, 1964

OKI KLYSTRONS STILL OPERATING AT 8,000 HOURS!

The test program commenced several months ago to determine the average useful life of the OKI mm-wave klystron continues. As announced in previous releases, six Type 35V10 OKI reflex klystrons were selected at random from stock for the purpose of testing to the point of ultimate failure. Of these original six tubes, three have now failed at 4,200 hours, 5,759 hours and 7,131 hours respectively.

Of the remaining three still on test, two are performing satisfactorily at 8,013 hours and 8,389 hours with output power levels of 100 mW. and 95 mW. respectively. The third unit has recently shown a sharp drop in output at 8,389 hours and is expected to fail shortly.

These tests will continue until all six units have failed, when a final report will be issued to serve as a guide in evaluating the OKI millimeter-wave tube.

Performance tabulation of one of the tubes under test is shown below.

TUBE TYPE — 35V10 SERIAL NO. — 573 RESONATOR VOLTAGE — 2000v.
RESONATOR CURRENT — 12.0 mA. FREQUENCY — 34.0 Gc.

DATE	HOURS OPERATION	OUTPUT (mW.)	CONTROL ELEC VOLTAGE	REFLECTOR VOLTAGE	HEATER CURRENT (A.)
May 22, 1963	1822	80	74	184	0.75
June 7, 1963	2200	85	73	182	0.75
June 29, 1963	2669	85	69	182	0.74
July 30, 1963	3336	86	69	179	0.75
Sept. 3, 1963	4081	76	69	183	0.74
Nov. 20, 1963	5723	78	41	187	0.76
Jan. 20, 1964	6811	90	63	180	0.75
Feb. 28, 1964	7642	87	51	185	0.75
April 3, 1964	8389	95	47	185	0.75

Customer reports indicate that many OKI klystrons continue to perform well beyond the ages attained to date in our tests. In some cases our tubes are continuing to operate satisfactorily after over three years almost constant use, involving some 10,000 hours operation.

BUTLER ROBERTS ASSOCIATES INC.
(A subsidiary of OKI Electronics of America Inc.)
Ft. Lauderdale, Florida & New York, N. Y.

PRICE LIST (NET)

ESTABLISHED OKI 1881

Effective July 1, 1964
(Supersedes all previous lists)

OKI MM-WAVE KLYSTRON TUBES

REFLEX KLYSTRONS

INDEX

FT – FULLY TUNABLE OVER RANGE
TT – TRIM TUNABLE AROUND SPECIFIED CENTER FREQ.
HV – HIGH VOLTAGE TUBE
LV – LOW VOLTAGE TUBE
BENCH – BENCH TYPE OF TUBE WITH OCTAL BASE
AIRBORNE – LIGHTWEIGHT AIRBORNE TYPE TUBE, 3½ OZ.
* – MEASURED WITH MATCHED LOAD

OKI MODEL NR.	TYPICAL FREQUENCY RANGE IN Gc.	TYPE OF TUBE (SEE INDEX)	TYPICAL OUTPUT THROUGH TUNING RANGE*	STANDARD FLANGE TYPE	STANDARD WAVEGUIDE TYPE	PRICE DEL'D.
17V10	15.5/18.5	FT HV BENCH	70 milliwatts	UG-419/U	RG-91/U	$ 455.00
24V10	22.0/26.0	FT HV BENCH	180 "	UG-595/U	RG-53/U	480.00
24V11	22.0/26.0	FT HV BENCH	500 "	UG-595/U	RG-53/U	825.00
30V10	27.0/32.0	FT HV BENCH	60 "	UG-599/U	RG-96/U	480.00
30V11	27.0/32.0	FT HV BENCH	160 "	UG-599/U	RG-96/U	825.00
33V10	31.0/36.0	FT HV BENCH	50 "	UG-599/U	RG-96/U	480.00
35V10	32.0/37.0	FT HV BENCH	50 "	UG-599/U	RG-96/U	480.00
35V11	32.0/37.0	FT HV BENCH	170 "	UG-599/U	RG-96/U	825.00
35V30	32.0/37.0	FT LV BENCH	40 "	UG-599/U	RG-96/U	825.00
35V51	34.7/35.3	TT HV AIRBORNE	150 "	UG-599/U	RG-96/U	955.00
35V61	34.7/35.3	TT LV AIRBORNE	35 "	UG-599/U	RG-96/U	1230.00
35V155	34.5/35.5	TT HV BENCH	60 "	UG-599/U	RG-96/U	480.00
40V10	37.0/42.0	FT HV BENCH	90 "	UG-383/U	RG-97/U	725.00
45V10	43.0/48.0	FT HV BENCH	80 "	UG-383/U	RG-97/U	725.00
47V10	44.0/51.0	FT HV BENCH	60 "	UG-383/U	RG-97/U	775.00
47V11	44.0/51.0	FT HV BENCH	140 "	UG-383/U	RG-97/U	1005.00
50V10	46.0/54.0	FT HV BENCH	40 "	UG-383/U & UG-385/U	RG-97/U & RG-98/U	840.00
55V10	50.0/60.0	FT HV BENCH	40 "	UG-385/U	RG-98/U	995.00
55V11	50.0/60.0	FT HV BENCH	100 "	UG-385/U	RG-98/U	1190.00
60V10	55.0/65.0	FT HV BENCH	40 "	UG-385/U	RG-98/U	1670.00
70V10	66.0/76.0	FT HV BENCH	35 "	UG-385/U & UG-387/U	RG-98/U & RG-99/U	2355.00
70V11	66.0/76.0	FT HV BENCH	80 "	UG-385/U & UG-387/U	RG-98/U & RG-99/U	2932.00
75V10	70.0/80.0	FT HV BENCH	30 "	UG-387/U	RG-99/U	2500.00
80V10	75.0/85.0	FT HV BENCH	20 "	UG-387/U	RG-99/U	2650.00
90V10	85.0/95.0	FT HV BENCH	15 "	UG-387/U	WR-10	3050.00
100V10	95.0/105.0	FT HV BENCH	10 "	UG-387/U	WR-10	3350.00
OKI "LADDERTRON"® TYPE KLYSTRONS						
34LV10	33.2/34.8	FT HV BENCH	10 watts	UG-599/U	RG-96/U	3693.00
50LV10	49.0/51.0	FT HV BENCH	2 watts	UG-383/U	RG-98/U	5639.00

All prices shown herein include shipment to any destination within the continental U.S.A. & Canada

BUTLER ROBERTS ASSOCIATES INC.

A Subsidiary of OKI ELECTRONICS OF AMERICA INC.

HEAD OFFICE:
500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA
TEL: AREA 305: 523-7202
WESTERN UNION TELEX: 051-423

NEW YORK OFFICE:
202 EAST 44TH STREET
NEW YORK 17, NEW YORK
TEL: AREA 212: 682-2989
WESTERN UNION TELEX: 01-25484

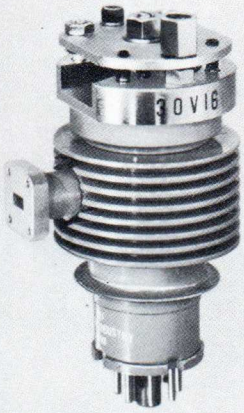
WEST COAST REP.:
FRANK R. THOMAS
P.O. BOX 1377
SANTA BARBARA, CALIF.
TEL: AREA 805: 962-5917

OKI MILLIMETER WAVE KLYSTRON

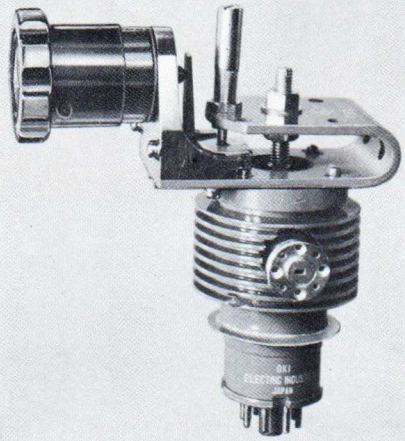
OKI electric industry co., ltd. TOKYO JAPAN

"OKI EXTENDS RANGE OF KLYSTRONS TO COVER MM-WAVE SPECTRUM TO 122GC"

Longer Operating Life — up to 10,000 hours Higher Stability — Higher Power — Double Warranty

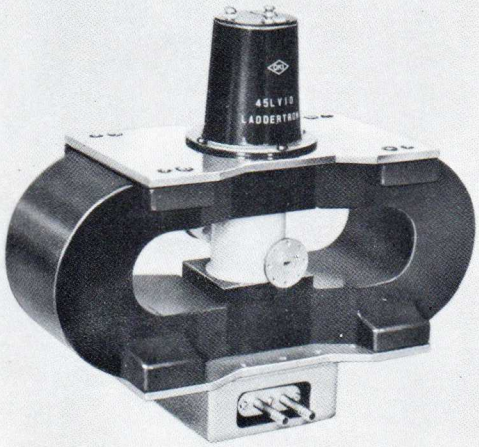


MODEL 30V16

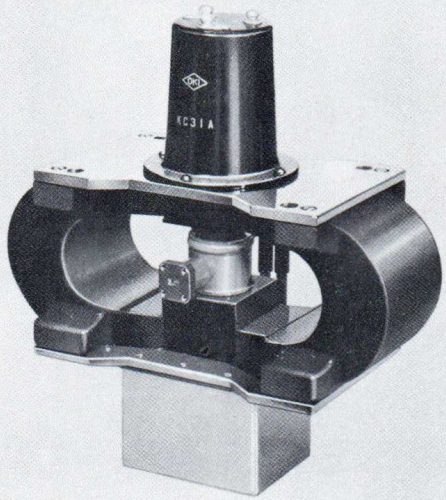


MODEL 70V10

MODEL 45LV10



MODEL KC31A



Oki Electric, recognized as one of the world's leaders in MM-wave tube development and manufacture, now offers new capability in this specialized field.

Available in the 15 to 122Gc range, Oki klystrons are unusually high in efficiency and stability. Broad experience in applied research, and use in a variety of systems, have demonstrated the long operating life expectancy of the Oki product. Prices are highly competitive, and quantity deliveries can be made rapidly.

Endurance tests have confirmed an even further improvement in the durability of Oki klystrons, now making it possible to substantially extend our standard warranty as follows:

Oki tubes up to 35 Gc ..... 1 year/1,000 hours
Oki tubes 40 to 100 Gc .... 1 year/ 500 hours
Oki tubes over 100 Gc ..... 1 year/ 200 hours

Specifications of the various types of standard Oki klystron appear in the following pages.

The Oki family of klystrons:

- Standard tunable laboratory-type klystrons
- Airborne type klystrons
- Trim-tunable type klystrons
- Low voltage type klystrons
- Oki Laddertron (High power tunable klystron)
- Oki high power ceramic klystron

Other MM-wave tubes now available from Oki:

- Backward-wave oscillators to 100 Gc
- Travelling-wave tubes
- Magnetrons to 94 Gc

We also invite your inquires for any type of MM-wave tube not listed.

OKI REFLEX KLYSTRON

STANDARD TYPE

The following specifications cover 24 models of the OKI standard type reflex klystron oscillators. They are mechanically and electronically tunable for wide band, and have the UG type output flanges for use with the standard RG type waveguides.

TYPICAL OPERATION DATA

Model	Frequency Spread (Gc)	Resonator Voltage (V)	Resonator Current (mA)	Control Electrode Voltage (V)	Frequency (Gc) ▽	Frequency (Gc) ■	Frequency (Gc) △	Reflector Voltage (V) ▽	Reflector Voltage (V) ■	Reflector Voltage (V) △	Output Power (mW) ▽	Output Power (mW) ■	Output Power (mW) △	Electronic Tuning Range (Mc) ▽	Electronic Tuning Range (Mc) ■	Electronic Tuning Range (Mc) △	Modulation Sensitivity (Mc/V) ▽	Modulation Sensitivity (Mc/V) ■	Modulation Sensitivity (Mc/V) △
17V10	15.5-18.5	2,000	12	-100	16.0	17.0	18.0	-215	-280	-360	120	100	100	50	45	30	0.7	0.45	0.28
20V10	18.0-22.0	2,000	12	-100	19.0	20.0	21.0	-170	-235	-297	120	150	130	40	45	40	0.8	0.7	0.5
22V10	20.0-24.0	2,000	12	-100	21.0	22.0	23.0	-235	-292	-350	120	150	140	35	40	30	0.7	0.65	0.4
24V10A	22.0-26.0	2,000	12	-100	23.0	24.0	25.0	-205	-265	-330	180	250	100	60	50	40	1.2	0.8	0.45
24V11	22.0-26.0	1,600	35	-80	23.0	24.0	25.0	-250	-315	-400	450	600	280	60	50	45	0.7	0.4	0.3
30V10	28.0-32.0	2,000	12	-100	29.0	30.0	31.0	-270	-310	-355	70	70	70	75	70	65	0.75	0.7	0.55
30V11	28.0-32.0	2,000	25	-80	29.0	30.0	31.0	-275	-325	-380	180	200	180	80	75	70	0.8	0.65	0.55
35V10	32.0-37.0	2,000	12	-90	34.0	35.0	36.0	-170	-195	-225	70	70	60	100	100	100	2.0	1.8	1.4
35V11	32.0-37.0	2,000	12	-90	34.0	35.0	36.0	-290	-330	-370	170	200	170	90	90	85	2.2	2.0	1.7
40V10	37.0-42.0	2,300	25	-150	38.0	40.0	42.0	-205	-250	-295	90	80	70	80	90	60	2.5	2.5	1.7
45V10	42.0-48.0	2,300	25	-130	43.0	45.0	47.0	-130	-160	-195	80	80	80	100	100	100	3.2	3.0	2.2
47V10	43.0-51.0	2,300	25	-110	45.0	47.0	49.0	-135	-170	-210	60	70	60	150	150	120	5.0	4.5	3.5
47V11	43.0-51.0	2,300	25	-110	45.0	47.0	49.0	-145	-185	-230	120	150	120	120	120	100	3.7	3.5	2.5
50V10	46.0-54.0	2,500	25	-100	48.0	50.0	52.0	-145	-180	-220	50	50	50	140	140	130	5.0	4.5	4.0
55V10	52.0-58.0	2,500	25	-120	53.0	55.0	57.0	-150	-185	-220	60	60	60	140	140	120	5.5	5.2	4.0
55V11	52.0-58.0	2,500	25	-120	53.0	55.0	57.0	-155	-195	-240	120	120	120	180	190	150	5.0	5.1	3.6
60V10	57.0-63.0	2,500	25	-120	58.0	60.0	62.0	-190	-235	-280	40	60	60	130	140	140	4.8	5.2	4.5
70V10	65.0-73.0	2,700	25	-125	67.0	70.0	73.0	-165	-195	-235	40	60	50	140	140	130	4.5	4.0	3.5
70V11A	65.0-75.0	2,700	25	-125	67.0	70.0	73.0	-165	-205	-250	100	125	100	180	165	140	6.0	5.5	4.3
80V10A	75.0-85.0	2,500	25	-125	77.0	80.0	83.0	-170	-215	-260	30	40	35	180	140	120	5.2	4.0	3.3
90V10A	85.0-95.0	2,500	25	-150	87.5	90.0	92.5	-140	-165	-190	25	30	20	200	180	150	6.7	6.0	5.0
90V11	85.0-95.0	2,500	20	-125	87.0	90.0	93.0	-205	-155	-198	50	60	60	250	300	250	20.0	20.0	18.0
100V10A	95.0-105.0	2,500	20	-100	98.0	100.0	102.0	-180	-205	-230	25	25	15	300	250	200	10.0	8.0	6.5
120V10	107.0-122.5	2,500	17	-150	110.0	115.0	120.0	-170	-220	-140	10	10	6	350	350	300	20.0	20.0	15.0

MAXIMUM RATINGS

Resonator Voltage (V)	Resonator Current (mA)	Output Power Min. (mW)
2,200	14	50
2,200	14	50
2,200	14	50
2,200	14	80
1,800	40	150
2,200	14	40
2,200	30	100
2,200	14	40
2,200	30	100
2,500	30	35
2,500	30	35
2,500	30	30
2,500	30	80
2,700	30	25
2,700	30	30
2,700	30	70
2,700	30	30
2,800	30	25
2,800	30	70
2,700	30	15
2,700	30	10
2,700	25	30
2,800	25	10
2,700	25	5

GENERAL ELECTRICAL DATA (ALL MODELS OF REFLEX KLYSTRON)

Heater Voltage .....5.7 to 6.9V dc
Heater Current .....0.55 to 0.85A
Control Electrode Voltage .....−40 to −200V dc (24V11: −10 to −100V dc)
Reflector Voltage .....−20 to −500V dc (17V10: −20 to −600V dc)
(24V11: −50 to −750V dc)

GENERAL MECHANICAL DATA (ALL MODELS OF REFLEX KLYSTRON)

Warming-up Time .....Minimum warming-up time is 120 seconds. With forced air cooling, 20 minutes are required to stabilize the frequency and to prevent drifting due to temperature rise.
Mounting .....Any position
Cooling .....Forced air cooling is required to keep tube temperature below 80°C. Minimum cooling rate is 800 litres of air flow per minute. Oil bath cooling is another effective method.
Cathode .....Indirectly heated
Dimensions .....See Figs. 1, 2, 3 & 4
RF Connections .....See Table shown below
Base Connections .....See Fig. 5 on page 8

Model	Dimensions	Output Waveguide	Output Flange
17V10	Fig. 3	RG-91/U	UG-419/U
20V10	Fig. 3	RG-53/U	UG-595/U
22V10	Fig. 3		
24V10A	Fig. 3		
24V11	Fig. 4		
30V10	Fig. 3	RG-96/U	UG-599/U
30V11	Fig. 4		
30V16	Fig. 2		
35V10	Fig. 3		
35V11	Fig. 4		
35V155	Fig. 2		
35V30	Fig. 3		
35V51	Fig. 1		
35V61	Fig. 1		

Model	Dimensions	Output Waveguide	Output Flange
40V10	Fig. 4	RG-97/U	UG-383/U
45V10	Fig. 4		
47V10	Fig. 4	RG-98/U	UG-385/U
47V11			
50V10			
55V10			
55V11			
60V10			
70V10	Fig. 4	RG-99/U	UG-387/U
70V11A			
80V10A			
90V10A			
90V11			
100V10A			
120V10	Fig. 4	*RG-138/U	UG-387/U

* RG-138/U waveguide will be modified to be equivalent to F-953A (FXR special type) or F-714 (TRG type).

OKI REFLEX KLYSTRON

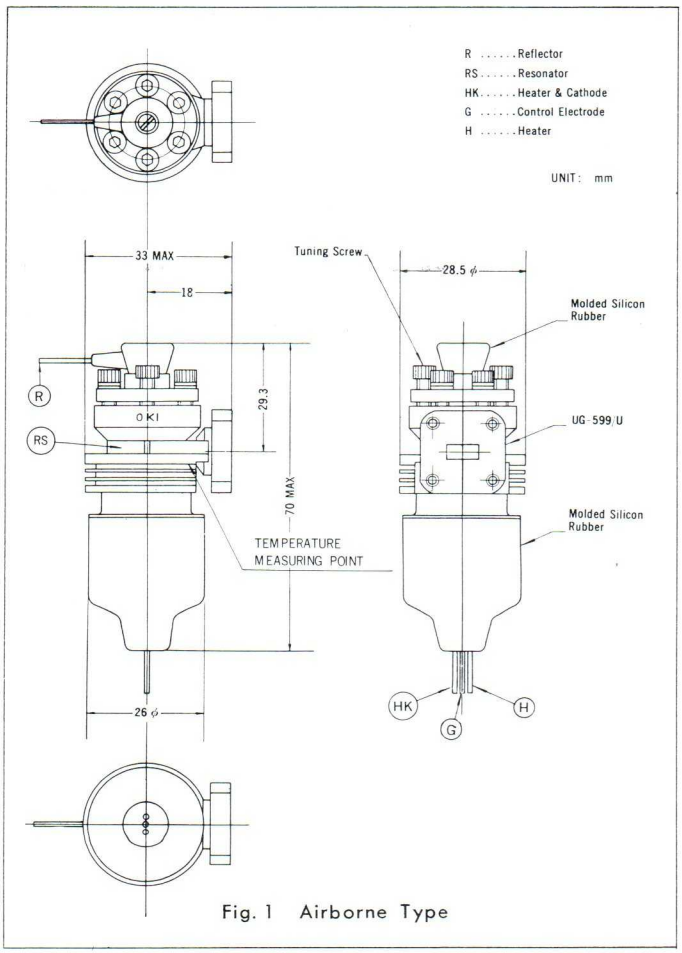


Fig. 1 Airborne Type

AIRBORNE TYPE

- MODEL 35V51 & 35V61 -

The OKI Airborne Type is a reflex klystron oscillator with ceramic structure of miniature size and light weight.

CHARACTERISTICS

Low voltage operation
Shock-proof
More stable oscillation and longer operation life by meshless structure

TYPICAL OPERATION DATA		35V51	35V61
Frequency	(Gc)	35.0	35.0
Output Power	(mW)	150	30
Heater Voltage	(V)	6.3	6.3
Resonator Voltage	(V)	2000	800
Resonator Current	(mA)	25	20
Reflector Voltage	(V)	−320	−320
Control Electrode Voltage	(V)	−100	−125
Warming-up Time	(Sec.)	120	120

ELECTRICAL DATA

Frequency Spread	(Gc)	34.75–35.25	34.75–35.25
Output Power	(mW min.)	80	15
Heater Voltage	(V max.)	5.7 — 6.9	5.7—6.9
Resonator Voltage	(V max.)	2200	1000
Resonator Current	(mA max.)	30	25
Reflector Voltage	(V)	−500 — −20	−500 — −20
Control Electrode Voltage	(V)	−200 — −40	−200 — −40
Warming-up Time	(Sec. min.)	90	90

MECHANICAL DATA

Output Flange		UG-599/U	UG-599/U
Output Waveguide		RG-96/U	RG-96/U
Mounting		Any position	Any position
Dimensions (See Fig. 1)	(mm)	28.5 × 33 × 60	28.5 × 33 × 60
Weight	(g)	98	98
Cooling		Forced air-cooling	Forced air-cooling

OKI REFLEX KLYSTRON

TRIM-TUNABLE TYPE

This type is trim-tunable within 500 Mc plus/minus the center frequency fixed.

Model	Frequency Spread	Center Frequency	Output Power (Typical)
30V16	27.5 — 32.5 Gc	28 — 32 Gc*	250 mW
30V150	29.5 — 30.5 Gc	30 Gc	80 mW
31V151	30.5 — 31.5 Gc	31 Gc	80 mW
32V152	31.5 — 32.5 Gc	32 Gc	80 mW
33V153	32.5 — 33.5 Gc	33 Gc	80 mW
34V154	33.5 — 34.5 Gc	34 Gc	80 mW
35V155	34.5 — 35.5 Gc	35 Gc	80 mW
36V156	35.5 — 36.5 Gc	36 Gc	60 mW

*The center frequency can be factory-fixed at one frequency in the range.

TYPICAL OPERATION DATA

		30V16		35V155	
Frequency	(Gc)	29.5	30	30.5	35.0
Output Power	(mW)	200	250	200	80
Resonator Voltage	(V)		2,000		2,000
Resonator Current	(mA)		25		12
Control Electrode Voltage	(V)		−80		−100
Reflector Voltage	(V)	−300	−325	−350	−195
Electronic Tuning Range	(Mc)	80	75	75	80
Modulation Sensitivity	(Mc/V)	0.8	0.65	0.55	2.0

ELECTRICAL DATA

Frequency Spread	(Gc)	27.5 — 32.5	34.5 — 35.5
Output Power	(mW min.)	180	50
Heater Voltage	(V)	5.7 — 6.9	5.7 — 6.9
Resonator Voltage	(V max.)	2200	2200
Resonator Current	(mA max.)	30	14
Warming-up Time	(Sec. min.)	120	120

MECHANICAL DATA

Output Flange	UG-599/U	UG-599/U
Output Waveguide	RG-96/U	RG-96/U
Mounting	Any position	Any position
Dimensions (See Fig.2) (mm)	55×120×52	55×120×52
Cooling	Forced air cooling	Forced air cooling

LOW VOLTAGE TYPE

-MODEL 35V30-

This type is a reflex klystron oscillator for low-voltage operation, with meshless structure.

TYPICAL OPERATION DATA

Frequency	(Gc)	34.0	35.0	36.0
Output Power	(mW)	40	40	40
Resonator Voltage	(V)	800		
Resonator Current	(mA)	20		
Control Electrode Voltage	(V)	−125		
Reflector Voltage	(V)	−110	−125	−145
Electronic Tuning Range	(Mc)	80	80	70
Modulation Sensitivity	(Mc/V)	2.3	2.0	1.4

ELECTRICAL DATA

Frequency Spread	(Gc)	32.0 — 37.0
Output Power	(mW min.)	20
Heater Voltage	(V)	5.7 — 6.9
Resonator Voltage	(V max.)	1,000
Resonator Current	(mA max.)	25
Warming-up Time	(Sec. min.)	120

MECHANICAL DATA

Output Flange		UG-599/U
Output Waveguide		RG-96/U
Mounting		Any position
Dimensions (See Fig.3)	(mm)	120×63×125
Cooling		Forced air cooling

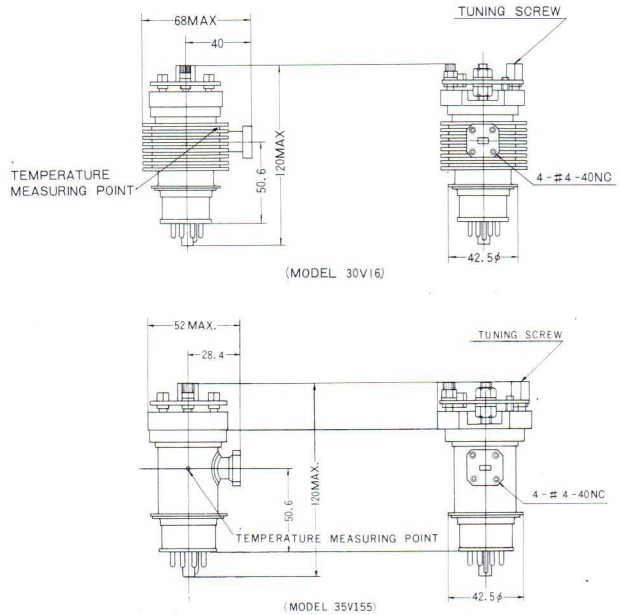


Fig. 2 Trim-tunable Type

OKI HIGH POWER KLYSTRON

-MODEL KC31A, KC55B & KCT31B-

The OKI High Power Klystron is an extended interaction oscillator with ceramic structure.

CHARACTERISTICS

High output power
Electronic tuning
Shock-proof
Lower voltage operation
FM or AM modulation

TYPICAL OPERATION DATA

		KC31A (Fixed tuned)	KC55B (Fixed tuned)	KCT31B (Tunable)
Frequency	(Gc)	31.0	55.0	31.0
Output Power	(W)	7	10	4
Resonator Voltage (Vrs)	(KV)	2.7	3.6	2.7
Collector Voltage	(V)	Vrs + 100	Vrs + 100	Vrs + 100
Control Electrode Voltage	(V)	−150	−200	−150
Cathode Current	(mA)	120	182	120
Heater Voltage	(V)	7.0	7.0	6.3

ELECTRICAL DATA

Frequency Spread	(Gc)	31.0 ± 1	55.0 ± 2	30.5 — 31.5
Output Power	(W min.)	3	5	1
Resonator Voltage (Vrs)	(KV max.)	3.0	3.9	3.0
Collector Voltage	(V max.)	Vrs + 100	Vrs + 100	Vrs + 100
Control Electrode Voltage	(V)	−300 — −80	−300 — −150	−300 — −30
Cathode Current	(mA max.)	150	200	150
Resonator Current	(mA max.)	60	70	60
Heater Voltage	(V max.)	7.5	7.5	7.5
Warming-up Time	(Sec. min.)	60	60	60

MECHANICAL DATA

Output Flange		UG-599/U	UG-385/U	UG-599/U
Output Waveguide		RG-96/U	RG-98/U	RG-96/U
Mounting		Any position	Any position	Any position
Weight	(kg)	6.1	6.1	6.4
Demensions (See Fig. 8)	(mm)	218 × 237 × 100	218 × 237 × 100	218 × 237 × 100
Cooling		Water cooling at flow rate of 1.5 litres per minute		

OKI LADDERTRON

-MODEL 34LV10, 45LV10 & 50LV10-

The Laddertron is a rectangular-resonator, multi-gap, flat-beam klystron oscillator produced solely by Oki Electric.

CHARACTERISTICS

High output power
Lower voltage operation
Mechanical and electronic tuning
FM or AM modulation

TYPICAL OPERATION DATA

		34LV10	45LV10	50LV10
Frequency	(Gc)	34	45	50
Output Power	(W)	10	5	5
Resonator Voltage	(V)	1900	2000	2000
Cathode Current	(mA)	120	130	130
Control Electrode Voltage	(V)	−200	−200	−200
Electronic Tuning Range	(Mc)	60	60	40
Modulation Sensitivity	(Mc/V)	0.4	0.4	0.2

ELECTRICAL DATA

Frequency Spread	(Gc)	33.0 — 35.0	44.0 — 46.0	49.2 — 50.8
Output Power	(W min.)	3	1	1
Heater Voltage	(V)	5.7 — 6.9	5.7 — 6.9	5.7 — 6.9
Heater Current	(A)	1.0 — 2.0	1.0 — 2.0	1.0 — 2.0
Resonator Voltage	(V max.)	2100	2200	2300
Cathode Current	(mA max.)	140	135	150
Control Electrode Voltage	(V)	−50 — −500	−50 — −500	−50 — −500
Warming-up Time	(Sec.)	120	120	120

MECHANICAL DATA

Output Flange		UG-599/U	UG-383/U	UG-385/U
Output Waveguide		RG-96/U	RG-97/U	RG-98/U
Mounting		Any position	Any position	Any position
Weight	(kg)	13 approx.	13 approx.	13 approx.
Dimensions (See Fig. 9)	(mm)	282 × 247.5 × 146	282 × 247.5 × 146	282 × 247.5 × 146
Cooling		Water cooling required. Minimum water flow at 20°C to be more than 0.5 litres per minute.		

DIMENSIONS

Unit: mm

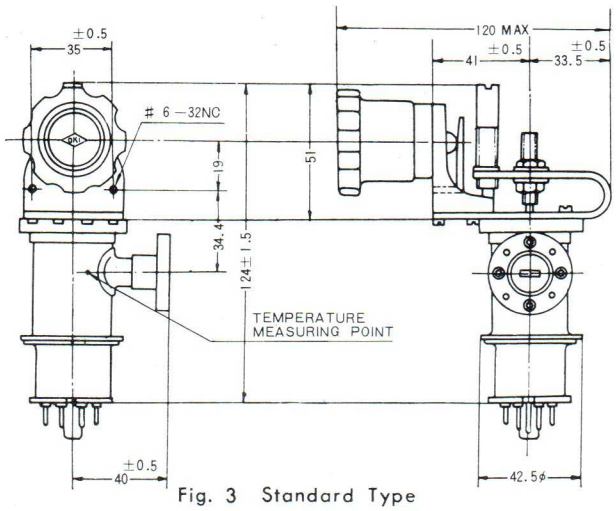


Fig. 3 Standard Type

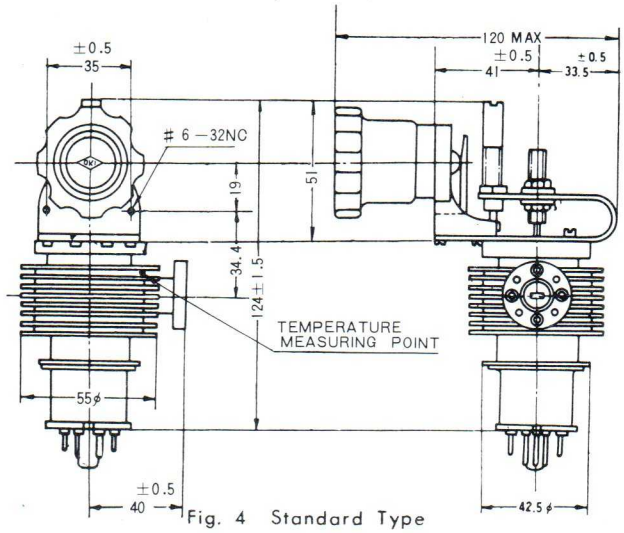


Fig. 4 Standard Type

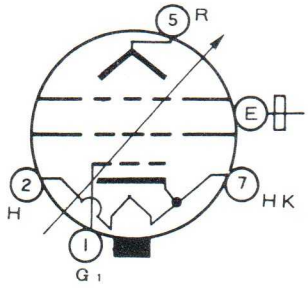


Fig. 5 Base Connections
(Reflex Klystron)

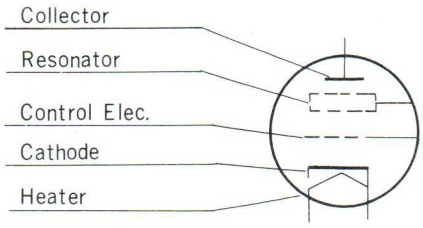


Fig. 6 Base Connections
(High Power Klystron)

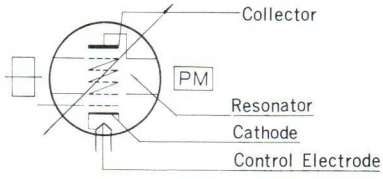


Fig. 7 Base Connections
(Laddertron)

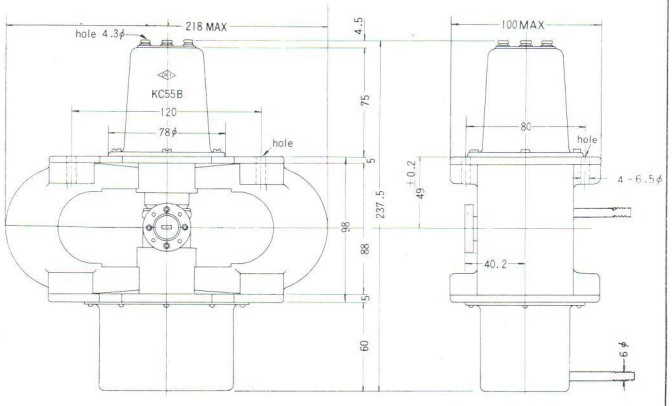


Fig. 8 OKI High Power Klystron

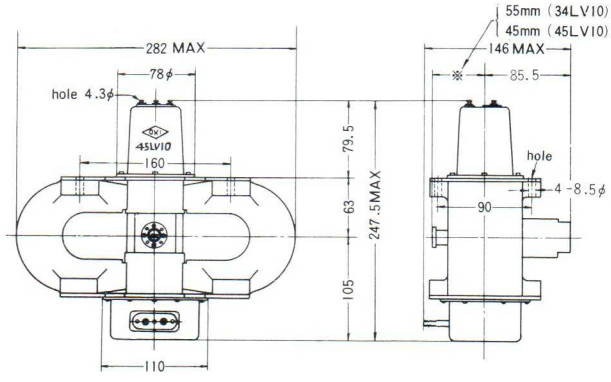


Fig. 9 OKI Laddertron

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OKI electric industry company, limited

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OKI
electric industry
co., ltd. TOKYO JAPAN

NEW AIRBORNE TYPE MM-WAVE KLYSTRONS

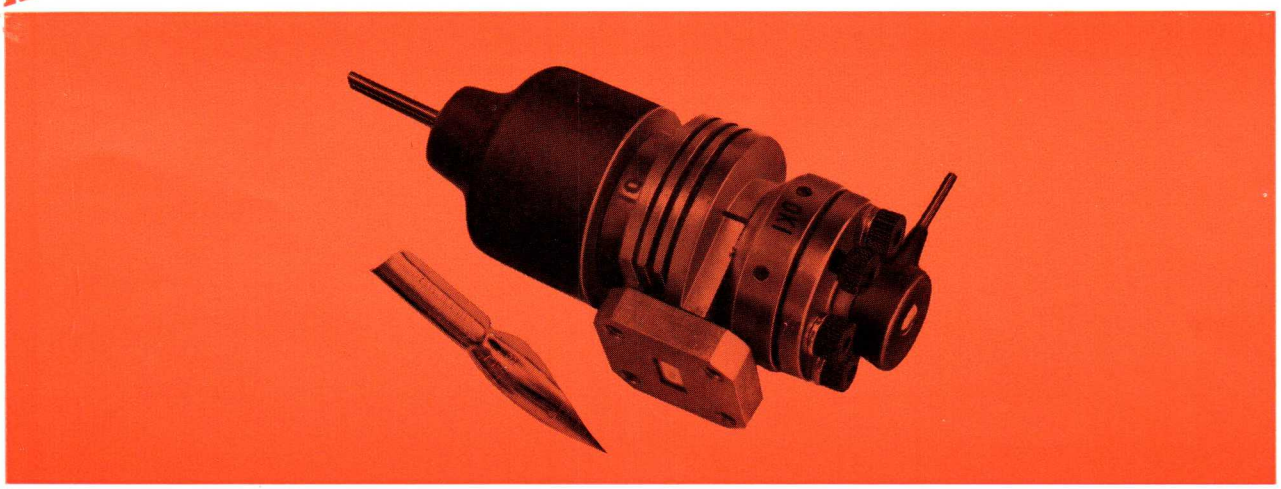
TYPES 35V51 & 35V61

NEW ANNOUNCEMENT

To meet airborne use in space research application, OKI Electric has developed new, smallsized, lightweighted (only weighing 98 gramms), low-voltage operated and shock-proof type mm-wave klystrons.

The Types 35V51 & 35V61 are the answer for the requirements. With the unique ceramic structure, they assure stable oscillation and long operating life.

Furthermore, for safe and simple connection to power source, the 35V51 & 35V61 are provided with the molded socket specially fitted to the tubes respectively.



SPECIFICATIONS

ELECTRICAL :	35V51		35V61	
	Absolute	Typical	Absolute	Typical
Heater Voltage (V d.c.)	5.7—6.9	6.3	5.7—6.9	6.3
Warming-up Time (sec.)	90 Min.	120	90 Min.	120
Resonator Voltage (V d.c.)	2200 Max.	2000	1000 Max.	800
Resonator Current (30mA)	30	25	25	20
Reflector Voltage (V d.c.)	-500 — -20	-320	-500 — -20	-320
Control Electrode Voltage (V d.c.)	-200 — -40	-100	-200 — -40	-125
Output Power (mW)	80 Min.	150	15 Min.	30
Frequency (Gc) Trim-tunable	34.75—35.25	35.00	34.75—35.25	35.00

MECHANICAL :	35V51	35V61
Output Flange	UG-599/U	UG-599/U
Output Waveguide	RG-96	RG-96
Mounting	Any Position	Any Position
Dimensions	28.5mm × 33mm × 60mm See Fig. 1	Same as left See Fig. 1
Weight	98 g	98 g
Cooling	Forced Air-Cooling	Forced Air-Cooling

OKI®
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Tel: TOKYO 265-3171 Telex: TK2627 Cable Address: "OKIDENKI TOKYO"
Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN TEL: TOKYO 501-3111

DIMENSIONS (Shown Actual Size)

R .....Reflector
RS.....Resonator
HK.....Heater & Cathode
G .....Control Electrode
H .....Heater

UNIT: mm

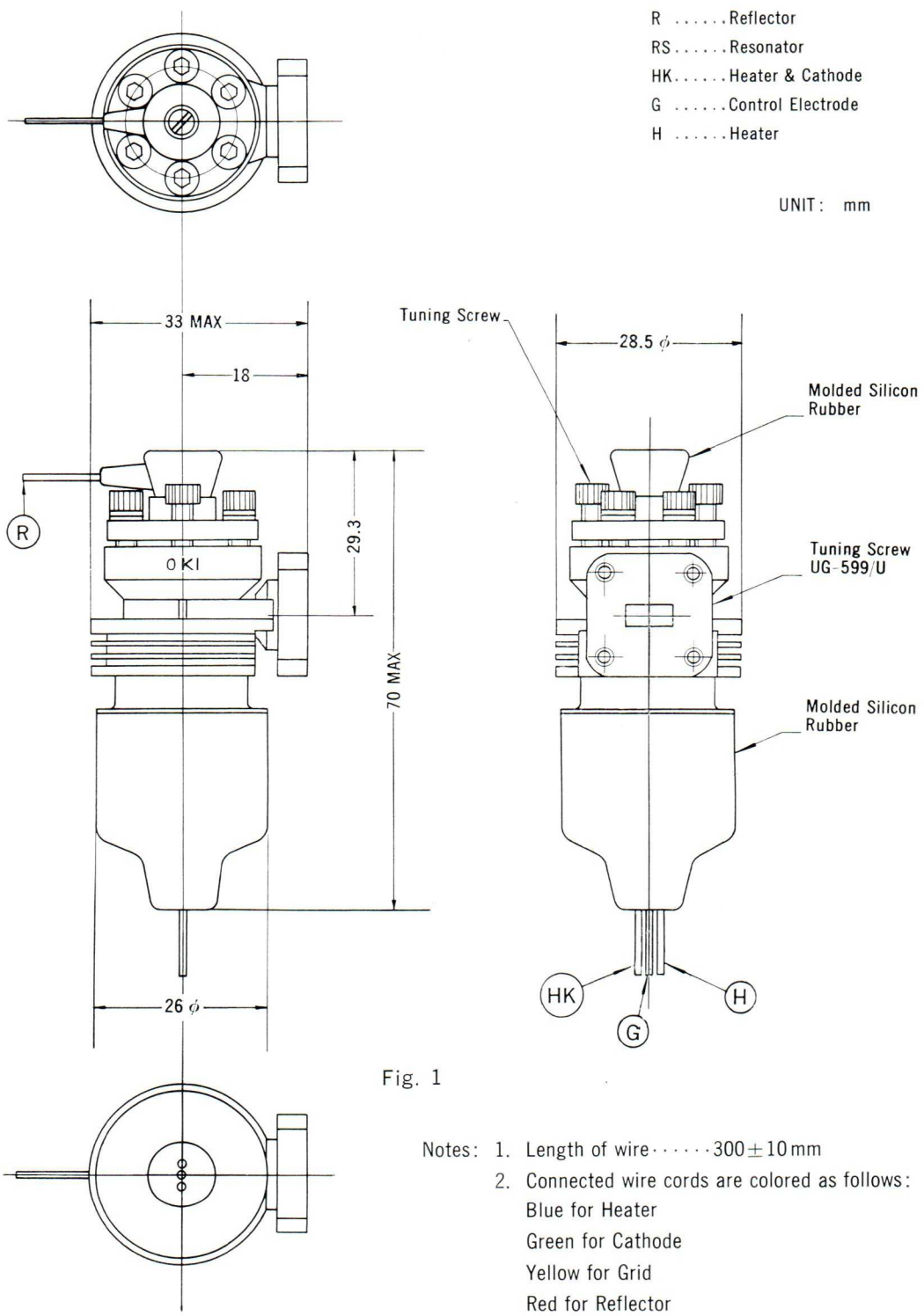

Fig. 1

Notes: 1. Length of wire·····300±10mm
2. Connected wire cords are colored as follows:
Blue for Heater
Green for Cathode
Yellow for Grid
Red for Reflector

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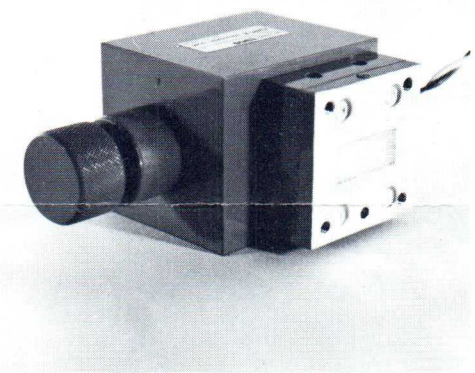
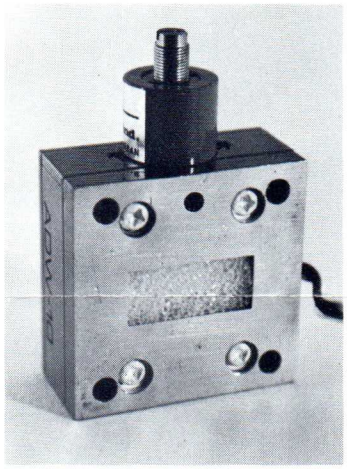
OKI AVALANCHE DIODE OSCILLATORS
*LOW NOISE - *HIGH POWER

ADC-10 Series



ADS-10 Series



ADW-10 Series

***LOW NOISE:** A specially developed passive system of self-injection locking (patent pending) improves the normal avalanche diode FM noise output by as much as 30dB, with less than 1db. loss of power.

***HIGH POWER:** OKI's unique mounting methods allow for operating efficiencies of as high as 6-7%.

GENERAL DESCRIPTION: The OKI AD Series of silicon avalanche diode (IMPATT) oscillators are available in three configurations. The type ADC units have coaxial output connectors, the type ADW units have waveguide outputs, and the ADS units are low noise devices designed around the unique (patent pending) OKI self-injection locking circuit and have waveguide outputs. All units have a minimum mechanical tuning range of ±250 MHz and are designed for optimum efficiency in the X-band region. These units are ideally suited for use as signal sources, local oscillators and parametric amplifier pumps.

ELECTRICAL CHARACTERISTICS

1.	Frequency availability	8.2 – 12.4 GHz (1)
2.	Mechanical tuning	±250 MHz min.
3.	Load VSWR	1.2 max
4.	Pulling figure for VSWR (all phase) = 1.2	2 parts in 10^4 typical
5.	Operating case temperature range	−30°C to +70°C
6.	Storage temperature	−65°C to +125°C
7.	Temperature coefficient of frequency	50 kHz/°C typical (ADC), 100 kHz/°C (ADS), 200 kHz/°C (ADW)
8.	DC bias voltage (pos. ground)	−75 to −95 volts(2)
9.	DC operating current	20 to 40 mA(2)
10.	RMS FM noise deviation in 1 kHz bandwidth @ frequency > 100 kHz	50 Hz typical (ADS series), 700 Hz (ADC and ADW series)

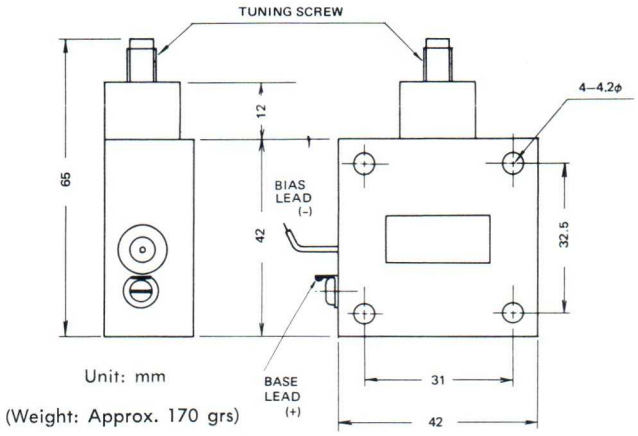
(1) To be specified within this range.

(2) Required operating voltage and current will be specified with each unit. Constant current supply should be used.

OKI AD SERIES AVALANCHE DIODE OSCILLATORS

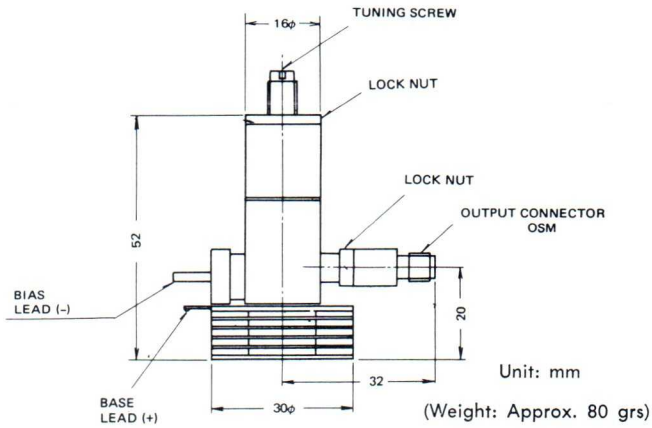
	*60mW Guar. Min. output power	*100mW Guar. Min. output power	*150mW Guar. Min. output power	*200 mW Guar. Min. output power
Coaxial output	ADC -10A	ADC -10B	ADC -10C	ADC -10D
Waveguide output	ADW-10A	ADW-10B	ADW-10C	ADW-10D
Low Noise Units	ADS -10A	ADS -10B	ADS -10C	ADS -10D

*In current production



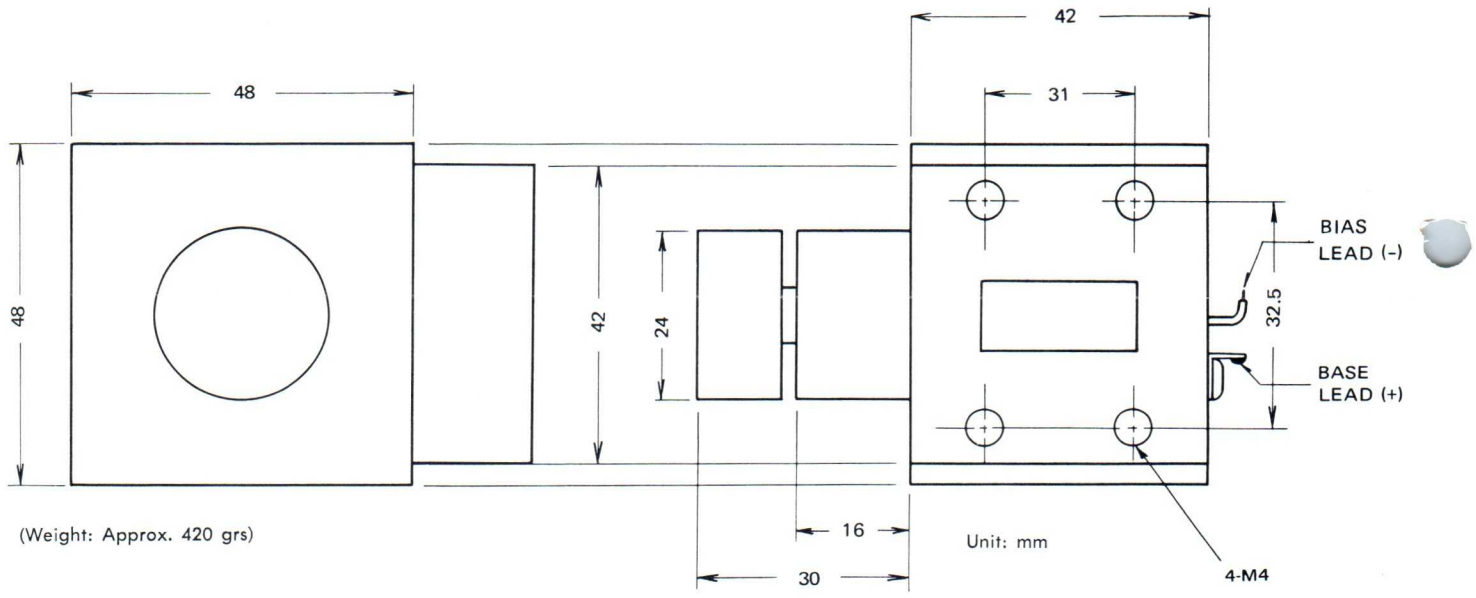
(Weight: Approx. 170 grs)

ADW-10 Series



(Weight: Approx. 80 grs)

ADC-10 Series



(Weight: Approx. 420 grs)

ADS-10 Series

POWER SUPPLY REQUIREMENTS: The OKI Model AS-101 power supply, which provides a voltage limiting, constant current, regulated source of power for the AD Series of oscillators is available from OKI Electronics of America, Inc.

OKI ELECTRONICS OF AMERICA INC.

THE OKI BUILDING, 500/506 S.E. 24th STREET

FORT LAUDERDALE, FLORIDA 33316

AREA CODE - 305
TEL. 523-7202
523-6571

TWX: 510-955-9837

OKI 34GC LADDERTRON

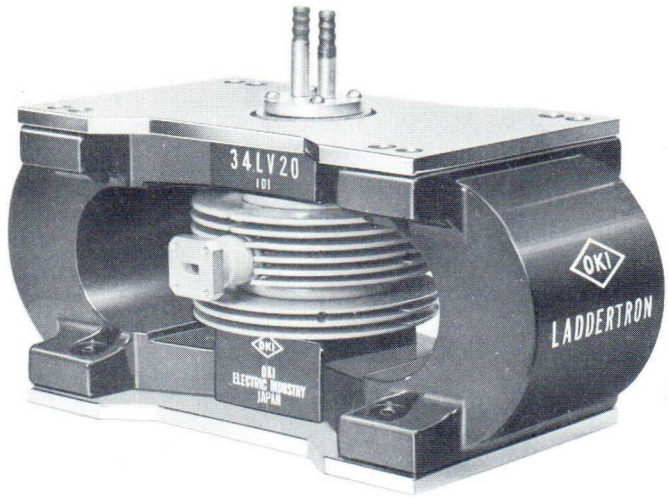
Air-cooled high power millimeter wave oscillator

OKI electric industry co., ltd. TOKYO JAPAN

Model 34LV20

1. GENERAL

The OKI Laddertron, Model 34LV20, is the latest development in the tunable, single cavity, multigap klystron series. One of the many excellent features of this high-power millimeter wave oscillator is that it can be either air-cooled or water-cooled according to the users demands and/or requirements. Ideal for communication or as a measuring wave power source. The 34LV20 is of the mechanical tuning type and has a frequency range of 33.2 to 34.8Gc. The output at center frequency is 10 watts.



2. FEATURES

1. Excellent air-cooling and water-cooling capability
2. Light weight and small size
3. Wide electronic tuning range·····more than 200Mc
4. More efficient than other klystrons
5. Low voltage operation·····1,500 to 1,900 volts
6. Mechanically tunable·····33.2 to 34.8Gc
7. High power output·····10 watts
8. Easy operation
9. Long life operation

3. SPECIFICATIONS

ELECTRICAL DATA

Typical Operating Data

(1) High level operation

	Collector separated (Refer to Fig. 2)	Collector connected to resonator (body) (Refer to Fig. 3)
Cooling	Forced air cooling	Water cooling (1 liter/min.)
Frequency	34Gc	34Gc
Output power	10W	10W
Resonator voltage	1800V	1800V
Resonator current	40mA	95mA
Collector voltage	600V	
Collector current	55mA	
(Cathode current	95mA	95mA)
Control electrode voltage	-100V	-100V
Efficiency	10 %	6 %
Heater voltage	6.3V	6.3V
Electronic tuning range	200Mc	200Mc
Modulation sensitivity	* (1) 1Mc/V	* (1) 1Mc/V
	* * (2) 2Mc/V	* * (2) 2Mc/V

(2) Low level operation

Cooling	Forced air cooling or water cooling, both capable	
Frequency	34Gc	34Gc
Output power	3W	3W
Resonator voltage	1700V	1700V
Resonator current	20mA	60mA
Collector voltage	600V	
Collector current	40mA	
(Cathode current	60mA	60mA)
Control electrode voltage	-400V	-400V
Total DC input power	58W	102W
Efficiency	5 %	3 %

Maximum Rating

Frequency range	33.2 — 34.8Gc	33.2 — 34.8Gc
Output power	5W min.	5W min.
Resonator voltage	2200V max.	2200V max.
Resonator current	80mA	120mA
Collector voltage	500V min. — 2200V max.	500V min. — 2200V max.
Collector current	120mA max.	120mA max.
(Cathode current	120mA	120mA)
Total DC input power	150W max.	250W max.
Control electrode voltage	-50V — -1000V	-50V — -1000V
Heater voltage	5.7V — 6.9V	5.7V — 6.9V
Heater current	1A — 2A	1A — 2A
Warming-up time	100 sec.	100 sec.
Load VSWR	1.5 max.	1.5 max.
Series resistance connected with cathode	20k Ω max.	20k Ω max.
Temperature at outflow of cooling water		35°C

MECHANICAL DATA

Output leadout Waveguide	RG-96/U
Flange	UG-599/U
Base connection	Refer to Fig. 4
Mounting	Any position
Weight	5.4kg
Dimensions	120 × 132 × 224 (mm)

* (1) This is the case that the resonator voltage is modulated on condition of the resistor $R_k = 0$ in Fig. 2 or 3.

* * (2) This is the case that the resistor R_k is inserted into the circuit of Fig. 2 or 3 and that the control electrode voltage is modulated. By varying the value of R_k, the modulation sesitivity can be changed, but, in this case, the power supply voltage should be kept at as high the voltage as compensates the voltage dropped in the resistor R_k.

For improvement, specifications will be changed without notice.

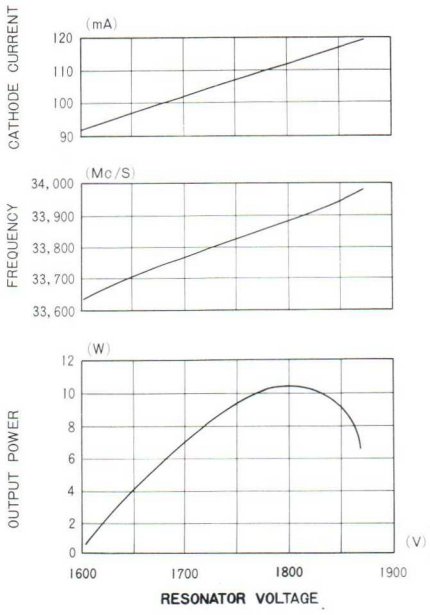


FIG. 1 Typical operating data

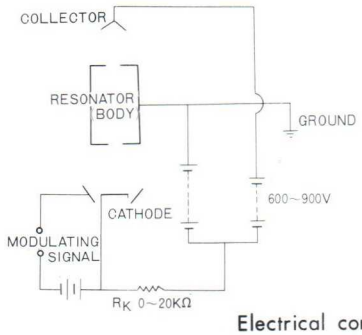
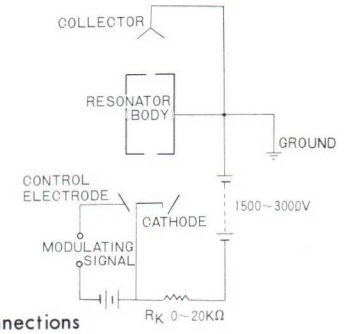


FIG. 2 Collector separated



Electrical connections

FIG. 3 Collector connected to resonator

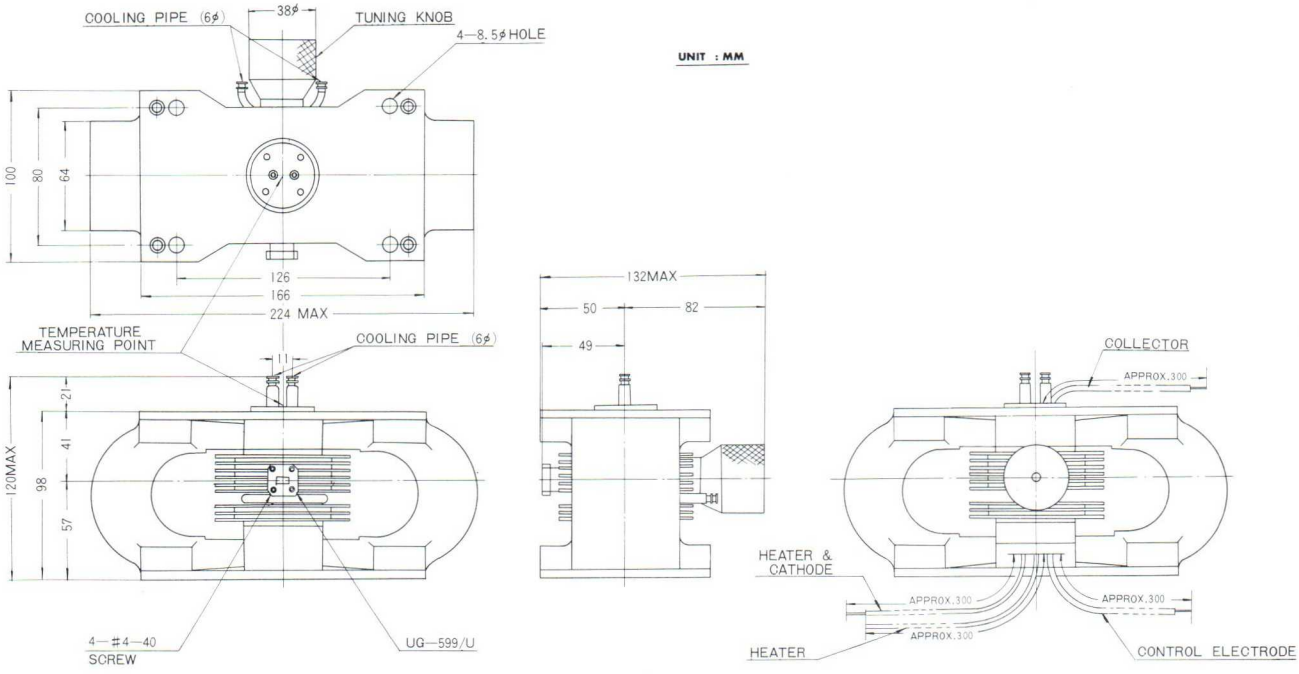


FIG. 4 Outside dimensions

OKI

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OKI electric industry company. limited

Export Department: 7, 2-CHOME, HIRAKAWA-CHO, CHIYODA-KU, TOKYO, JAPAN
Tel: TOKYO 263-1111 Telex: TK2627 Cable Address: "OKIDENKI TOKYO"
Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN

DISTRIBUTOR: **BUTLER ROBERTS ASSOCIATES INC.**

Head Office: 500 S.E. 24th Street, Ft. Lauderdale, Florida Tel: Area 305: 523-7202
New York Office: 202 East 44th Street, New York 17, New York Tel: Area 212: 682-2989
West Coast Rep.: Frank R. Thomas, P.O. Box 1377, Santa Barbara, Calif. Tel: Area 805: 962-5917

OP - 1031

66. 1. 90 PRINTED IN JAPAN

45 KMC LADDERTRON

NEW TUNABLE HIGH POWER MILLIMETER WAVE OSCILLATOR

OKI electric industry co., ltd. TOKYO JAPAN

Model 45LV10

NEW ANNOUNCEMENT!

1. GENERAL

The "LADDERTRON" is a tunable, flat-beam, single cavity, multi-gap klystron that has many superior features and characteristics as a high-power millimeter wave oscillator.
The 45LV10 is of mechanical tuning type, ranging from 44000Mc to 46000Mc and the output at 45000Mc is 5 watts approximately.

2. FEATURES

1. High output power.
2. Higher officiency as compared with other Klystrons.
3. Operation at lower voltage.
4. Broad range for mechanical tuning.
5. Broad range for elctronic tuning.
6. Capable of frequency modulation by control electrode voltage.

3. SPECIFICATIONS

MECHANICAL DATA

Output leadout:	Waveguide	RG—97/U
	Flange	UG—383/U
Base connections:	Refer to Fig. 3	
Mounting:	Any position Magnetic materials should be kept away from the magnet by more than 10cm.	
Weight:	13kg. approx.	
Dimensions:	282mm × 246mm × 147mm. approx. (Refer to Fig. 3)	
Cooling:	Water cooling required Minimum water flow at 20°C to be more than 0.5 liters per minute.	

ELECTRICAL DATA

Maximum rating:

Heater voltage	5.7—6.9V
Heater current	1—2.0A
Resonator voltage	2200 max.
Cathode current	135mA max.
Control electrode voltage	−50 — −500V
Frequency range	44000—46000Mc
Output power	1 watts min.
Warming up time	150sec. min.
Load VSWR	1.5 max.
Series resistance connected with cathode	20kΩ
Temperature at outflow of cooling water	35°C

Typical Operating Data:

Heater voltage	6.3V
Frequency	45000Mc
Resonator voltage	2000V
Cathode current	130mA
Control electrodo voltage	−200V
Output power	5W
Electronic tuning range	*(1) 40Mc/s
	**(2) 60Mc/s
Modulation sensitivity	*(1) 0.25mc/Vc
	**(2) 0.4Mc/Vw
Cooling water flow	1ℓ/min.

*(1) Defined as the frequency difference between the half power points of the maximum power output and is obtained by the variation of the resonator voltage alone. (Refer to Fig. 1)

**(2) Defined as the frequency difference between the half power points of the maximum power output and is obtained by the variation of the control electrode voltage using the reference circuit in Fig. 2.

Caution: 1. Do not turn on the switch of the power supply to the resonator without applying the water cooling.
2. Much care should be taken not to give any shock to the tuning mechanism.

OKI®
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Export Department: 7, 2-CHOME, HIRAKAWA-CHO, CHIYODA-KU, TOKYO, JAPAN
Tel: TOKYO 265-3171 Telex: TK2627 Cable Address: "OKIDENKI TOKYO"
Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN TEL: TOKYO 501-3111

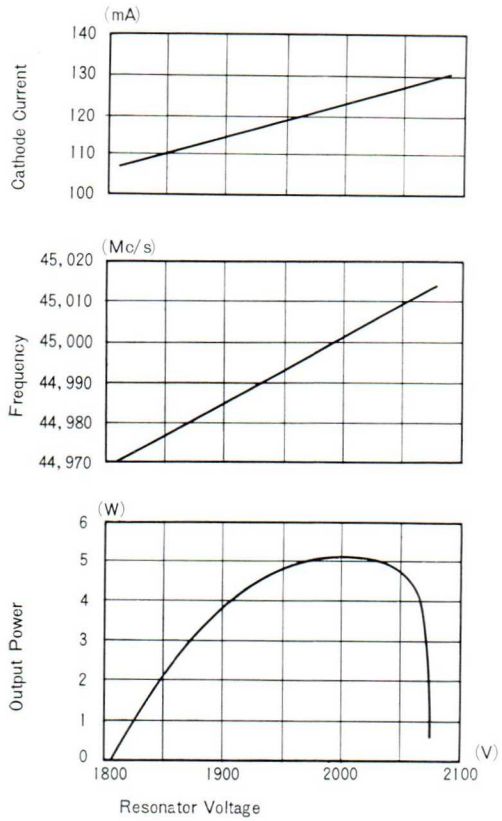


FIG. 1 Typical operating data

With mechanical tuning fixed at a certain position, the circuit with which FIG. 1 is obtained by changing the beam voltage is shown in FIG. 2 (at R = 0).

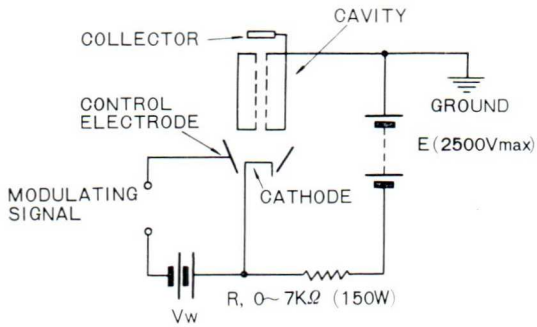


FIG. 2 Electrical connections

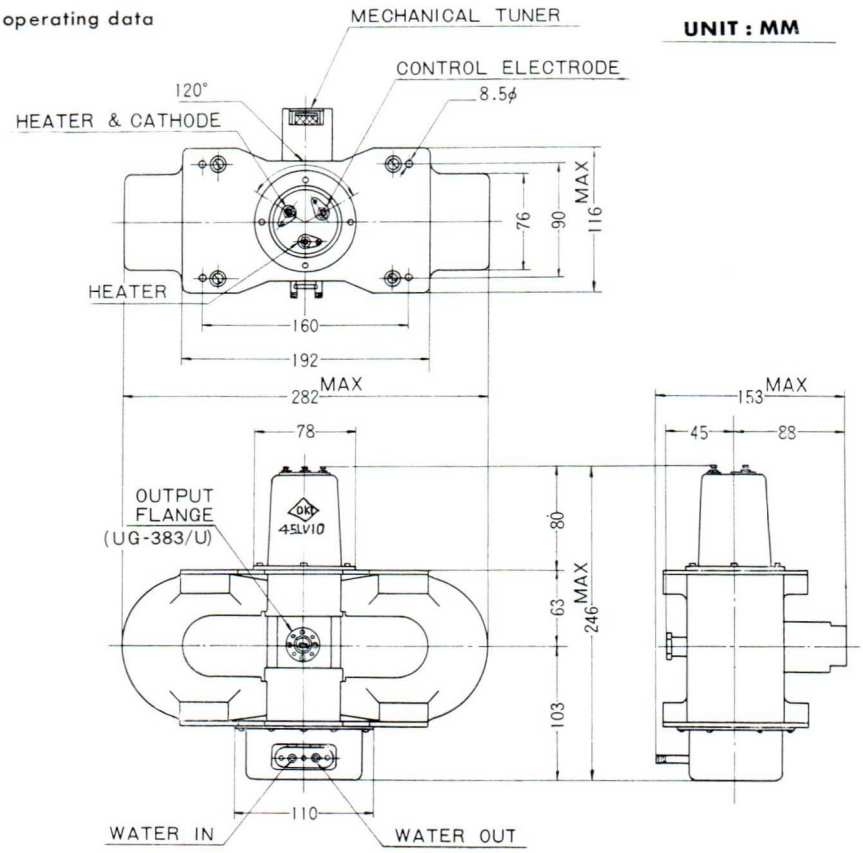


FIG. 3 Outside dimensions

65. 2. 25 PRINTED IN JAPAN

BUTLER ROBERTS ASSOCIATES INC.

A Subsidiary of
OKI ELECTRONICS OF AMERICA INC.

HEAD OFFICE:

500 S. E. 24th STREET
FT. LAUDERDALE,
FLORIDA

TEL: AREA 305
523-7202

WESTERN UNION
TELEX: 051-423

NEW YORK OFFICE:

202 EAST 44th STREET
NEW YORK,
NEW YORK

TEL: AREA 212
682-2989

WESTERN UNION
TELEX: 01-25484

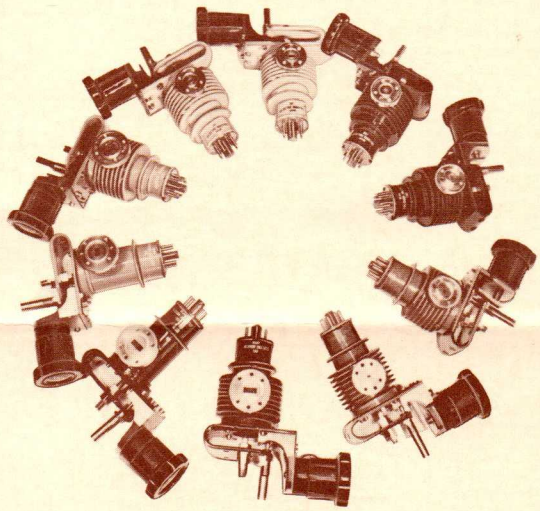
WEST COAST REP.:

FRANK R. THOMAS

P. O. BOX 1377
SANTA BARBARA,
CALIFORNIA

TEL: AREA 805
962-5917

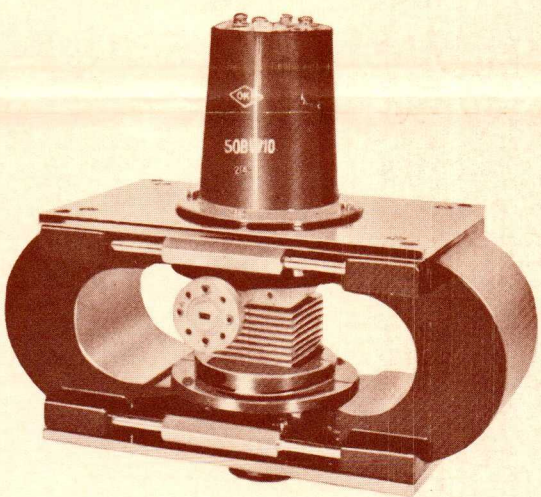
EXPANSION OF MM-WAVE PRODUCT LINE BY



REFLEX KLYSTRONS

KLYSTRONS TO 120 Gc.

OKI



BWO'S TO 100 Gc.
MAGNETRONS TO 94 Gc.

WITH WARRANTY INCREASED TO ONE YEAR AND AS HIGH AS 1000 HOURS (To 35 Gc.)

OKI

ESTABLISHED 1881

October 1, 1965
Ft. Lauderdale, Florida

EXPANDED PRODUCT LINE: The increasing acceptance of OKI millimeter-wave tubes by private enterprise and government agencies both here and abroad has enabled OKI to expand its line to include a wider range of frequency and power options. Many new types of klystrons are now available, from low powered laboratory and airborne models, to dual-cavity ceramic tubes capable of watt-order power.

BACKWARD-WAVE OSCILLATORS are now available from 50 Gc. to 100 Gc., as are MAGNETRONS up to as high as 94 Gc. TRAVELLING-WAVE TUBES, initially for the 6 mm. band, will also be available shortly.

Dedication of a modern multi-million dollar plant exclusively to mm-wave technology permits OKI to offer a reliable source of supply of these devices at the lowest possible cost consistent with established high engineering standards and conservative rating policies.

Furthermore, the flexibility of OKI facilities enables us to offer custom-designed tubes in a wide range of frequency and power combinations. If you do not find an OKI catalog item that fits your needs, please submit your requirements to us. Quotations will gladly be furnished for any quantity of special tubes, if an advantageous price can be offered you while maintaining our excellence of product and dependability of service.

A new UNIVERSAL KLYSTRON POWER SUPPLY is available now from OKI, specifically designed around many suggestions received from our customers for a unit that will afford adequate protection to costly klystron tubes . . . something lacking in low-priced supplies currently on the market.

A complete line of WAVEGUIDE SYSTEM COMPONENTS is now being introduced by OKI, again in response to customer requests for complete system component availability from one source. This line will include all devices necessary to cover the frequency ranges of OKI mm-wave tubes. While a comprehensive catalog is being prepared, we invite your inquiries for specific components of OKI quality, precision and value.

WARRANTY: All OKI tubes are backed by a sound warranty policy for your protection. The normal warranty is now valid for ONE YEAR from date of delivery to original purchaser, and covers 1,000 hours operation for reflex klystrons up to 35 Gc., and 500 hours up to and including 100 Gc.; over 100 Gc. they are warranted for 200 hours operation. Adjustments under this warranty are made on a pro-rata basis according to actual hourly usage obtained prior to failure, (assuming the unit has been operated in accordance with factory recommendations).

PERFORMANCE: OKI mm-wave tubes usually perform well into thousands of hours of useful life. Satisfied users and factory test programs show that these tubes can be expected to operate from three to four thousand hours, to as high as 10,000 hours as in some cases on record, before any serious deterioration in performance occurs. We will be happy to submit, upon request, detailed information covering tests performed on specific types of tube.

POWER RATINGS: OKI continues to maintain an extremely conservative output power rating policy. Although "typical output" power levels are shown, the majority of OKI tubes far exceed these "typical" levels. If you have a minimum power requirement at any specific frequency, please so specify when ordering or inquiring. In many cases we can select a suitable unit from our stock and/or check its performance at your specified frequency, and submit this information to you prior to placement of your order.

SERVICE: In certain cases it is possible to effect repairs upon klystron tubes that have failed subsequent to expiration of the warranty. The facilities of our Florida mm-wave laboratory are at your disposal for determination as to feasibility of repair; quotations will be provided should repairs prove possible. No charge is made for testing of OKI tubes to determine extent of damage. A nominal charge is made, however, for checking and/or recalibration of klystrons by other manufacturers.

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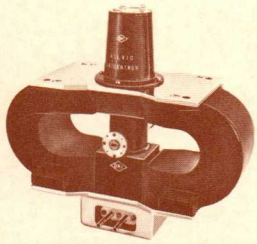
OKI MM-WAVE KLYSTRON TUBES. (ALL OUTPUT LEVELS MEASURED INTO A MATCHED LOAD)



INDEX

FX—FIXED TUNED. (SPECIFY FREQ.)
TT—TRIM TUNABLE. (SPECIFY CENTER FREQ.)
FT—FULLY TUNABLE OVER RANGE.
SP—SPECIAL PURPOSE HIGH POWER PACKAGED KLYSTRON. TWO-CAVITY. FIXED TUNED.
HV—HIGH VOLTAGE TUBE.
LV—LOW VOLTAGE TUBE.
BENCH—BENCH TYPE OF TUBE WITH OCTAL BASE.
AIRBORNE—LIGHTWEIGHT AIRBORNE TUBE. 3½ OZ. WEIGHT
LADDERTRON—SPECIAL PURPOSE HIGH POWER PACKAGED KLYSTRON. TUNABLE.

OKI MODEL NR.	TYPICAL FREQUENCY RANGE IN Gc.	TYPE OF TUBE (SEE INDEX)	TYPICAL OUTPUT AT MIDBAND	FLANGE TYPE	PRICE DEL'D.
17V10	15.5/18.5	FT HV BENCH	100 milliwatts	UG-419/U	$ 455.00
20V10	18.0/22.0	FT HV BENCH	150 "	UG-595/U	480.00
22V10	20.0/24.0	FT HV BENCH	150 "	UG-595/U	480.00
24V10A	22.0/26.0	FT HV BENCH	250 "	UG-595/U	480.00
24V11	22.0/26.0	FT HV BENCH	600 "	UG-595/U	825.00
30V10	27.0/32.0	FT HV BENCH	70 "	UG-599/U	480.00
30V11	27.0/32.0	FT HV BENCH	200 "	UG-599/U	825.00
30V16	29.5/31.5	TT HV BENCH	250 "	UG-599/U	825.00
KC31A	30.0/32.0	FX HV SP	7 watts	UG-599/U	2575.00
KCT31B	30.5/31.5	FT HV SP	3 "	UG-599/U	3100.00
33V10	31.0/36.0	FT HV BENCH	70 milliwatts	UG-599/U	480.00
34LV10	33.2/34.8	LADDERTRON	10 watts	UG-599/U	3693.00
35V10	32.0/37.0	FT HV BENCH	70 milliwatts	UG-599/U	480.00
35V11	32.0/37.0	FT HV BENCH	200 "	UG-599/U	825.00
35V30	32.0/37.0	FT LV BENCH	40 "	UG-599/U	825.00
35V51	34.7/35.3	TT HV AIRBORNE	150 "	UG-599/U	955.00
35V61	34.7/35.3	TT LV AIRBORNE	30 "	UG-599/U	1230.00
35V155	34.5/35.5	TT HV BENCH	80 "	UG-599/U	480.00
40V10	37.0/42.0	FT HV BENCH	80 "	UG-383/U	725.00
45V10	43.0/48.0	FT HV BENCH	80 "	UG-383/U	725.00
45LV10	44.3/45.7	LADDERTRON	5 watts	UG-383/U	5250.00
47V10	44.0/51.0	FT HV BENCH	70 milliwatts	UG-383/U	775.00
47V11	44.0/51.0	FT HV BENCH	150 "	UG-383/U	1005.00
50V10	46.0/54.0	FT HV BENCH	50 "	UG-383/U & UG-385/U	840.00
55V10	50.0/60.0	FT HV BENCH	60 "	UG-385/U	995.00
55V11	50.0/60.0	FT HV BENCH	120 "	UG-385/U	1190.00
KC55B	53.0/57.0	FX HV SP	10 watts	UG-385/U	3720.00
60V10	55.0/65.0	FT HV BENCH	60 milliwatts	UG-385/U	1595.00
70V10	66.0/76.0	FT HV BENCH	60 "	UG-385/U & UG-387/U	1940.00
70V11A	66.0/76.0	FT HV BENCH	125 "	UG-385/U & UG-387/U	2170.00
75V10	70.0/80.0	FT HV BENCH	40 "	UG-387/U	2055.00
80V10A	75.0/85.0	FT HV BENCH	40 "	UG-387/U	2300.00
90V10	85.0/95.0	FT HV BENCH	30 "	UG-387/U	2300.00
90V11	85.0/95.0	FT HV BENCH	60 "	UG-387/U	2700.00
100V10A	95.0/105.0	FT HV BENCH	25 "	UG-387/U	2470.00
120V10	107.0/122.0	FT HV BENCH	10 "	UG-387/U	3300.00

DELIVERY: Delivery of the more popular OKI klystrons can normally be made from our Ft. Lauderdale, Florida, facility within hours of receipt of order. Shipments are made by prepaid Air Express to any destination in the U.S.A. and Canada at no additional cost to you.

OKI

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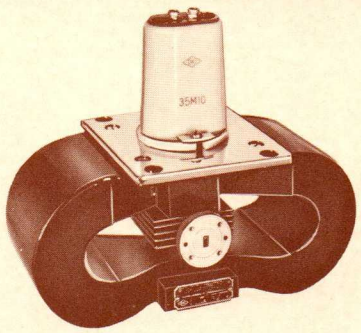
OKI MM-WAVE BACKWARD-WAVE OSCILLATORS

OKI MODEL NR.	TYPICAL FREQUENCY RANGE IN Gc.	TYPE OF TUBE	TYPICAL OUTPUT	FLANGE TYPE	PRICE DEL'D.
50BW10	44.0/54.0	BWO	500 mW @ 54 Gc.	UG-385/U	$3100.00
60BW10	55.0/65.0	BWO	on request*	UG-385/U	on request*
85BW10	80.0/90.0	BWO	on request*	UG-387/U	on request*

*NOTE: A selection of BWO's to cover 50 to 100 Gc. is now being prepared. The first production model is the 50BW10, to be followed by those shown above, and finally other models to fill the frequency gaps between 50 and 100 Gc. will be made available. Please request quotation for your special requirements if not shown above.

OKI MM-WAVE MAGNETRONS



OKI MODEL NR.	TYPICAL FREQUENCY RANGE IN Gc.	TYPE OF TUBE	TYPICAL OUTPUT	FLANGE TYPE	PRICE DEL'D.
15M10	15.425/15.575	MAGNETRON	25 Kw peak	UG-419/U	On request*
24M10	23.760/24.240	MAGNETRON	50 Kw peak	UG-595/U	$1080.00
33M10	32.274/32.926	MAGNETRON	40 Kw peak	UG-381/U	1440.00
35M10	34.512/35.208	MAGNETRON	40 Kw peak	UG-381/U	1500.00
50M10	49.000/51.000	MAGNETRON	20 Kw peak	UG-383/U	1800.00
60M10	59.875/60.765	MAGNETRON	10 Kw peak	UG-385/U	2170.00
70M10	68.600/71.400	MAGNETRON	5 Kw peak	UG-385/U	On request*
85M10	83.500/86.500	MAGNETRON	1 Kw peak	UG-387/U	On request*
94M10	92.500/95.500	MAGNETRON	1 Kw peak	UG-387/U	On request*

*NOTE: These four models are now in prototype production. Please request quotation for your special requirements if not shown above.

OKI TRAVELLING-WAVE TUBES

Current prototype production involves TWT for 44 Gc. to 48 Gc. Power output at midband averages from 200 mW. to 500 mW., (signal gain from 23 db. to 32 db.). Maximum output from existing prototypes has been 700 mW. (signal gain of 45 db.). Please request quotation for your special TWT requirements.

TERMS AND PRICES: Prices shown are NET, delivered; terms to rated organizations are thirty days NET. For quantity prices please indicate specific quantities desired, and delivery programming where necessary.

OKI

ESTABLISHED 1881

OKI UNIVERSAL KLYSTRON POWER SUPPLY

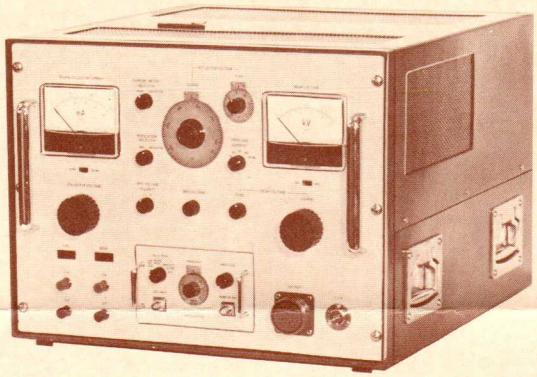
MODEL KS-6

POWER INPUT: 115 v. AC 60 cps.

DIMENSIONS: 14.75″ high, 19.5″ wide, 21.25″ deep

WEIGHT: 200 lbs.

PRICE AND DELIVERY: On request



HEATER SUPPLY

Voltage	5.7, 6.3 & 7.0 v. DC
Current	2.5 amp. max.
Ripple	2% max.

BEAM SUPPLY

Voltage	200 to 3,600 v., cont. var., pos. gnd.
Current	150 mA max.
Ripple	5 mV rms. max.
Regulation	0.02% for line var. 105 to 125 v. AC

GRID SUPPLY

Voltage	0 to 75 v. pos. (to neg. side of Beam supply) 0 to 300 v. neg. (to neg. side of Beam supply)
Current	10 mA max. (positive) 1 mA max. (negative)
Ripple	2 mV max.
Regulation	0.01% max. for line var. 105 to 125 v. AC

OVERLOAD PROTECTION

A.C. line — 10A fuse

A.C. high voltage — 5A fuse

D.C. high voltage — variable overload relay, 15, 30, 50 & 100 mA, plus very short pulsive overload relay (see Note 3 below)

REFLECTOR SUPPLY

Voltage	20 to 700 v. neg. (to neg. side of Beam supply) Output impedance, 150,000 ohms max.
Current	100 μA for specified voltage accuracy. Up to 1 mA of current is, however, available.
Ripple	2 mV max.
Regulation	0.01% max. for line var. 105 to 125 v. AC

COLLECTOR SUPPLY

Voltage	0 to 200 v. unregulated
Current	150 mA max.

MODULATOR

Sawtooth Wave	0 to 150 v. p-p 40 to 400 cps., and 60 cps. 10% max. linearity
Square Wave	0 to 150 v. p-p 3 μ sec. max. rise time 40 to 2,000 cps.
Sine Wave	0 to 150 v. p-p at line freq. (60 cps)
External Mod.	Freq. up to 100,000 cps. sine wave
Amp. Gain	30 db. approx.

METERING

Beam Voltage	Range 1Kv, 4 Kv, Accuracy $\pm$ 2.5%
Beam or Collector mA	Range 50 mA, 150 mA, Accuracy $\pm$ 2.5%
Reflector Volts	Accuracy $\pm$ 2%

ADDITIONAL SPECS.

All modulation externally available at "MONITOR OUT" jack

NOTES:

1. Silicon diodes used for rectifiers.
2. Modulator transistorized except for final amplifier tube.
3. Equipped with transistorized pulsive overload protection device, to protect klystron and power supply from extremely short pulsive overloads, of the type that the variable overload relay cannot handle.
4. This power supply has been specifically designed by OKI in response to many requests from users of OKI and other millimeter-wave tubes, and incorporates many suggestions offered by our customers.

OKI

ESTABLISHED 1881

U. S. GOVERNMENT PROVES OKI KLYSTRONS THE MOST RELIABLE

Over the past few years, OKI millimeter-wave klystron tubes have earned a well-deserved reputation for excellent overall performance, reliability and availability. Our immediate and unquestioning compliance with warranty provisions has further enhanced the value of these OKI products in the U. S. market.

In the U. S. our steady klystron customers now number many hundreds, and include almost every organization active in the millimeter-wave field, both in private industry as well as in government. Users of OKI tubes include the U. S. Army, U. S. Air Force, U. S. Navy, NASA, National Bureau of Standards, etc. OKI tubes contributed to the success of Bell Telephone Labs'. "TELSTAR" project, and many similar scientific projects.

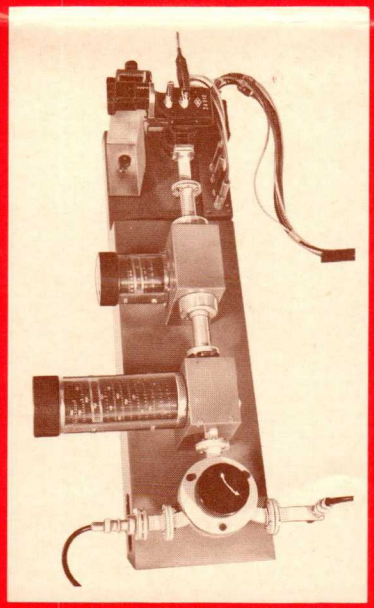
Typical of the formal acknowledgments of the superiority of OKI klystrons in official U. S. Government publications is the following:

"THE OKI KLYSTRONS HAVE PROVEN TO BE THE MOST RELIABLE"

(Page 18, ASTIA AD-284652, Report No. 4, Dept. of the Army, Project No. 3A991500102, Contract DA-36-039-SC-87321 placed by the U. S. Army Signal Supply Agency, Fort Monmouth, N. J.)

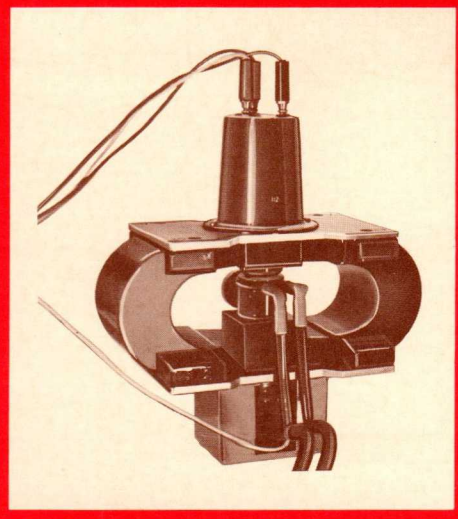
Typical of acknowledgments in the industrial field is the following extract from a paper given by J. J. Gallagher, et al, at the 1962 Frequency Control Symposium, Atlantic City, N. J., and which is referred to by the U. S. Government publication quoted above.

"OKI KLYSTRONS HAVE PROVEN TO BE BY FAR THE MOST RELIABLE TUBES FOR PHASE-LOCK WORK. THEY ARE RELATIVELY INSENSITIVE TO MECHANICAL VIBRATIONS, OPERATE WELL WITH FORCED AIR COOLING, AND DRIFT VERY LITTLE AFTER A FIVE MINUTE WARMUP"



SYSTEM COMPONENTS BY OKI

35 Gc. AIRBORNE KLYSTRON



10 WATTS CW at 55 Gc. — KC55B

High Power Millimeterwave Klystron KC55B

This tube is a two-resonator klystron oscillator, fixed tuned for wave guide output, cooled by liquid and packaged in permanent magnet.
Long life and stable oscillation is assured by the unique ceramic structure.

ELECTRICAL RATING :	Maximum rating	Typical performance
Resonator voltage, Vrs	3.9 KVdc max.	3.6 KVdc
Collector voltage	Vrs+100 Vdc max.	3.7 KVdc
Control electrode voltage	−300V～−150 Vdc	−200 Vdc
Cathode current	200 mA max	182 mA
Resonator current	70 mA max	50 mA
Heater voltage	7.5 V max	7.0 V
Heater warming up time	60 sec. min	60 sec.
Output power	5 W min	12 W
Frequency	55 GC±2GC	54.52 GC

Note : voltages are measured to the cathode

MECHANICAL RATING :

Dimensions:	237mm (H) ×218mm (W) ×100mm (D) (Refer to Fig. 1)
Weight:	6.1 Kgr (13 1bs 7 oz)
Mounting:	Any position Four mounting holes, 6.5mm dia, are provided
R. F. connection:	Wave guide RG-98/U, mating with cover flange UG-385/U
Cooling:	Water cooling at flow rate of 1.5 litre/minute

Leadout connection:

Heater	H }
Cathode	K } tube cap
Control electrode	W }
Collector	lead wire (provided by the side of cooling pipe)
Resonator	body or flange

Note : Resonator or collector should be grounded

AUTHORIZED OKI DISTRIBUTOR :

Butler Roberts Associates Inc.

ESTABLISHED 1881

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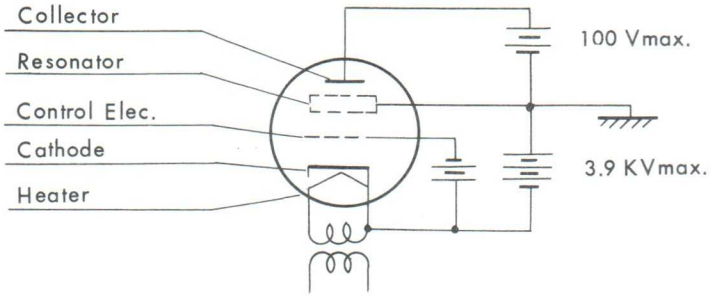
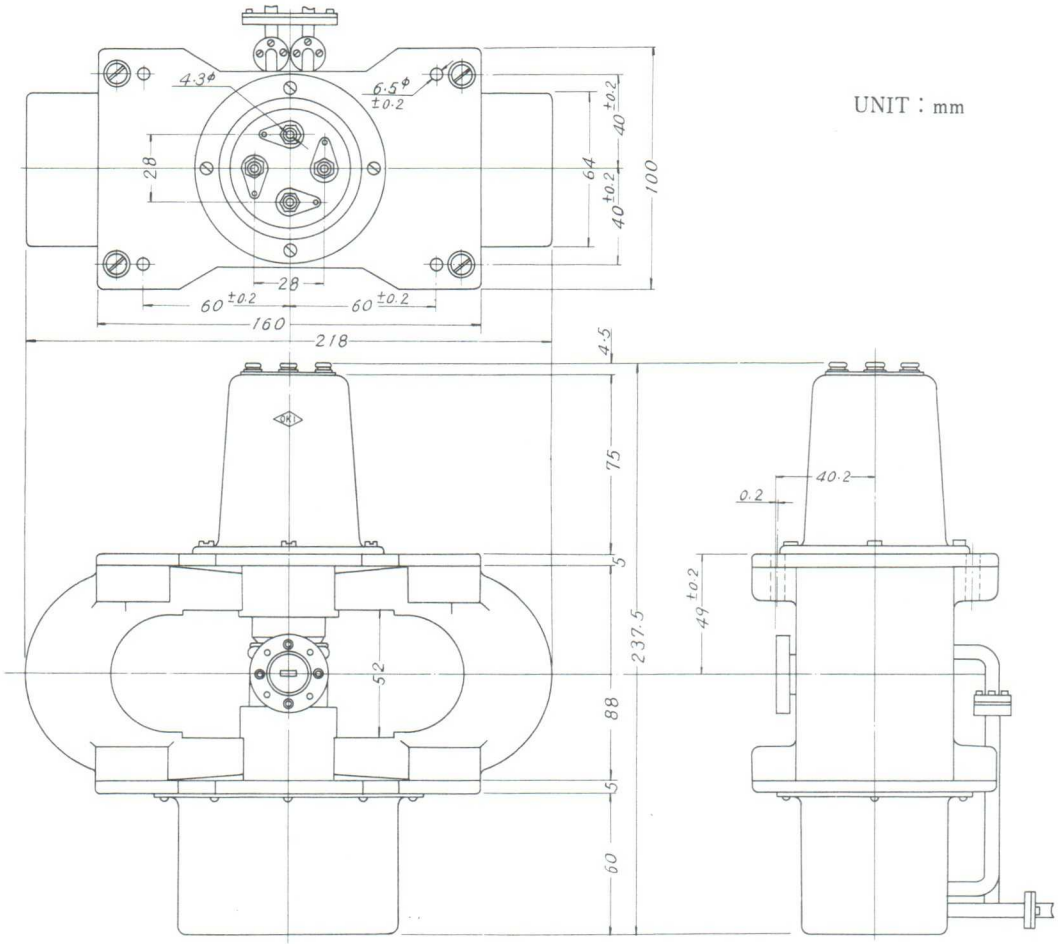
WEST COAST REP.: Frank R. Thomas, P.O. BOX 1377, SANTA BARBARA, CALIF. TEL: AREA 805: 962-5917

OPERATION CIRCUIT



OUTSIDE DIMENSIONS

UNIT : mm



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A Subsidiary of OKI ELECTRONICS OF AMERICA INC.

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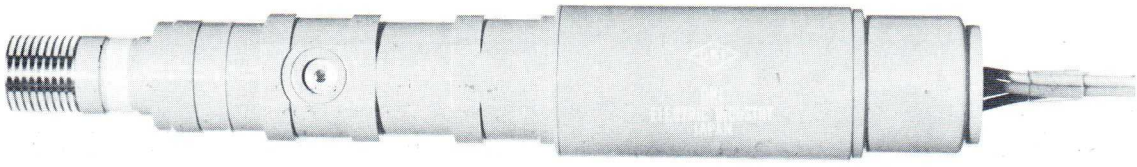
OKI
electric industry
co., ltd. TOKYO JAPAN

CW TRAVELLING-WAVE AMPLIFIER FOR THE 6—7 MILLIMETER BAND



This travelling-wave tube is the CW power amplifier with wide range performance in the millimeter wave region. More than 17 db of gain has been achieved in the range of 45,000 Mc to 51,000 Mc. A maximum CW output of 600 milliwatts has been obtained in this band.

TENTATIVE PERFORMANCE DATA

Heater voltage	6.3V	Grid voltage	-3.0V
Frequency range	45,000 Mc to 51,000 Mc	Small signal gain	20 db
Circuit voltage	3,870V	Maximum power output	600 mW
Beam current	6.0 mA	VSWR, input and output	1.5 : 1
Anode voltage	4,000V	Focusing magnetic field	2,400 Gauss

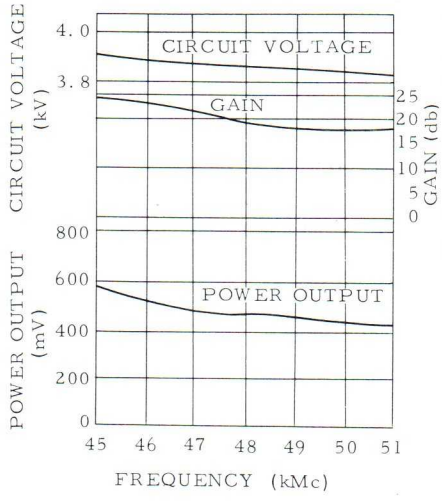


Fig. 1

Frequency characteristics of maximum power output, gain and circuit voltage at beam current 6 mA.

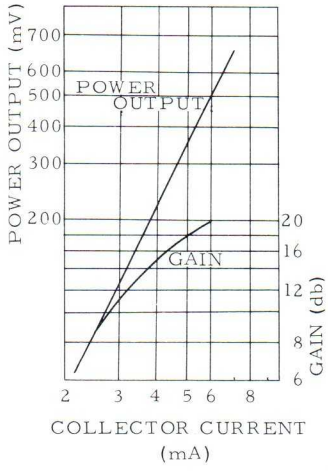
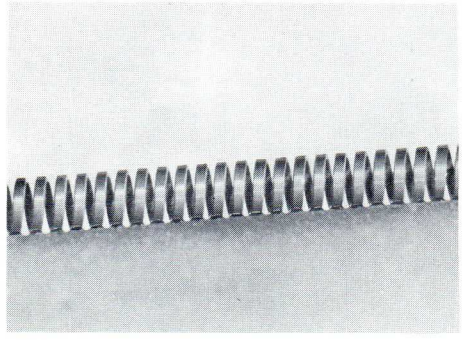


Fig. 2

Small signal gain and maximum power output vs beam current



Slow wave structure
Helix glazed to Be0 rod.
Microscopic photograph

This tube has been developed under contract with the Electrical Communication Laboratory of Nippon Telegraph and Telephone Public Corporation.

MAIN PRODUCTS & SERVICES

Telephone Set	Automatic, Common Battery, Magneto, Portable, Marine, Anti-explosion
Telephone Switching Equipment	Strowger, Crossbar & Electronic System Automatic Switching Equipment, Common Battery & Magneto Switchboard
Telegraph Equipment	Telex Switching Equipment, Telex Subscriber Set, Page & Tape Type Teleprinter, Telegraph Relay Equipment
Data Processing Equipment	Electronic Computer & Input/Output Device, P.C.S. Equipment, Data Transmission Equipment
Radio Equipment	SSB, DSB, ISB & FS Shortwave Transmitter & Receiver, VHF, UHF & SHF Multiplex Transmitter & Receiver, 27Mc Citizen Band Transceiver
Carrier Equipment	Cable, Open-wire & Radio Multiplex Telephone Carrier Equipment, Telegraph Carrier Equipment
Broadcasting Equipment	MF & VHF/FM Broadcast Transmitter, TV Translator, ST Link, Studio Equipment
Radar Equipment	Marine Radar, Harbour Radar, Weather Radar, Loran
Measuring Equipment	Standard Signal Generator, Frequency Meter, Field Intensity Meter, Magnet Field Scope, Echo Sounder, Measuring Equipment for Meteorological Observation
Electronic Components	Millimeter Wave Tubes: Klystron, Laddertron, Magnetron, Travelling Wave Tube, Backward Wave Oscillator Semi-conductors: Transistor, Diode, Tantalum & Plastic Film Capacitor Thin Film Integrated Circuit
Audio Equipment	Tape Recorder, AM/FM Multiplex Radio, Public Address System
Installation Materials	Cable, Wire, Insulator, Terminal box, Telephone Protector, Other Miscellaneous Materials
Others	Intercom Apparatus, D.C. Electric Clock System, Automatic Fire Alarm System, Community Telephone System with Broadcasting Equipments
SURVEY, PLANNING AND INSTALLATION OF ABOVE	

OKI

ESTABLISHED 1881

OKI electric industry company, limited

Export Department: 7, 2-CHOME, HIRAKAWA-CHO, CHIYODA-KU, TOKYO, JAPAN
Tel: TOKYO 263-1111 Telex: TK2627 Cable Address: "OKIDENKI TOKYO"
Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN

OP - 1033 66. 1. 06 PRINTED IN JAPAN

Tentative Data

OKI electric industry co., ltd. TOKYO JAPAN

High Power Millimeterwave Klystron KC31A

This tube is a two-resonator klystron oscillator, fixed tuned for wave guide output, cooled by liquid and packaged in permanent magnet.
Long life and stable oscillation is assured by the unique ceramic structure.
The performance is fully warranted.

ELECTRICAL RATING:	Absolute rating	Typical performance
Resonator voltage, Vrs	3.0 KVdc max.	2.7 KVdc
Collector voltage	Vrs+100 Vdc max.	2.8 KVdc
Control electrode voltage	−300 V～−80 Vdc	−150 Vdc
Cathode current	150 mA max.	120 mA
Resonator current	60 mA max.	35 mA
Heater voltage	7.5 V max.	7.0 V
Heater warming up time	60 sec. min	120 sec.
Output power	3 W min	7 W
Frequency	31 GC±1 GC	31.0 GC

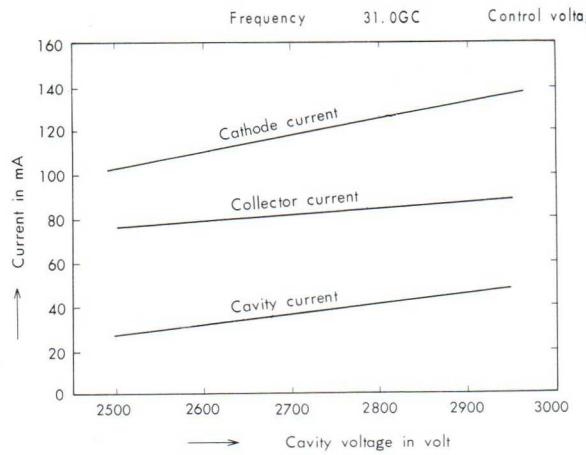
Note: voltages are measured to the cathode.

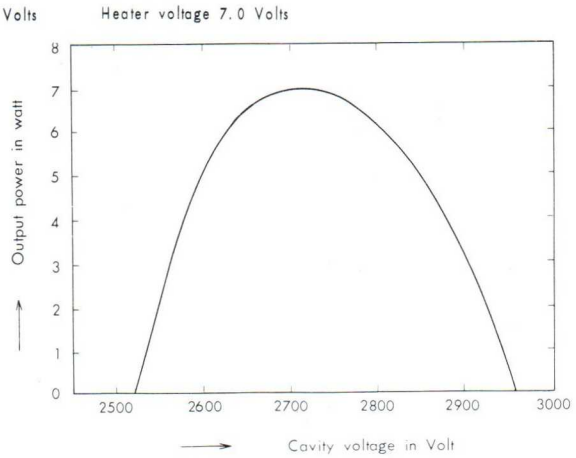
MECHANICAL RATING:

Dimensions: (Refer to Fig. 1)	237mm (H) × 218mm (W) × 100mm (D) ($9\frac{1}{3}''\times 8\frac{3}{5}''\times 3\frac{9}{10}''$)
Weight:	6.1Kgr (13 lbs 7 oz)
Mounting:	Any position Four mounting holes, 6.5mm dia, are provided
R.F. connection:	Wave guide RG-96/U, mating with cover flange UG-599/U
Cooling:	Water cooling at flow rate of 1.5 litre/minute
Leadout connection:	
Heater	H } terminated on tube cap
Cathode	K } terminated on tube cap
Control electrode	W } terminated on tube cap
Collector	lead wire (provided by the side of cooling pipe)
Resonator	body or flange

Note: Resonator or collector should be grounded

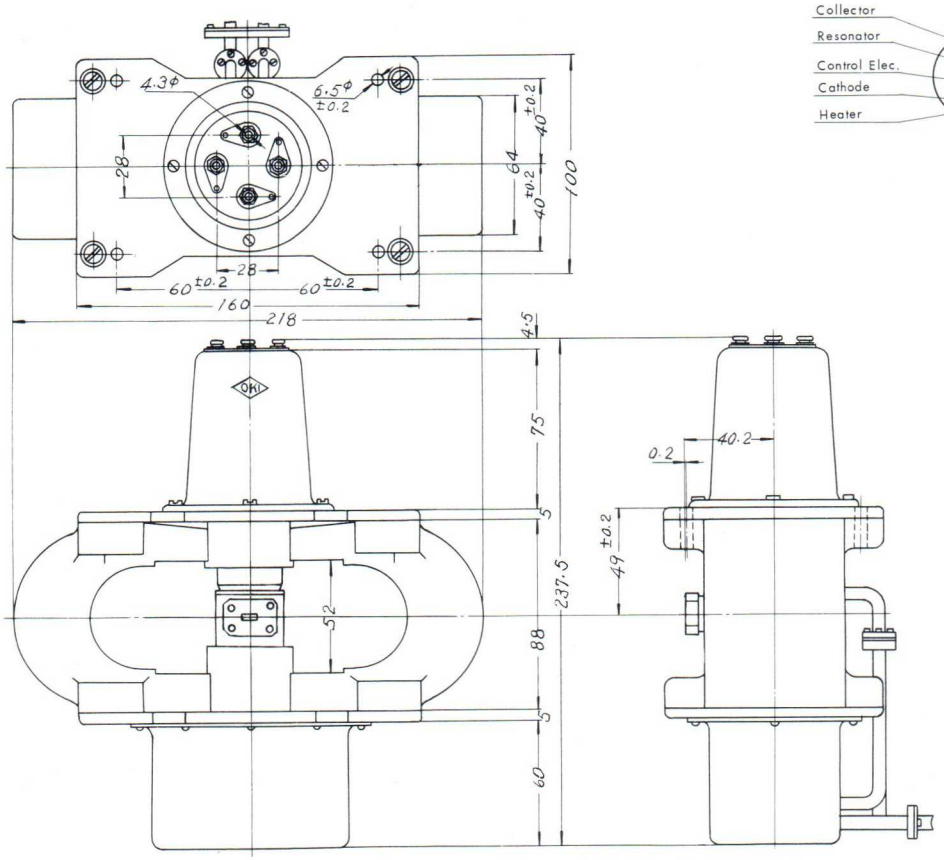
TYPICAL PERFORMANCE



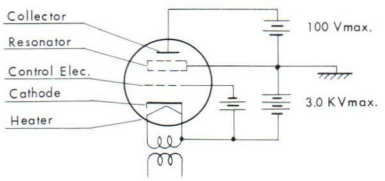


OUTSIDE DIMENSIONS

UNIT: mm



OPERATION CIRCUIT



OP-1013

64.9.20 PRINTED IN JAPAN

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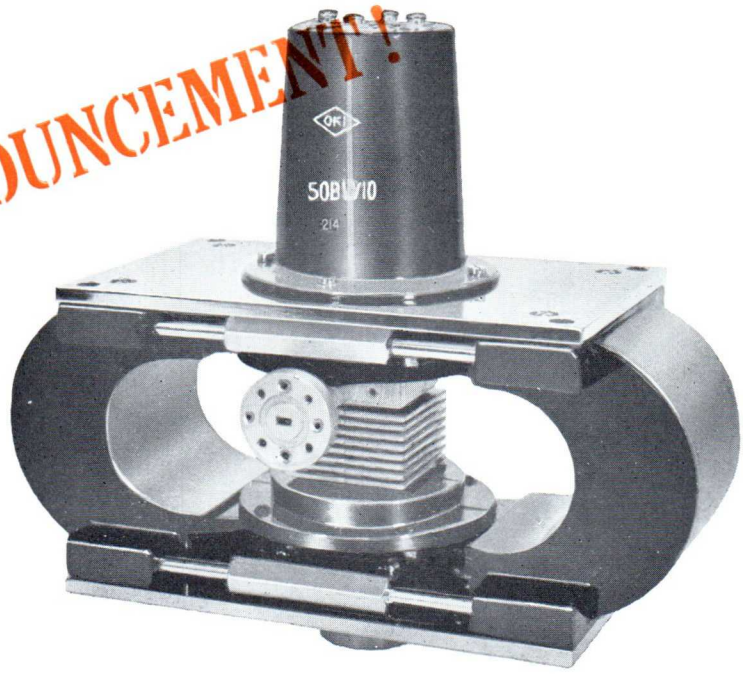
OKI
electric industry
co., ltd. TOKYO JAPAN

NEW MM-WAVE BACKWARD WAVE OSCILLATOR TYPE 50BW10

The 50BW10 is a mm-wave magnet-packaged backward wave tube and designed for generation of wideband mm-wave continuous waves.
It is an electronic-tuning oscillator with the variable tuning range of 44 Gc to 54 Gc. The output is approximately 280 milliwatts at 50 Gc.
The 50BW10 is forced air-cooled and provided with a waveguide for high frequency output leadout.

NEW ANNOUNCEMENT!



SPECIFICATIONS :

ELECTRICAL DATA :

	Maximum Rating	Typical Data
Delay Line Voltage	3.5 KV	1.7—3.5 KV
Delay Line Current	40 mA	40 mA
Anode Voltage	800 V	700 V
Anode Current	2 mA	0.5 mA
Wehnelt Voltage	—300 V	—210 V
Heater Voltage	5.7—6.9 V a.c.	6.3 V a.c.
Heater Current	—	1.0 A
Warming-up Time	60 sec. (Min.)	120 sec.
Output Power	20 mW (Min.)	20 mW at 44 Gc 280 mW at 50 Gc 100 mW at 54 Gc
Frequency Range	47—52 Gc	44—54 Gc

MECHANICAL DATA :

Output Flange	UG-383/U	
Output Waveguide	RG-97/U	
Mounting Position	Any Direction	
Dimensions	See Fig. 3	218mm × 198mm × 100mm
Weight	5.5 Kg (12.1 lb)	
Cooling	Forced Air Cooling	800 liters/min

OKI
ESTABLISHED 1881
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Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN

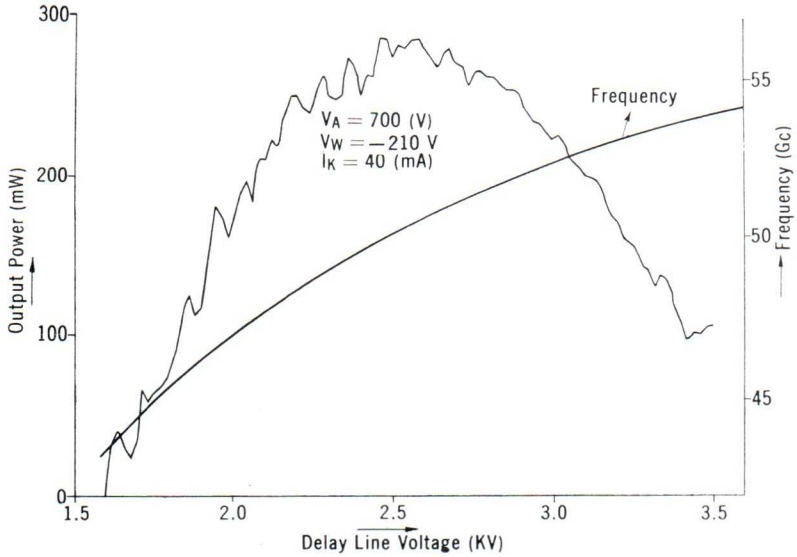


FIG. 1 TYPICAL OPERATING DATA

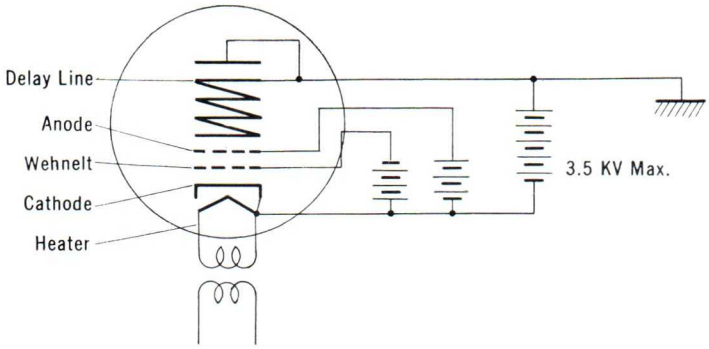
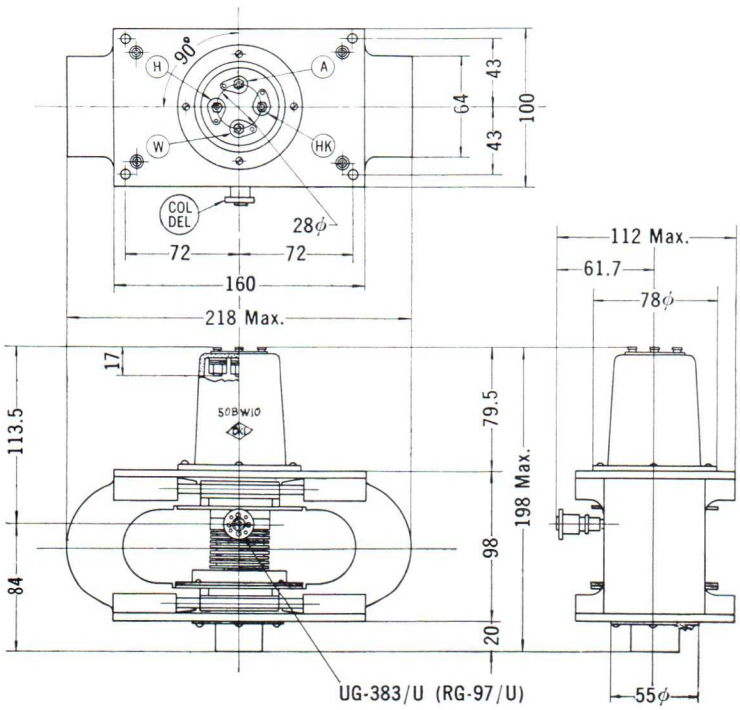
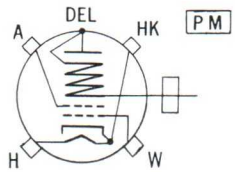


FIG. 2 ELECTRICAL CONNECTION





BASE CONNECTION

UNIT: mm

FIG. 3 DIMENSIONS

OP-1026B

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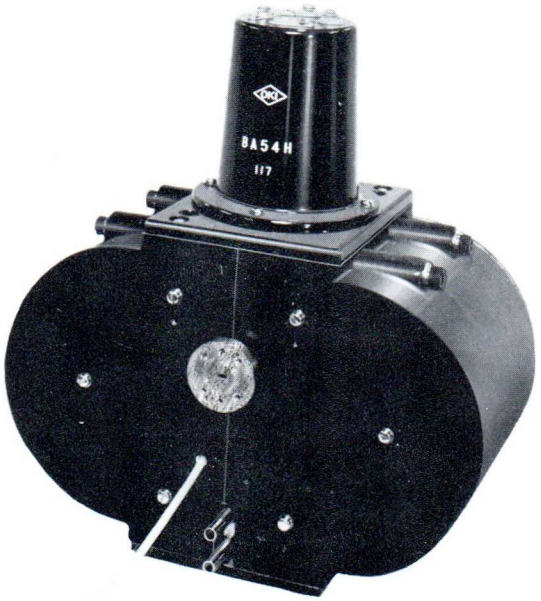
OKI
electric industry
co., ltd. TOKYO JAPAN

A NEW FAMILY OF OKI MILLIMETER WAVE BACKWARD WAVE OSCILLATOR TUBES

OKI's new series of voltage-tunable BWO's were specially developed for the generation of continuous wave signals over broad frequency bands using a single tube mode.



OKI BWO's are focused by integral permanent magnets, and can be either forced - air or liquid cooled. They have extremely good frequency stability, produce little spurious noise, do not exihibit signal drop-outs under mismatched conditions and have the traditional OKI reliability and long life.

These oscillators are capable of being amplitude and/or frequency modulated at high repetition rates over their entire frequency range. With years of experience in the design, development and production of millimeter tubes, OKI is also available to produce special tubes through 100 GHz to meet your particular requirements.

FEATURES

* Wide band frequency coverage by electronic tuning
* High power output ····· 20 mW minimum
* Long life operation ····· 2,000 hours expected and one year warranted
* Easy operation with air- or water-cooling capability
* FM modulation at high repetition rate over tuning range
* Easy AM modulation
* Low noise

APPLICATIONS

Possible applications include use as telemetry transmitter, telemetry local oscillator, beacon transmitter, radar oscillator, doppler transmitter, paramp pump and sweep generator.

BACKWARD WAVE OSCILLATORS
OPERATING DATA AND RATINGS

TYPICAL OPERATING DATA

Model	BA47F	BA50G	50BW10	BA55B	BA60C	BA47H	BA48H	BA50H	BA54H
Frequency Spread (GHz)	43-52	45-54	44-54	50-59	54-65	45-52	45-50.5	48-55	51.5-55
Output Power (mW)	30-150	30-150	20-120	20-120	20-100	150-600	300-700	150-600	500-700
Delay Line Voltage (kV)	1.8-3.6	1.8-3.6	1.7-3.5	1.8-3.6	1.7-3.6	2.1-4.0	2.3-4.0	2.1-4.0	2.7-4.0
Delay Line Current (mA)	30	30	40	30	30	60	60	60	60
Anode Voltage (V)	700	700	700	700	700	1,150	1,150	1,150	1,150
Anode Current (mA)	0	0	0.5	0	0	0	0	0	0
Wehnelt Voltage (V)	-150	-150	-210	-150	-150	-300	-300	-300	-300
Heater Voltage (V) ac	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Heater Current (A)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Warming-up Time (sec)	120	120	120	120	120	120	120	120	120

MAXIMUM RATINGS

Frequency Range (GHz)	43.5-51.5	46-53.5	46-54	51-59	55-65	46-52	46-50	48-54	53.5-54.5
Output Power (mW) Min.	30	30	20	20	20	150	300	150	500
Delay Line Voltage (kV) Max.	3.6	3.6	3.5	3.6	3.6	4.0	4.0	4.0	4.0
Delay Line Current (mA) Max.	33	33	40	33	33	65	65	65	65
Anode Voltage (V) Max.	800	800	800	800	800	1,200	1,200	1,200	1,200
Anode Current (mA) Max.	2	2	2	2	2	2	2	2	2
Wehnelt Voltage (V) Max.	-300	-300	-300	-300	-300	-300	-350	-350	-350
Heater Voltage (V) ac	5.7-6.9	5.7-6.9	5.7-6.9	5.7-6.9	5.6-6.9	5.7-6.9	5.7-6.9	5.7-6.9	5.7-6.9
Warming-Up Time (Sec) Min.	90	90	60	90	90	90	90	90	90

MECHANICAL DATA

Output Flange	UG-383/U	UG-385/U	UG-383/U	UG-385/U	UG-385/U	UG-383/U	UG-383/U	UG-385/U	UG-385/U
Output Waveguide	RG-97/U	RG-98/U	RG-97/U	RG-98/U	RG-98/U	RG-97/U	RG-97/U	RG-98/U	RG-98/U
Mounting Position	Any	Any	Any	Any	Any	Any	Any	Any	Any
Dimensions (mm)	196×213.5×110		218×198×127	196×213.5×110		196×213.5×130.3		196×213.5×130.3	
Weight (kg)	7	7	5.5	7	7	9	9	9	9
Cooling	*	*	*or** (Note)	*	*	**	**	**	**

For improvement, specifications will be changed without notice.

* : Forced Air-cooling 800 liters per minute.

** : Water-Cooling 0.5 - 1.5 liters per minute.

Note: Water-Cooling is required for operation at delay line current of over 30 mA.

BUTLER ROBERTS ASSOCIATES INC.

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA 33316

TELEPHONE 523-7202
AREA CODE 305

August 1966

OKI BACKWARD WAVE OSCILLATORS

PRICE LIST

The following price list covers OKI BWO tubes currently in production. For OKI BWO tubes from 65 GHz. up through 300 GHz. kindly request specific information indicating your area of interest.

OKI TYPE	FREQ. SPREAD (GHZ.)	TYPICAL POWER OUTPUT RANGE	UNIT PRICE	COOLING METHOD
BA47F	43.0/52.0	30/150 mW	$ 3,705.oo	Air
BA50G	45.0/54.0	30/150 mW	$ 3,705.oo	Air
50BW10	44.0/54.0	20/120 mW	$ 3,705.oo	Either (See Note)
BA55B	50.0/59.0	20/120 mW	$ 4,445.oo	Air
BA60C	54.0/65.0	20/100 mW	$ 4,995.oo	Air
BA47H	45.0/52.0	150/600 mW	$ 6,185.oo	Water
BA48H	45.0/50.5	300/700 mW	$ 6,555.oo	Water
BA50H	48.0/55.0	150/600 mW	$ 6,185.oo	Water
BA54H	51.5/55.0	500/700 mW	$ 6,555.oo	Water

Note; Model 50BW10 may be cooled either by air blower, (28 cu.ft./min.) or by circulating water through integral water jacket, for which from ½ to 1½ quarts of water per minute are required. Water cooling must be used with this tube for operation at delay line current of over 30 mA.

For correct operation of these BWO tubes we recommend the OKI BWO power supply specifically designed for the purpose. Model BWS-104B, consisting of two rack-mounted units, is priced at $6,235.oo, complete with all interconnecting cables and plugs. A table-top cabinet unit, Model BWS-104A is also available at the same price on special order; it is identical electrically. All prices are FOB Fort Lauderdale, Florida.

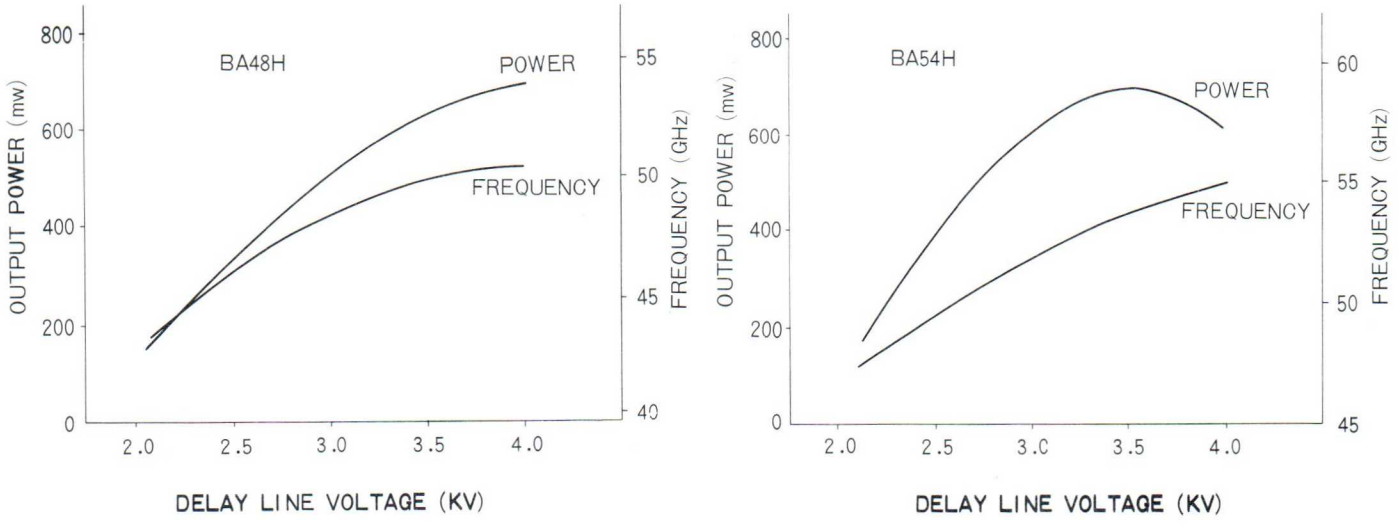


Fig.1 TYPICAL OPERATING DATA

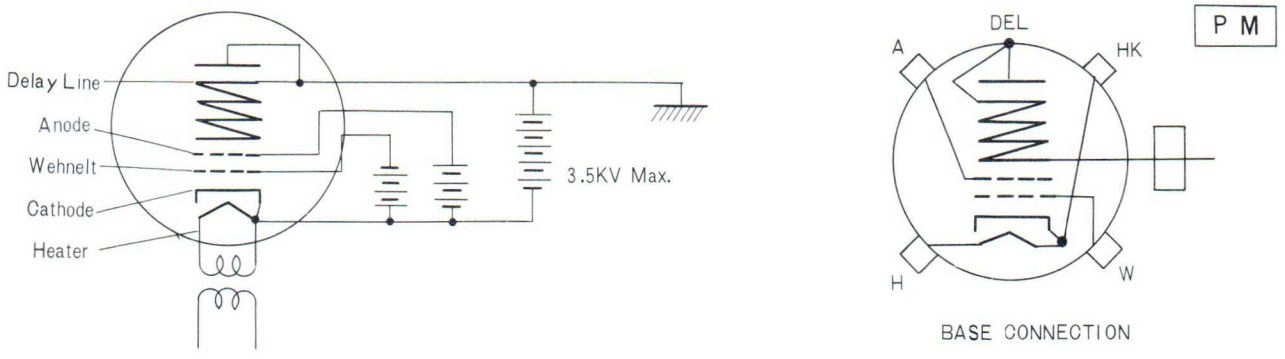
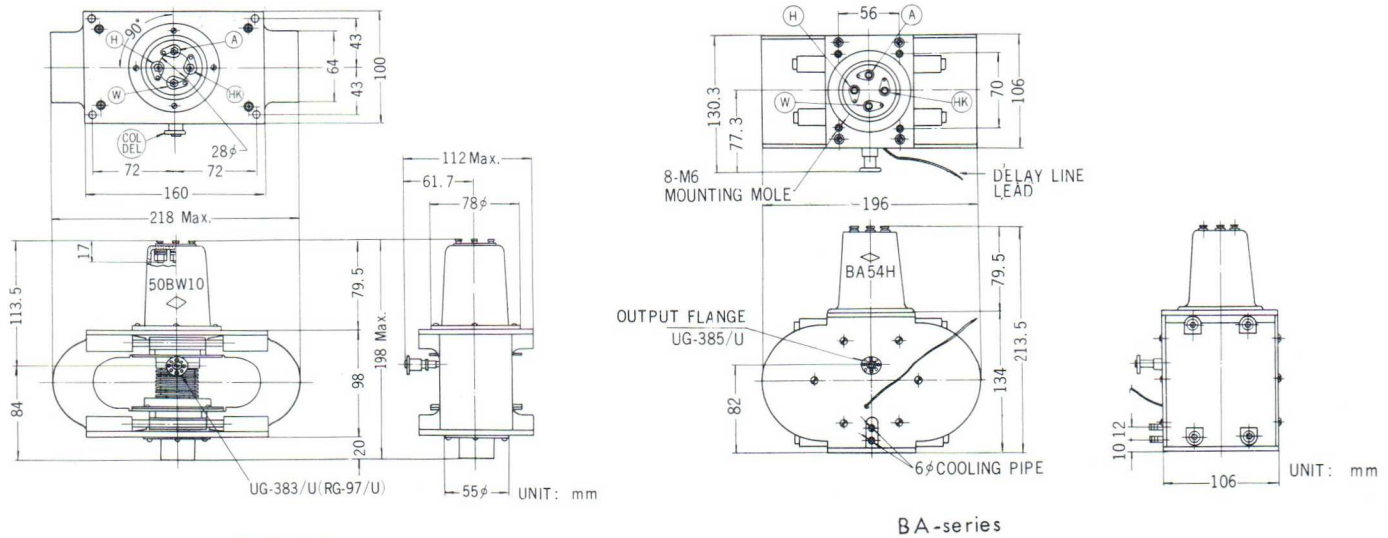


Fig.2 ELECTRICAL CONNECTIONS & BASE CONNCTIONS



50BW10

Fig.3 DIMENSIONS

FOR EFFICIENT AND ECONOMICAL OPERATION OF OKI BWO

— OKI BWO Power Supply and Waveguide Components are recommended —

As well as producing backward wave oscillators, OKI offers you most reliable BWO Power Supply and Waveguide Components. Both of these exclusive products are ideally designed for top operation of OKI Backward Wave Oscillators.

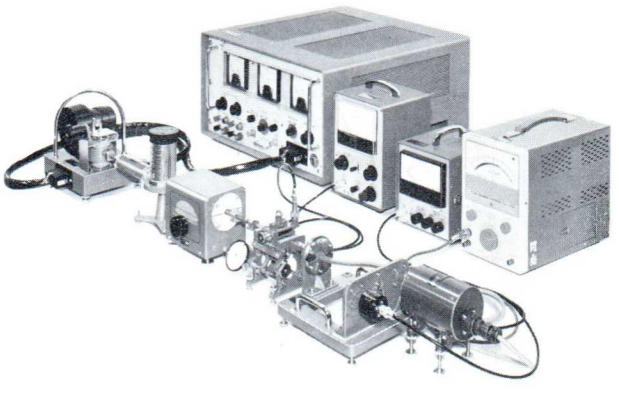
OKI BWO POWER SUPPLY

The models BWS-104A and BWS-104B are compact power supplies ensuring economical and tube-protective performance. The BWS-104A is incased in a metal cabinet and the BWS-104B is of a rack mount type, and these models are specially designed to meet the customers' requirements for stabilized power supply, competitive price and adequate protection of costly BWOs and power supply itself.

OKI MM-BANDS WAVEGUIDE COMPONENTS

— The most complete line of testing and measuring components —

Waveguide System Components are specifically developed by OKI, in the responce to customers' requests for complete system component availability from one source. This line includes all devices necessary to cover the frequency ranges of 18 GHz to 140 GHz. While a comprehensive catalog is being prepared, we invite your inquiries for specific components of OKI quality, precision and value.



For complete information, write for our catalog covering a complete line of OKI Waveguide Components, as well as BWO Power Supplies.

OKI ESTABLISHED 1881

OKI electric industry company, limited

10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN Tel: 501-3111
P.O.BOX 1797 Tokyo Central·Telex TK 2627·Cable Address "OKIDENKI TOKYO"

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Head Office & Laboratory: 500 S.E. 24th Street, Ft. Lauderdale, Florida Tel: Area 305: 523-7202
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OP—1040B

66. 7. 100. PRINTED IN JAPAN

34 & 50 KMC LADDERTRONS

NEW TUNABLE HIGH POWER MILLIMETER WAVE KLYSTRON

OKI electric industry co., ltd. TOKYO JAPAN

1. GENERAL

The "Laddertron", invented by Kazuo Fujisawa of Kobe University (Japanese Pat. 234537) and now being produced by OKI ELECTRIC CO., LTD. of Tokyo, is a tunable flat-beam, single-cavity, multi-gap, mm-wave klystron of the floating drift type, capable of continuous power out levels of the order of seven watts.

2. CONSTRUCTION

As a drift section the OKI Laddertron employs a pair of slotted-plane "ladders" in the center of a rectangular cavity, between which passes a flat high-density electron beam. Twelve coupling gaps are provided in the "ladders" through which interaction between the beam and the cavity field takes place. The cavity has two wave guides coupled through apertures on opposite side walls. One is used to vary the resonant frequency of the cavity by means of an adjustable plunger, while the other provides output coupling to the external load. The electron gun is of the convergent confined-flow type, the electron beam emitted by the wide surface cathode being bunched statically and magnetically. The beam is led through a rectangular tunnel measuring 0.35×11.8 millimeters, relatively good beam transmission efficiency of 95% being obtained. Maximum transmission current is more than 115 mA., or in terms of current density, 15A/cm².

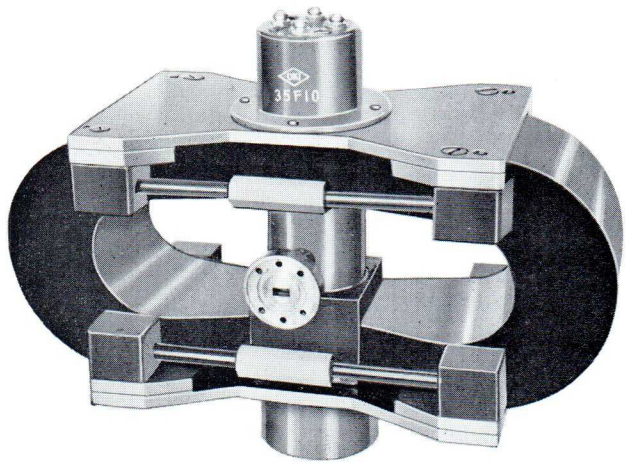


Fig. 1

3. SPECIFICATIONS

MECHANICAL DATA

		35F10	50F10
Output leadout :	Wave guide	RG-96/U	RG-98/U
	Flange	UG-381/U	UG-385/U
Mounting :	Any position Magnetic materials should be separated from the magnet by at least 10 cm.		
Weight :	11 kg. approximately		
Dimensions :	280 mm×200 mm×132 mm approx. (Refer to Fig. 2A)		
Cooling :	Water cooling required Minimum water flow at 20°C to be more than 0.5 litre perominute		

ELECTRICAL DATA

Electrical connections :
Refer to Fig. 2B

Maximam rating :

Heater voltage	5.7-6.9 V	5.7-6.9 V
Heater current	1-2.0A	1-2.0A
Resonator voltage	2,000V max	2,300V max
Cathode current	140 mA max	140 mA max
Control electrode voltage	—50-400V	—50-500V
Frequency range	33,250-34,750	49,000-51,000 Mc
Output power	1 watt min.	1 watt min.
Warming up time	5 minutes min	5 minutes min

Typical Operating Data :

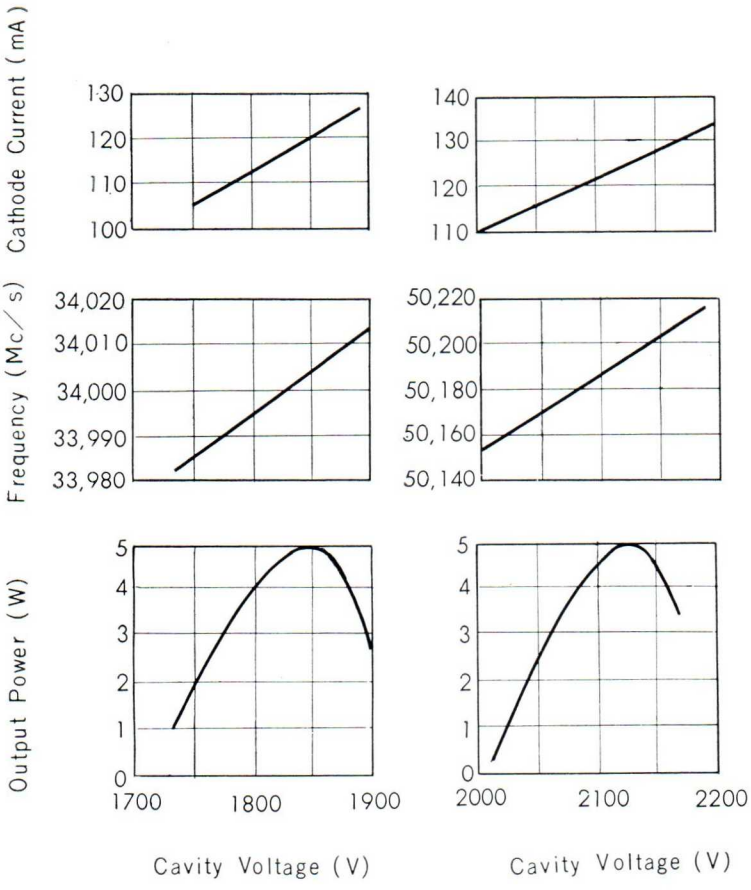
Heater voltage	6.3V	6.3V
Frequency	34,000Mc	50,000Mc
Resonator voltage	1,850V	2,140V
Cathode current	110 mA	120 mA
Control electrode voltage	—200V	—100V
Omtput power	5 watts	5 watts
Electronic tuning range	*(1) 20Mc/s *(2) 40Mc/s	20Mc/s 40Mc/s
Modulation sensitivity	*(1) 0.2Mc/Vc *(2) 0.4Mc/Vw	0.2Mc/Vc 0.2Mc/Vw

*(1) Defined as the frequency between the half power points of the maximum power output and is obtained By variation of the resonator voltage alone. (Refer to Fig. 3a and 3b)

*(2) Defined as the frequency between the half power points of the maximum power output and is obtained by variation of the control electrode valtage using the reference circuit in Fig. 4.

Caution : Do not apply cavity voltage without water cocling.

OKI
ESTABLISHED 1881
10 SHIBA-KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN
TEL : TOKYO 501 3111 Cable Address : "OKIDENKI TOKYO"



Operating Characteristics

Fig. 3A 35F10

Fig. 3B 50F10

Recommended Circuit
for Wide Electro-tuning
Range with Control
Electrode Voltage Variation

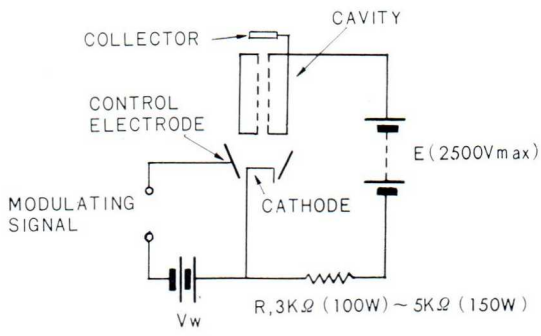


Fig. 4

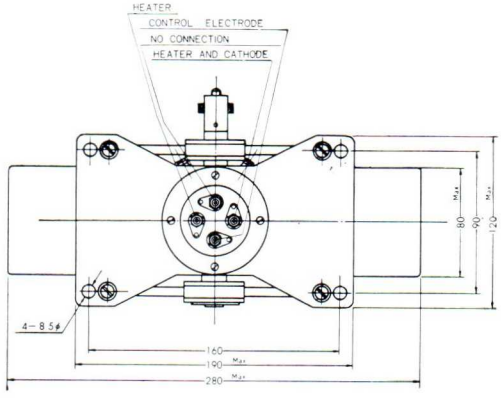


Fig. -1B
(UNIT:MM)

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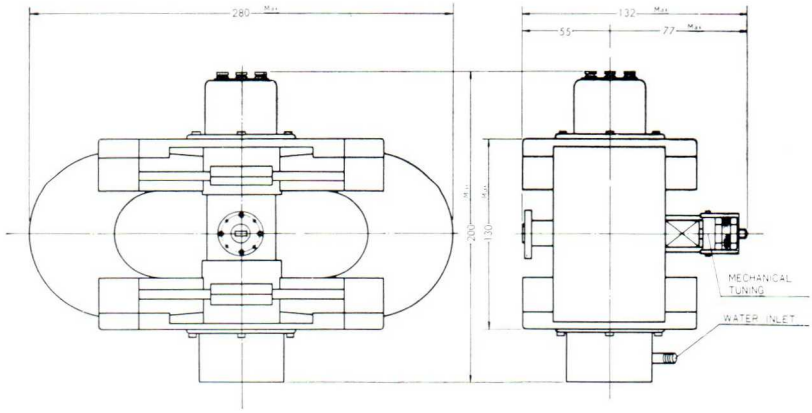

Fig. -1A
(UNIT:MM)

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4471 N. W. 36TH STREET MIAMI SPRINGS, FLORIDA TELEPHONE TU 7-3751
AUTHORIZED OKI DISTRIBUTOR

17 KMC KLYSTRON

NEW REFLEX MILLIMETER WAVE TUBE

OKI electric industry co., ltd. TOKYO JAPAN

Model 17V10

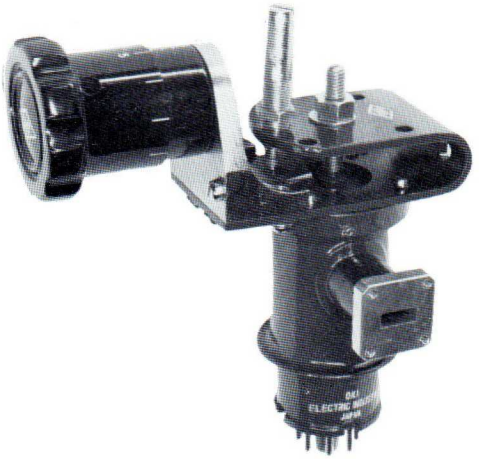


Fig. 1

ELECTRICAL DATA

Frequency	
Minimum	15500 Mc
Maximum	18500 Mc
Heater voltage	6.3 V
Heater current	0.75 A
Preheating	120 sec.

MECHANICAL DATA

Mounting	Optional
Flange	UG-419/U
Waveguide	RG-91/U
Cooling	Forced air
Tuning	Vernier tuner
Weight	400 g approx.
Cathode	Indirect heated oxide coated

MAXIMUM RATING

	Minimum	Muximum
Heater voltage	5.7 V	6.9 V
Preheating	90 sec.	—
Resonator voltage	—	2200 Vdc
Resonator current	—	14 mAdc
Resonator input	—	33 W
Output power	40 mW	—
Reflector voltage	−600 Vdc	−20 Vdc
Reflector current	—	30 μAdc
Control electrode voltage	−200 Vdc	−40 Vdc
Control electrode current	—	30 μAdc
Control electrode loss	—	0.1 W
Load VSWR	—	1.5
Resonator temperature	—	80°C

TYPICAL DATA

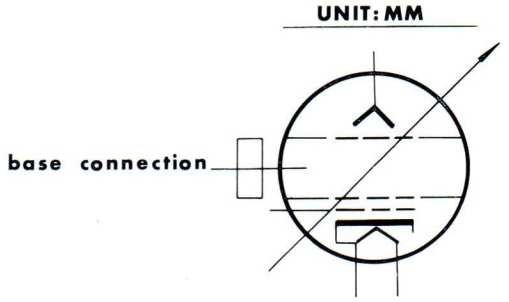
Frequency	17000 Mc
Resonator voltage	2000 Vdc
Resonator current	12 mAdc
Reflector voltage (at max. output)	−280 Vdc
Reflector current	0.1 μAdc
Control electrode voltage	−100 Vdc
Control electrode current	0.1 μAdc
Output power	60 mW
Electronic tuning range (half power points)	45 Mc
Modulation sensitivity	0.45 Mc/v
Cooled air volume	800 ℓ/min

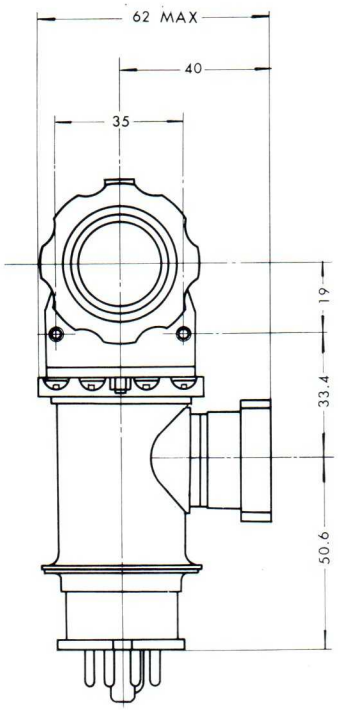
OKI

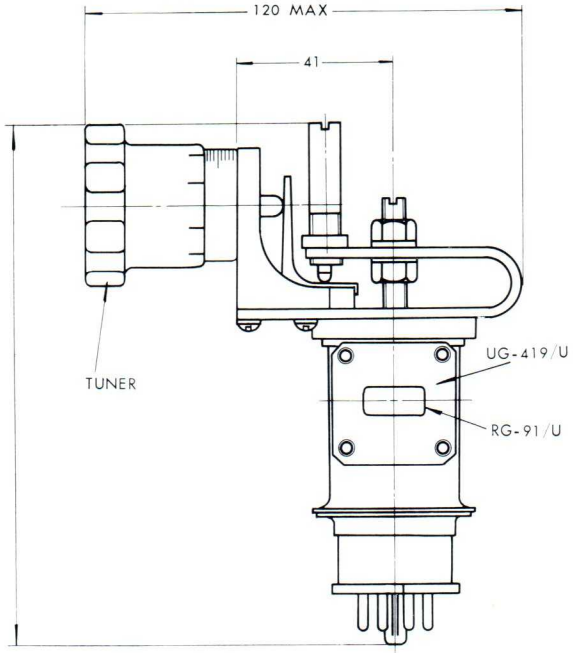
ESTABLISHED 1881

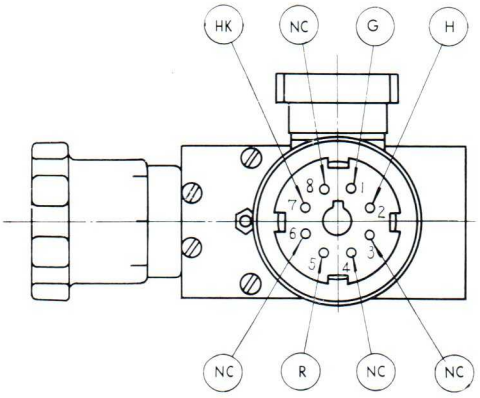
OUTSIDE DIMENSIONS :

UNIT: MM









BUTLER ROBERTS ASSOCIATES INC.

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AUTHORIZED OKI DISTRIBUTOR

34 KMC LADDERTRON

NEW TUNABLE HIGH POWER MILLIMETER WAVE OSCILLATOR (Former 35F10)

OKI electric industry co., ltd. TOKYO JAPAN

Model 34LV10

1. GENERAL

The "LADDERTRON" is a tunable, flat-beam, single cavity, multi-gap klystron that has many superior features and characteristics as a high-power millimeter wave oscillator.
The 34LV10 is of mechanical tuning type, ranging from 33200 Mc to 34800 Mc and the output at 34000 Mc is 10 watts approximately.

2. FEATURES

1. High output power
2. Higher efficiency as compared with other Klystrons.
3. Operation at lower voltage.
4. Broad range for mechanical tuning.
5. Broad range for elctronic tuning.
6. Capable of frequency modulation by control electrode voltage.

3. SPECIFICATIONS

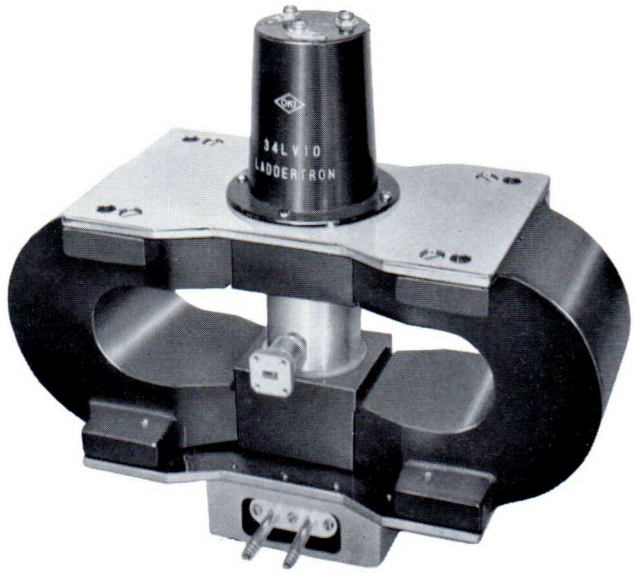
MECHANICAL DATA

Output leadout:	Waveguide	RG—96/U
	Flange	UG—599/U
Base connections:	Refer to Fig. 3	
Mounting:	Any position Magnetic materials should be kept away from the magnet by more than 10 cm.	
Weight:	13 kg. approx.	
Dimensions:	282 mm × 246 mm × 147 mm. approx. (Refer to Fig. 3)	
Cooling:	Water cooling required Minimum water flow at 20°C to be more than 0.5 liters per minute.	

ELECTRICAL DATA

Maximum rating:

Heater voltage	5.7—6.9 V
Heater current	1—2.0 A
Resonator voltage	2100 V max.
Cathode current	140 mA max.
Control electrode voltage	−50—−500 V
Frequency range	33200—34800 Mc
Output power	3 watts min.
Warming up time	150 sec. min.
Load VSWR	1.5 max.
Series resistance connected with cathode	20 kΩ max.
Temperature at outflow of cooling water	35°C



Typical Operating Data:

Heater voltage	6.3 V
Frequency	34000 Mc
Resonator voltage	1900 V
Cathode current	120 mA
Control electrode voltage	−200 V
Output power	10 W
Electronic tuning range	*(1) 20 Mc/s
	**(2) 40 Mc/s
Modulation sensitivity	*(1) 0.2 Mc/Vc
	**(2) 0.4 Mc/Vw
Cooling water flow	1ℓ/min.

*(1) Defined as the frequency difference between the half power points of the maximum power output and is obtained by the variation of the resonator voltage alone. (Refer to Fig. 1)

**(2) Defined as the frequency difference between the half power points of the maximum power output and is ob tained by the variation of the control electrode voltage using the reference circuit in Fig. 2.

Caution: 1. Do not turn on the switch of the power supply to the resonator without applying the water cooling.
2. Much care should be taken not to give any shock to the tuning mechanism.

OKI
ESTABLISHED 1881

Export Department: 7, 2-CHOME, HIRAKAWA-CHO, CHIYODA-KU, TOKYO, JAPAN
Tel: TOKYO 265-3171 Cable Address: "OKIDENKI TOKYO"
Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN. TEL: TOKYO 501-3111

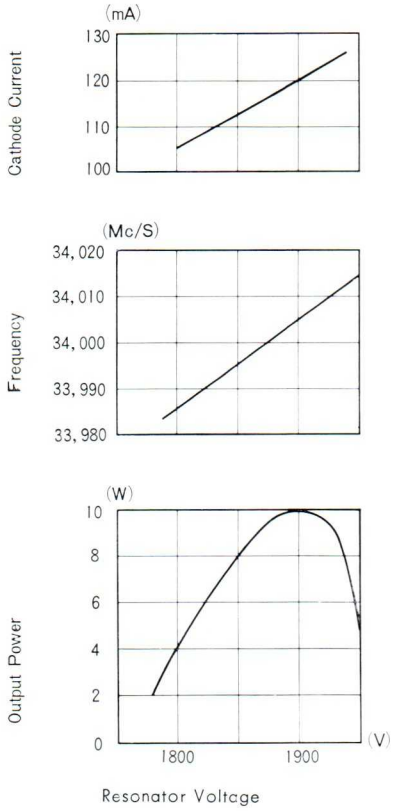


FIG. 1 Typical operating data

With mechanical tuning fixed at a certain position, the circuit with which FIG. 1 is obtained by changing the beam voltage is shown in Fig. 2 (at R = 0).

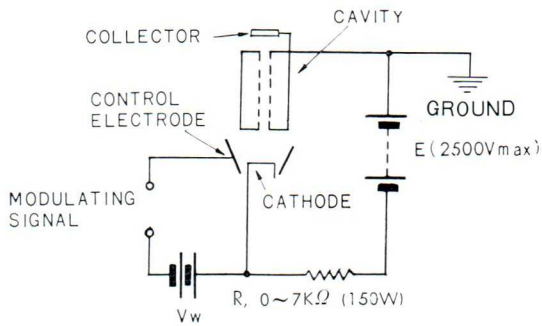


FIG. 2 Electrical connections

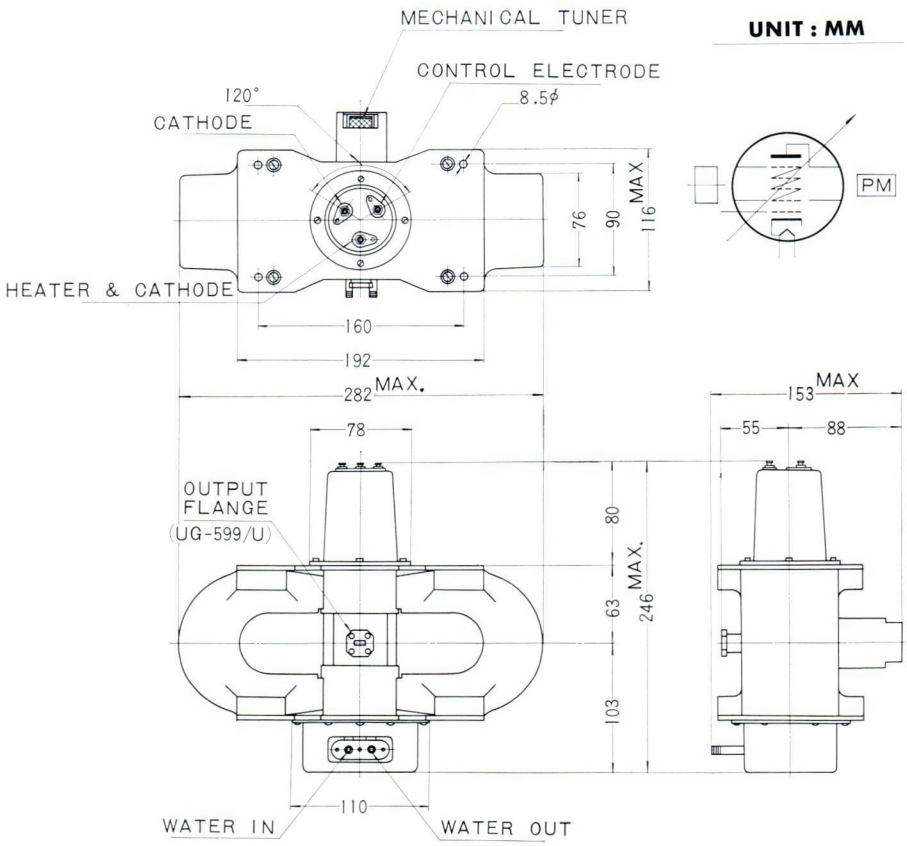


FIG. 3 Outside dimensions

100 KMC KLYSTRON

NEW REFLEX MILLIMETER WAVE TUBE

OKI electric industry co., ltd. TOKYO JAPAN

Model 100V10

ELECTRICAL DATA

Frequency	
Minimum	95000 Mc
Maximum	105000 Mc
Heater voltage	6.3 V
Heater current	0.75 A
Preheating	120 sec.

MECHANICAL DATA

Mounting	Optional
Flange	UG–387/U
Waveguide	WR–10
Cooling	Forced air
Tuning	Vernier tuner
Weight	600 g approx.
Cathode	Indirect heated oxide coated

Fig. 1

MAXIMUM RATING

	Minimum	Maximum
Heater voltage	5.7 V	6.9 V
Preheating	90 sec.	—
Resonator voltoge	—	2800 Vdc
Resonator current	—	30 mAdc
Resonator input	—	80 W
Output power	1 mW	—
Reflector voltage	−500 Vdc	−20 Vdc
Reflector current	—	30 μAdc
Control electrode voltage	−250 Vdc	−40 Vdc
Control electrode current	—	30 μAdc
Control electrode loss	—	0.1 W
Load VSWR	—	2.0
Resonator temperature		80°C

TYPICAL DATA

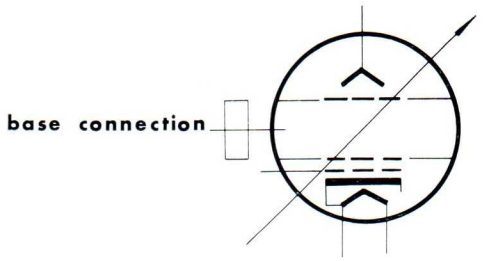
Frequency	100000 Mc
Resonator voltage	2500 Vdc
Resonator current	25 mAdc
Reflector voltage (at max. output)	−200 Vdc
Reflector current	0.1 μAdc
Control electrode voltage	−180 Vdc
Control electrode current	0.1 μAdc
Output power (matched load)	5 mW
Output power (optimum load)	10 mW
Electronic tuning range (half power points)	200 Mc
Modulation sensitivity	6 Mc
Cooled air volume	800 ℓ/min

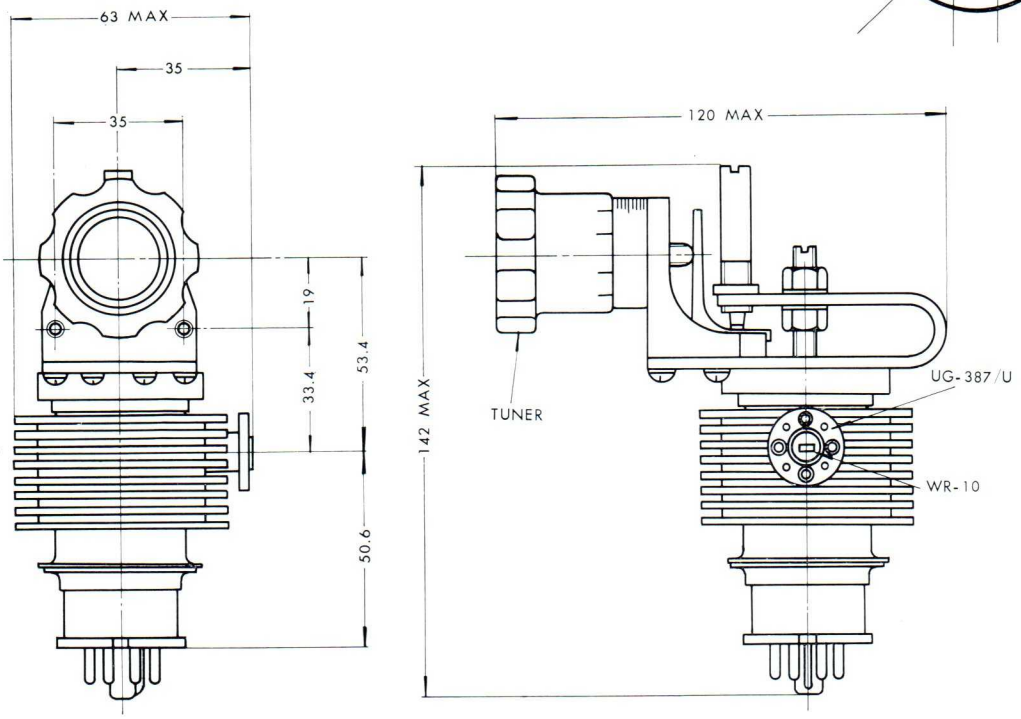
OKI

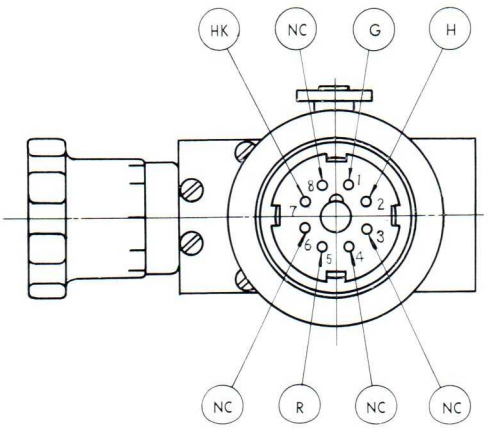
ESTABLISHED 1881

OUTSIDE DIMENSIONS :

UNIT: MM







BUTLER ROBERTS ASSOCIATES INC.

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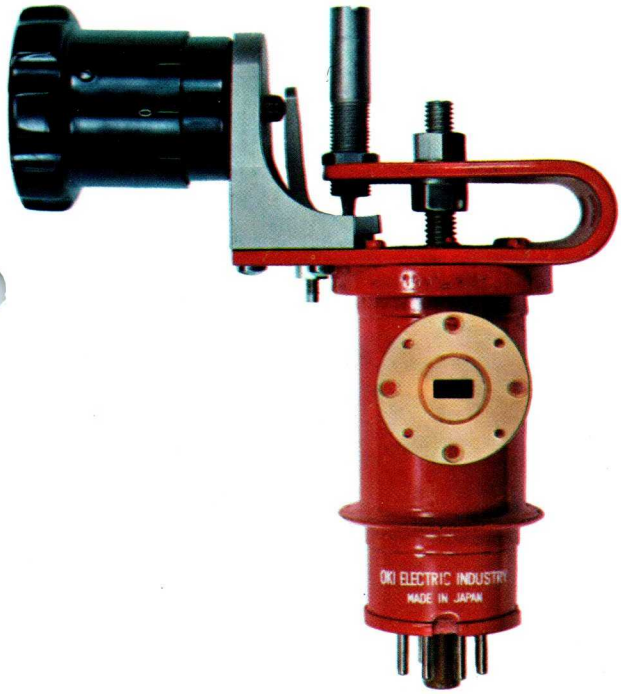
500 S.E. 24TH STREET FORT LAUDERDALE, FLORIDA TELEPHONE 523-7202 AREA CODE 305

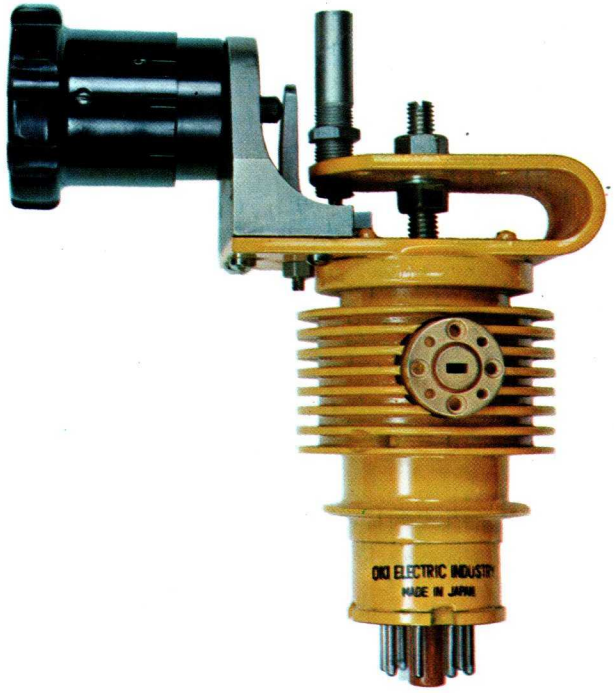
AUTHORIZED OKI DISTRIBUTOR

OKI MILLIMETER WAVE REFLEX KLYSTRON

OKI electric industry co., ltd. TOKYO JAPAN



MODEL 35V10



MODEL 50V10

The following brief specifications cover nineteen types of reflex klystron including new types now in production by Oki Electric.
They are mechanically-tunable oscillators, with waveguide output flanges for use with the standard RG type waveguide generally utilized at the frequencies in question.

Model No.	Center frequency MC	Frequency spread KMC	Resonator voltage V	Resonator current mA	Output at center frequency (mW) (measured with matched load)
17V10	17000	[redacted] 15.5-18.5	2200	14	70
24V10	24000	22–26	2200	14	160
24V11	24000	22–26	2200	30	500
30V10	30000	28–32	2200	14	60
30V11	30000	28–32	2200	30	160
35V10	35000	32–37	2200	14	50
35V11	35000	32–37	2200	30	170
35V155	35000	34.5–35.5	2200	14	60
40V10	40000	37–42	2500	30	80
45V10	45000	[redacted] 42-48	2500	30	80
47V10	47000	43–51	2500	30	60
47V11	47000	43–51	2500	30	140
50V10	50000	46–54	2700	30	40
55V10	55000	52–58	2700	30	40
55V11	55000	52–58	2700	30	100
60V10	60000	57–63	2700	30	[redacted] 40
70V10	70000	65–73	2800	30	[redacted] 35
70V11	70000	65–73	2800	30	[redacted] 80
100V10	100000	95–105	2800	30	5

Maximum rating :

Model	Resonator voltage	Resonator current	Output power	Frequency
17V10	2,200V max.	14mA max.	40mW min.	15,500 – 18,500 Mc
24V10	2,200V max.	14mA max.	40mW min.	22,000 – 26,000 Mc
24V11	2,200V max.	30mA max.	150mW min.	22,000 – 26,000 Mc
30V10	2,200V max.	14mA max.	15mW min.	28,000 – 32,000 Mc
30V11	2,200V max.	30mA max.	80mW min.	28,000 – 32,000 Mc
35V10	2,200V max.	14mA max.	15mW min.	32,000 – 37,000 Mc
35V11	2,200V max.	30mA max.	80mW min.	32,000 – 37,000 Mc
35V155	2,200V max.	14mA max.	30mW min.	34,500 – 35,500 Mc
40V10	2,500V max.	30mA max.	15mW min.	37,000 – 42,000 Mc
45V10	2,500V max.	30mA max.	15mW min.	42,000 – 48,000 Mc
47V10	2,500V max.	30mA max.	15mW min.	43,000 – 51,000 Mc
47V11	2,500V max.	30mA max.	80mW min.	43,000 – 51,000 Mc
50V10	2,700V max.	30mA max.	15mW min.	46,000 – 54,000 Mc
55V10	2,700V max.	30mA max.	15mW min.	52,000 – 58,000 Mc
55V11	2,700V max.	30mA max.	70mW min.	52,000 – 58,000 Mc
60V10	2,700V max.	30mA max.	15mW min.	57,000 – 63,000 Mc
70V10	2,800V max.	30mA max.	10mW min.	65,000 – 73,000 Mc
70V11	2,800V max.	30mA max.	50mW min.	65,000 – 73,000 Mc
100V10	2,800V max.	30mA max.	1mW min.	95,000 – 105,000 Mc

Mechanical data :

Output flange	Output waveguide	Dimensions	Color
UG-419/U	RG-91/U	See Fig. 1	Red
UG-595/U	RG-53/U	See Fig. 1	Red
UG-595/U	RG-53/U	See Fig. 2	Red
UG-599/U	RG-96/U	See Fig. 1	Light scarlet
UG-599/U	RG-96/U	See Fig. 2	Light scarlet
UG-381/U or UG-599/U	RG-96/U	See Fig. 1	Light scarlet
UG-381/U or UG-599/U	RG-96/U	See Fig. 2	Light scarlet
UG-599/U	RG-96/U	See Fig. 1	Light scarlet
UG-383/U	RG-97/U	See Fig. 2	Medium yellow
UG-383/U	RG-97/U	See Fig. 2	Medium yellow
UG-385/U or UG-383/U	RG-98/U or RG-97/U	See Fig. 2	Medium yellow
UG-385/U or UG-383/U	RG-98/U or RG-97/U	See Fig. 2	Medium yellow
UG-385/U	RG-98/U	See Fig. 2	Medium yellow
UG-385/U	RG-98/U	See Fig. 2	Willow green medium
UG-385/U	RG-98/U	See Fig. 2	Willow grean medium
UG-385/U	RG-98/U	See Fig. 2	Willow green medium
UG-387/U	RG-99/U	See Fig. 2	Royal blue
UG-387/U	RG-99/U	See Fig. 2	Royal blue
UG-387/U	WR-10 or WR-12	See Fig. 2	Dark blue

Typical operating

Frequency :(Mc)	Res vol
16,000 17,000 18,000	
23,000 24,000 25,000	
23,000 24,000 25,000	
29,000 30,000 31,000	
29,000 30,000 31,000	
34,000 35,000 36,000	
34,000 35,000 36,000	
35,000	
38,000 40,000 42,000	
43,000 45,000 47,000	
45,000 47,000 49,000	
45,000 47,000 49,000	
48,000 50,000 52,000	
53,000 55,000 57,000	
53,000 55,000 57,000	
58,000 60,000 62,000	
67,000 70,000 73,000	
67,000 70,000 73,000	
98,000 100,000 102,000	

data :

onator tage (KV)	Control electrode voltage (V)	Resonator current (mA)	Reflector voltage (V)	Output power (mW)	Electronic tuning range (Mc)	Modulation sensitivity (Mc/V)	Model
2.0	−100	12.0	−215	70	50	0.70	
2.0	−100	12.0	−280	70	45	0.45	17V10
2.0	−100	12.0	−360	70	30	0.28	
2.0	−100	12.0	−205	180	60	1.2	
2.0	−100	12.0	−265	160	50	0.8	24V10
2.0	−100	12.0	−330	90	40	0.45	
2.0	−80	25.0	−250	450	60	0.7	
2.0	−80	25.0	−315	500	50	0.4	24V11
2.0	−80	25.0	−400	280	45	0.3	
2.0	−100	12.0	−270	60	75	0.75	
2.0	−100	12.0	−310	60	70	0.70	30V10
2.0	−100	12.0	−355	60	65	0.55	
2.0	−80	25.0	−275	115	80	1.8	
2.0	−80	25.0	−325	160	75	0.65	30V11
2.0	−80	25.0	−380	160	70	0.55	
2.0	−90	12.0	−170	50	100	2.0	
2.0	90	12.0	−195	50	100	1.8	35V10
2.0	−90	12.0	−225	50	100	1.4	
2.0	−80	25.0	−290	170	90	2.2	
2.0	−80	25.0	−330	170	90	2.0	35V11
2.0	−80	25.0	−370	170	85	1.7	
2.0	−100	12.0	−195	60	80	2.0	35V155
2.3	−150	25.0	−205	90	80	2.5	
2.3	−150	25.0	−250	80	90	2.5	40V10
2.3	−150	25.0	−295	70	60	1.7	
2.3	−130	25.0	−130	80	100	3.2	
2.3	−130	25.0	−160	80	100	3.0	45V10
2.3	−130	25.0	−195	80	100	2.2	
2.3	−110	25.0	−135	60	150	5.0	
2.3	−110	25.0	−170	60	150	4.5	47V10
2.3	−110	25.0	−210	50	120	3.5	
2.3	−110	25.0	−145	120	120	3.7	
2.3	−110	25.0	−185	140	120	3.5	47V11
2.3	−110	25.0	−230	120	100	2.5	
2.5	−100	25.0	−145	40	140	5.0	
2.5	−100	25.0	−180	40	140	4.5	50V10
2.5	−100	25.0	−220	40	130	4.0	
2.5	−120	25.0	−155	100	190	3.0	
2.5	−120	25.0	−195	100	190	5.1	55V10
2.5	−120	25.0	−240	100	150	3.6	
2.5	−120	25.0	−150	40	140	5.5	
2.5	−120	25.0	−185	40	140	5.2	55V11
2.5	−120	25.0	−220	35	120	4.0	
2.5	−120	25.0	−190	40	130	4.8	
2.5	−120	25.0	−235	40	140	5.2	60V10
2.5	−120	25.0	−280	40	140	4.5	
2.7	−125	25.0	−165	30	140	4.5	
2.7	−125	25.0	−195	35	140	4.0	70V10
2.7	−125	25.0	−235	35	130	3.5	
2.7	−125	25.0	−165	70	180	6.0	
2.7	−125	25.0	−205	80	165	5.5	70V11
2.7	−125	25.0	−250	80	140	4.3	
2.5	−100	25.0	−175	5	300	—	
2.5	−100	25.0	−200	5	250	—	100V10
2.5	−100	25.0	−225	3	200	—	

General electrical data : (All models)

Heater Voltage.....5.7 to 6.9 V
Heater Current .....0.55 to 0.85 A
Control Electrode Voltage .....–40 to –200 V
Control Electrode Current.....30 mA Max.
Reflector Voltage.....–50 to –500 V
Reflector Current.....39 mA Max.

General mechanical data : (All models)

Warming-up time .....Minimum warming-up time is 120 seconds. With forced air cooling, 20 minutes are required to stabilize the frequency and to prevent drifting due to temperature rise.
Mounting .....Any position
Cooling .....Forced air cooling is desirable to prevent tube temperature from rising above 80°C.
Cathode .....Oxide coated, indirectly heated.
Base Connections .....See Fig. 3.

Fig. 1 : Outside dimensions (Unit mm)

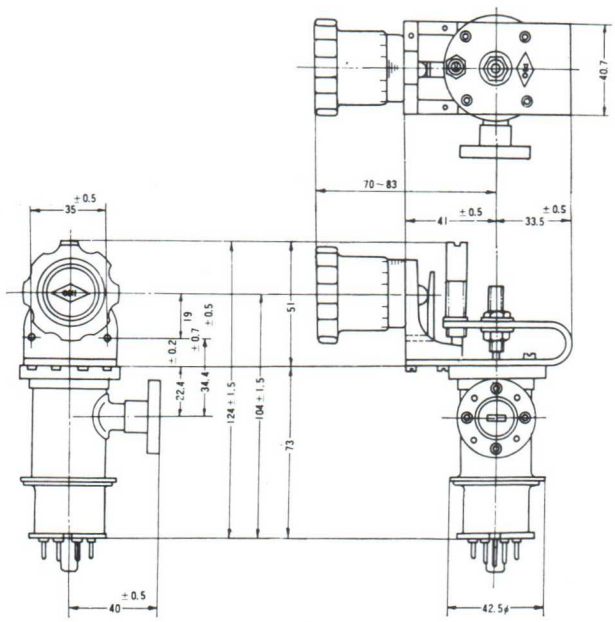
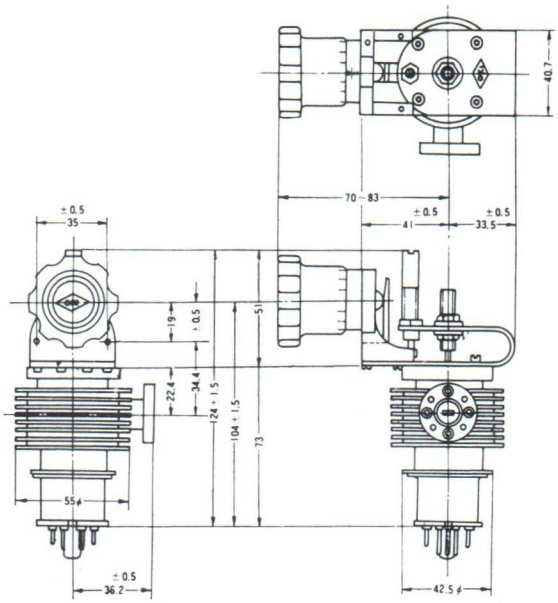


Fig. 2 : Outside dimensions (Unit mm)



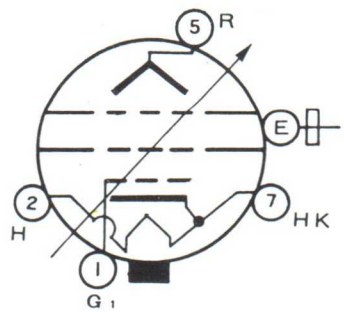


Fig. 3 : Base connections (All models)

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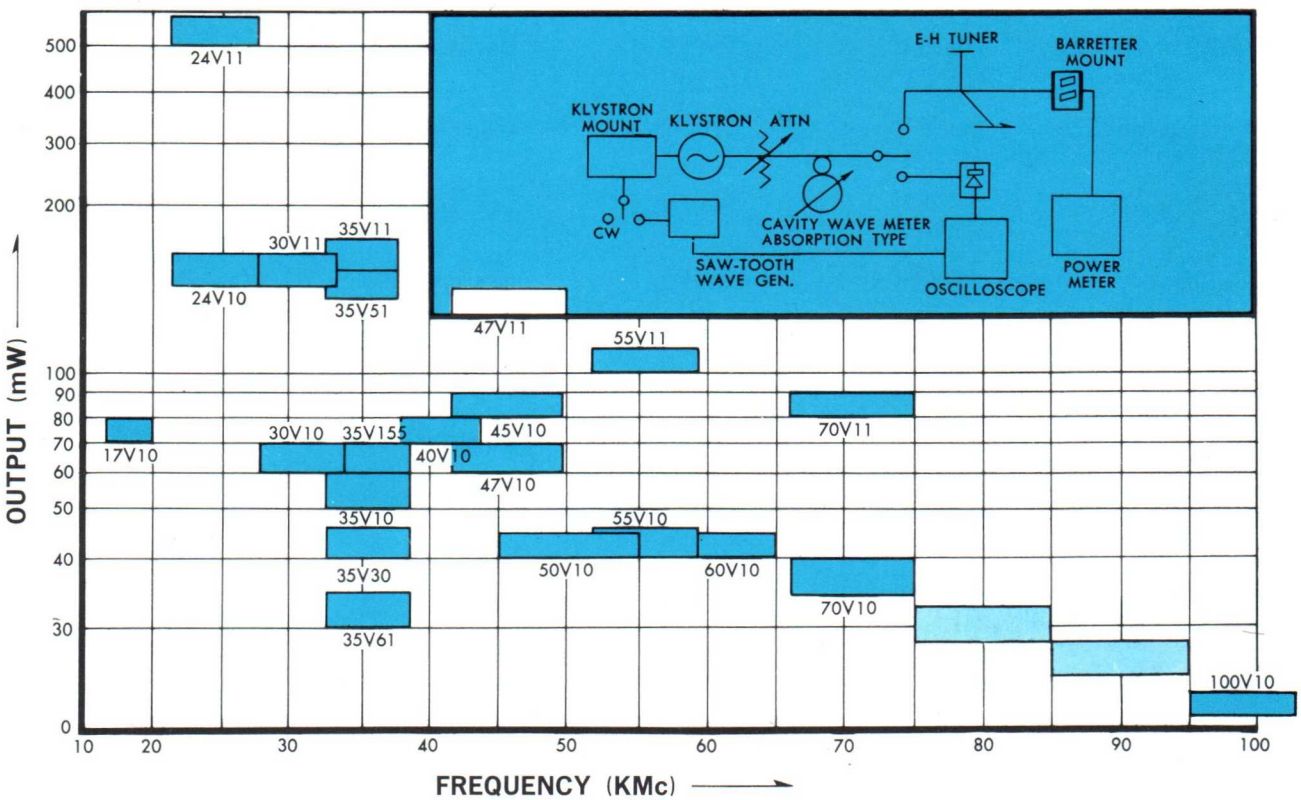
6

LINE-UP OF V-SERIES REFLEX KLYSTRONS

Frequency vs. output



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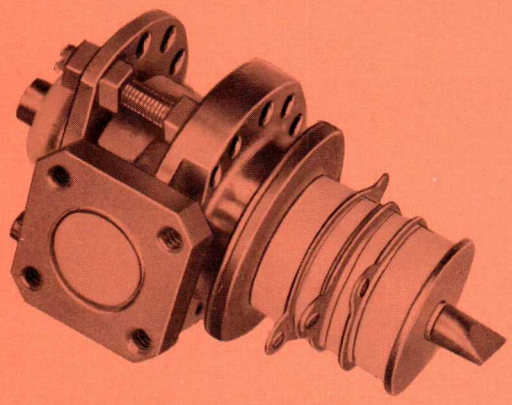
OKI
electric industry
co., ltd. TOKYO JAPAN

NEW CERAMIC AND LOW-VOLTAGE TYPE KLYSTRON FOR AIRBORNE USE



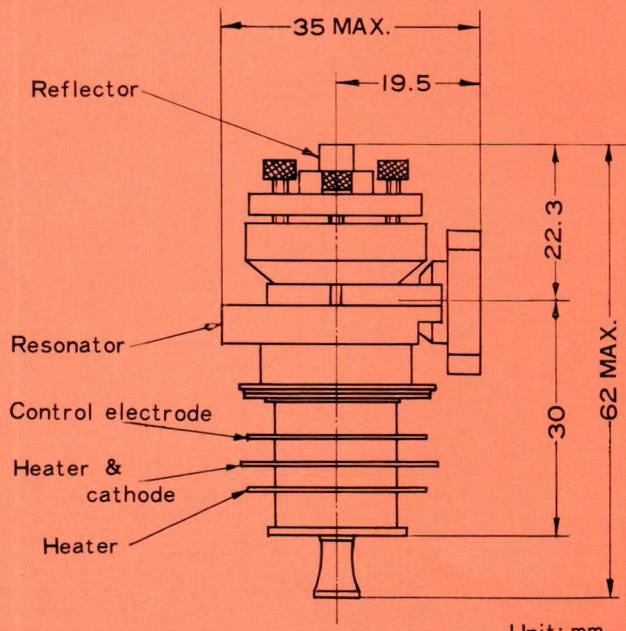


Fig. 4

Unit: mm
Size: 1/1

To fill various applications which have been expanded day after day, Oki Electric has developed new types of airborne and low-voltage type klystrons.

The new types are of ceramic tube type and are exteremely reduced in size and weight for airborne service.

Treated in high temperature, this type of klystron assures long life and high stability.

Furthermore, for airborne use, it is ruggedly constructed to endure any shock and vibration in operation.

Another is of low-voltage type and different from the conventional types, it eliminates a mesh which has been considered to be needed for low voltage operation.

Thus, a new type results in elimination of various defects from :

1. Bad influence from mesh by the 2nd electron
2. Generation of gas.
3. Burning by heat loss of mesh.

OKI
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Main Office: 10, SHIBA KOTOHIRA-CHO, MINATO-KU, TOKYO, JAPAN TEL: TOKYO 501-3111

The following specifications indicate the outline of new ceramic and low-voltage types :

		35 V 51	35 V 61	35 V 30
Maximum Ratings	Resonator voltage	2200 V max.	1000 V max.	1000 V max.
	Resonator current	30 mA max.	25 mA max.	25 mA max.
	Warming up time	120 sec. min.	120 sec. min.	120 sec. min.
	Output power	80 mW min.	15 mW min.	15 mW min.
	Frequency	34750-35250 Mc Trim tunable	34750–35250 Mc Trim tunable	32000–37000 Mc Fully tunable
Mechanical Data	Output flange	UG-599/U	UG-599/U	UG-599/U
	Output waveguide	RG-96/U	RG-96/U	RG-96/U
	Dimensions	See Fig. 4	See Fig. 4	See Fig. 2
	Color	Gold Plated	Gold Plated	Light Scarlet

Typical Operating Data	Frequency (Mc)	34750	35000	35250	34750	35000	35250	34000	35000	36000
	Resonator voltage (KV)	2.0	2.0	2.0	0.8	0.8	0.8	0.8	0.8	0.8
	Control electrode voltage (V)	–100	–100	–100	–125	–125	–125	–125	–125	–125
	Resonator current (mA)	25	25	25	20	20	20	20	20	20
	Reflector voltage (V)	–305	–320	–335	–144	–150	–158	–110	–125	–145
	Output power (mW)	150	150	150	35	30	25	40	40	40
	Electronic tuning range (Mc)	70	70	70	70	70	65	80	80	60
	Modulation sensitivity (Mc/V)	1.4	1.4	1.4	1.5	1.5	1.4	2.3	2.0	1.4

For improvement, specifications are subject to change without notice.

64. 2. 50. PRINTED IN JAPAN

September 15, 1963

CONTINUATION OF LIFE TESTING OF OKI REFLEX KLYSTRONS TYPE 35V10

Life testing of a group of six OKI klystrons of the 35V10 type, commenced in early February this year, continues to demonstrate the reliability and great life expectancy of these millimeter wave tubes. The six under test were selected at random, and tests will be continued until final failure. The tabulation below covers operation of tube Serial No. 585, representative of the entire group under test. These tabulations will be released from time to time, and a final report will be issued upon completion of the tests.

TUBE TYPE: 35V10 NUMBER: 585 RESONATOR VOLTAGE: 2,000 volts HEATER VOLTAGE: 6.3 volts

RESONATOR CURRENT: 12.0 mA FREQUENCY: 34.0 KMC

DATE 1963	TOTAL OPERATION HOURS	OUTPUT (mW)	CONTROL ELECTRODE VOLTAGE	REFLECTOR VOLTAGE	HEATER CURRENT (A)	ELECTRONIC TUNING RANGE	ACTIVATION
Apr 1	1295	96	137	179	0.76	120 Mc	Good
10	1516	99	132	174	0.76	105 "	Good
22	1729	100	130	174	0.76	110 "	Good
May 3	1955	104	130	176	0.76	120 "	Good
17	2223	110	129	176	0.76	125 "	Good
22	2351	109	129	177	0.76	120 "	Good
30	2536	111	136	175	0.77	120 "	Good
Jun 7	2728	113	132	173	0.77	125 "	Good
14	2888	109	133	173	0.77	120 "	Good
21	3050	105	136	176	0.77	120 "	Good
29	3199	111	130	174	0.76	115 "	Good
Jul 6	3365	117	129	176	0.77	115 "	Good
13	3526	107	134	177	0.77	110 "	Good
20	3675	111	133	175	0.78	105 "	Good
30	3845	105	133	176	0.78	100 "	Good
Aug10	4017	101	135	176	0.78	110 "	Good
19	4241	107	135	174	0.77	115 "	Good
Sep 3	4567	97	144	174	0.77	115 "	Good

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PRICE LIST (NET)

Effective June 1, 1963

OKI

ESTABLISHED 1881

OKI MILLIMETER WAVE TUBES (REFLEX KLYSTRONS)

OKI TUBE TYPE	MECH. TUNING RANGE	AVERAGE OUTPUT MILLIWATTS	PREFERRED FLANGE TYPE	PRICE F.O.B. DESTN. (CONT. U.S.A.)
24V10	21.5/26.5 Gc	200	UG-595/U	$ 435.00
24V11	21.5/26.5 Gc.	500	UG-595/U	785.00
30V10	26.5/32.0 Gc.	100	UG-599/U	455.00
30V11	26.5/32.0 Gc	240	UG-599/U	805.00
33V10	30.0/36.0 Gc.	100	UG-599/U	465.00
35V10	32.0/37.0 Gc.	100	UG-599/U	475.00
35V11	32.0/37.0 Gc.	240	UG-599/U	805.00
40V10	37.0/42.0 Gc.	100	UG-383/U	705.00
45V10	41.0/48.0 Gc.	100	UG-383/U	705.00
50V10	43.0/51.0 Gc.	80	UG-383/U & UG-385/U+	760.00
55V10	50.0/60.0 Gc.	80	UG-385/U	975.00
60V10	55.0/65.0 Gc.	60	UG-385/U	1,635.00
70V10	65.0/75.0 Gc.	40	UG-385/U & UG-387/U++	2,442.00
75V10	70.0/80.0 Gc.	40	UG-387/U	2,545.00
80V10	75.0/85.0 Gc.	30	UG-387/U	2,970.00
90V10	85.0/95.0 Gc.	20	UG-387/U	3,175.00
100V10	95.0/105.0 Gc.	20	Not yet established	3,390.00

Note + For tubes to be used principally below 50 Gc., flange type UG-383/U (waveguide type RG-97/U) is recommended. For tubes to be used principally above 50 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended.

Note ++ For tubes to be used principally below 70 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended. For tubes to be used principally above 70 Gc., flange type UG-387/U (waveguide type RG-99/U) is recommended.

OKI "LADDERTRON®" KLYSTRONS

These new high-power klystrons are completely packaged units, presently being manufactured in the 35 Gc. and 50 Gc. frequency ranges. Although conservatively rated, power output levels of as high as 15 watts are obtainable. When ordering, please specify the frequency at which maximum output is desired. Limited mechanical tuning is provided giving a range of 33.250-34.750 Gc. with the Type 35F10, and 49.000-51.000 Gc. with Type 50F10.

Laddertron Type 35F10 ---------- $2,980.00 F.O.B. Destination (Cont. U.S.A.)

Laddertron Type 50F10 ---------- $3,980.00 F.O.B. Destination (Cont. U.S.A.)

All prices shown herein include shipment to any destination within the continental U.S.A.

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PRICE LIST (NET)

OKI

ESTABLISHED 1881

Effective June 1, 1963

OKI MILLIMETER WAVE TUBES (REFLEX KLYSTRONS)

OKI TUBE TYPE	MECH. TUNING RANGE	AVERAGE OUTPUT MILLIWATTS	PREFERRED FLANGE TYPE	PRICE F.O.B. DESTN. (CONT. U.S.A.)
24V10	21.5/26.5 Gc	200	UG-595/U	$ 435.00
24V11	21.5/26.5 Gc.	500	UG-595/U	785.00
30V10	26.5/32.0 Gc.	100	UG-599/U	455.00
30V11	26.5/32.0 Gc	240	UG-599/U	805.00
33V10	30.0/36.0 Gc.	100	UG-599/U	465.00
35V10	32.0/37.0 Gc.	100	UG-599/U	475.00
35V11	32.0/37.0 Gc.	240	UG-599/U	805.00
40V10	37.0/42.0 Gc.	100	UG-383/U	705.00
45V10	41.0/48.0 Gc.	100	UG-383/U	705.00
50V10	43.0/51.0 Gc.	80	UG-383/U & UG-385/U+	760.00
55V10	50.0/60.0 Gc.	80	UG-385/U	975.00
60V10	55.0/65.0 Gc.	60	UG-385/U	1,635.00
70V10	65.0/75.0 Gc.	40	UG-385/U & UG-387/U++	2,442.00
75V10	70.0/80.0 Gc.	40	UG-387/U	2,545.00
80V10	75.0/85.0 Gc.	30	UG-387/U	2,970.00
90V10	85.0/95.0 Gc.	20	UG-387/U	3,175.00
100V10	95.0/105.0 Gc.	20	Not yet established	3,390.00

Note + For tubes to be used principally below 50 Gc., flange type UG-383/U (waveguide type RG-97/U) is recommended. For tubes to be used principally above 50 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended.

Note ++ For tubes to be used principally below 70 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended. For tubes to be used principally above 70 Gc., flange type UG-387/U (waveguide type RG-99/U) is recommended.

OKI "LADDERTRON®" KLYSTRONS

These new high-power klystrons are completely packaged units, presently being manufactured in the 35 Gc. and 50 Gc. frequency ranges. Although conservatively rated, power output levels of as high as 15 watts are obtainable. When ordering, please specify the frequency at which maximum output is desired. Limited mechanical tuning is provided giving a range of 33.250-34.750 Gc. with the Type 35F10, and 49.000-51.000 Gc. with Type 50F10.

Laddertron Type 35F10 ..... $2,980.00 F.O.B. Destination (Cont. U.S.A.)

Laddertron Type 50F10 ..... $3,980.00 F.O.B. Destination (Cont. U.S.A.)

All prices shown herein include shipment to any destination within the continental U.S.A.

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FT. LAUDERDALE, FLORIDA
TEL: 523-7202

LIFE TESTING OF OKI REFLEX KLYSTRONS TYPE 35V10

In response to many inquiries concerning actual life expectancy of the OKI Klystron, six 35V10 Klystrons were selected at random from stock, and a series of life tests commenced by operating all tubes in a laboratory test system at the OKI laboratories. These tubes will continue to be used until final failure. In the meantime, the following performance tabulation of tube serial number 585, one of the six involved, shows that at 3050 hours of operation output level is normal, with no abnormal developments apparent. Only one of the six tubes under test has shown a slight decrease in performance with output dropping to 55 mW at 3050 hours compared to 77 mW at beginning of test. All other tubes undergoing this test show a slight increase in power output. If you are interested in receiving information at completion of these tests, kindly let us know and we will send you this data when the tests are completed.

TUBE TYPE: 35V10 NUMBER: 585 RESONATOR VOLTAGE: 2,000 volts HEATER VOLTAGE: 6.3 volts

RESONATOR CURRENT: 12.0 mA FREQUENCY: 34.0 KMC

DATE 1963	TOTAL OPERATION HOURS	OUTPUT (mW)	CONTROL ELECTRODE VOLTAGE	REFLECTOR VOLTAGE	HEATER CURRENT (A)	ELECTRONIC TUNING RANGE	ACTIVATION
Apr 1	1295	96	137	179	0.76	120 Mc	Good
6	1415	92	137	178	0.76	105 "	Good
8	1467	100	134	174	0.76	110 "	Good
10	1516	99	132	174	0.76	105 "	Good
16	1635	100	132	178	0.76	100 "	Good
22	1729	100	130	174	0.76	110 "	Good
27	1853	102	131	178	0.76	115 "	Good
May 3	1955	104	130	176	0.76	120 "	Good
8	2010	100	131	176	0.76	125 "	Good
17	2223	110	129	176	0.76	125 "	Good
22	2351	109	129	177	0.76	120 "	Good
27	2463	108	132	176	0.77	115 "	Good
30	2536	111	136	175	0.77	120 "	Good
Jun 7	2728	113	132	173	0.77	125 "	Good
14	2888	109	133	173	0.77	120 "	Good
21	3050	105	136	176	0.77	120 "	Good

BUTLER ROBERTS ASSOCIATES INC. *A Subsidiary of OKI ELECTRONICS OF AMERICA INC.*

202 EAST 44TH STREET
NEW YORK 17, NEW YORK
TEL: 682-2989

00 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA
TEL: 523-7202

PRESS RELEASE — 1-16-64

Fort Lauderdale, Florida
January 16, 1964

OKI KLYSTRONS STILL "GOING STRONG" AFTER 6,000 HOURS!

During the past few months, we have been issuing reports covering our current program to determine the useful life of standard OKI mm-wave klystrons selected at random from stock. This information has been circulated to all those on our mailing list. Of the six OKI type 35V10 klystrons selected, one failed at 4,200 hours, and a second one has recently failed at 5,759 hours. The other four are **still operating with near-normal output at 5,576, 5,723, 5,723 and 6,096 hours** respectively!

Previous releases described in detail operation of one tube in this group, Serial No. 585. Extracts of this tube's performance are shown below. All tubes will be tested to failure, and a final report will be issued covering the entire test program.

TUBE TYPE — 35V10 SERIAL NO. — 585 RESONATOR VOLTAGE — 2000v.
RESONATOR CURRENT — 12.0 mA. FREQUENCY — 34.0 Gc.

DATE 1963	HOURS OPERATION	OUTPUT (MW.)	CONTROL ELEC VOLTAGE	REFLECTOR VOLTAGE	HEATER CURRENT (A.)
Apr 1	1295	96	137	179	0.76
May 3	1955	104	130	176	0.76
Jun 7	2728	113	132	173	0.77
Jul 6	3365	117	129	176	0.77
Aug 10	4017	101	135	176	0.78
Sep 3	4567	97	144	174	0.77
Oct 13	5085	113	132	175	0.78
Nov 13	5759	120	132	182	0.79
Nov 30	6096	105	124	178	0.78

Customer reports indicate that many OKI klystrons continue to perform well beyond the ages attained to date in our tests. In some cases our tubes are continuing to operate satisfactorily after over three years almost constant use, involving some 10,000 hours operation.

BUTLER ROBERTS ASSOCIATES INC.
(A subsidiary of OKI Electronics of America Inc.)
Ft. Lauderdale, Florida & New York, N. Y.

PRICE LIST (NET)

ESTABLISHED OKI 1881

Effective January 15, 1964
(Supersedes all previous lists)

OKI MM-WAVE KLYSTRON TUBES

REFLEX KLYSTRONS

INDEX
FT – FULLY TUNABLE OVER RANGE
TT – TRIM TUNABLE AROUND SPECIFIED CENTER FREQ.
HV – HIGH VOLTAGE TUBE
LV – LOW VOLTAGE TUBE
BENCH – BENCH TYPE OF TUBE WITH OCTAL BASE
AIRBORNE – LIGHTWEIGHT AIRBORNE TYPE TUBE, 3½ OZ.

OKI MODEL	FREQUENCY RANGE Gc.	TYPE OF TUBE (SEE INDEX)	TYPICAL OUTPUT MW.	FLANGE TYPE	WAVEGUIDE TYPE	PRICE DEL'D.
17V10	15.5/18.5	FT HV BENCH	60	UG-419/U	RG-107/U	$ 455.00
24V10	21.5/26.5	FT HV BENCH	200	UG-595/U	RG-66/U	480.00
24V11	21.5/26.5	FT HV BENCH	500	UG-595/U	RG-66/U	825.00
30V10	26.5/32.0	FT HV BENCH	100	UG-599/U	RG-96/U	480.00
30V11	26.5/32.0	FT HV BENCH	240	UG-599/U	RG-96/U	825.00
33V10	30.0/36.0	FT HV BENCH	100	UG-599/U	RG-96/U	480.00
35V10	32.0/37.0	FT HV BENCH	100	UG-599/U	RG-96/U	480.00
35V11	32.0/37.0	FT HV BENCH	240	UG-599/U	RG-96/U	825.00
35V30	32.0/37.0	FT LV BENCH	60	UG-599/U	RG-96/U	825.00
35V51	32.0/37.0	TT HV AIRBORNE	130	UG-599/U	RG-96/U	955.00
35V61	32.0/37.0	TT LV AIRBORNE	50	UG-599/U	RG-96/U	1230.00
35V155	32.0/37.0	TT HV BENCH	80	UG-599/U	RG-96/U	480.00
40V10	37.0/42.0	FT HV BENCH	100	UG-383/U	RG-97/U	725.00
45V10	41.0/48.0	FT HV BENCH	100	UG-383/U	RG-97/U	725.00
47V10	43.0/50.0	FT HV BENCH	80	UG-383/U	RG-97/U	775.00
47V11	43.0/50.0	FT HV BENCH	120	UG-383/U	RG-97/U	1005.00
50V10	43.0/51.0	FT HV BENCH	80	UG-383/U & UG-385/U	RG-97/U & RG-98/U	840.00
55V10	50.0/60.0	FT HV BENCH	80	UG-385/U	RG-98/U	995.00
55V11	50.0/60.0	FT HV BENCH	120	UG-385/U	RG-98/U	1190.00
60V10	55.0/65.0	FT HV BENCH	60	UG-385/U	RG-98/U	1670.00
70V10	65.0/75.0	FT HV BENCH	40	UG-385/U & UG-387/U	RG-98/U & RG-99/U	2355.00
70V11	65.0/75.0	FT HV BENCH	60	UG-385/U & UG-387/U	RG-98/U & RG-99/U	2650.00
75V10	70.0/80.0	FT HV BENCH	40	UG-387/U	RG-99/U	2500.00
80V10	75.0/85.0	FT HV BENCH	20	UG-387/U	RG-99/U	2650.00
90V10	85.0/95.0	FT HV BENCH	15	UG-387/U	WR-10	3050.00
100V10	95.0/105.0	FT HV BENCH	10	UG-387/U	WR-10	3350.00

OKI "LADDERTRON"® KLYSTRONS

35F10	33.2/34.8	FT HV BENCH	10 watts	UG-599/U	RG-96/U	2980.00
50F10	49.0/51.0	FT HV BENCH	2 watts	UG-383/U	RG-98/U	4400.00

All prices shown herein include shipment to any destination within the continental U.S.A. & Canada

BUTLER ROBERTS ASSOCIATES INC.

A Subsidiary of OKI ELECTRONICS OF AMERICA INC.

HEAD OFFICE:
50[illegible] S. E. 24TH STREET
FT. [illegible]DERDALE, FLORIDA
TEL: AREA 305: 523-7202
WESTERN UNION TELEX: 051-423

NEW YORK OFFICE:
202 EAST [illegible]TH STREET
NEW YO[illegible] NEW YORK
TEL: ARE[illegible] 212: 682-2989
WESTERN UNION TELEX: 01-25484

WEST COAST REP.:
FRANK R. THOMAS
P.O. BOX 1377
SANTA BARBARA, CALIF.
TEL: AREA 805: 962-5917

BUTLER ROBERTS ASSOCIATES INC.

202 EAST 44TH STREET
NEW YORK 17, NEW YORK

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA

OKI MILLIMETER WAVE TUBES

AND THE

"BUY AMERICAN" ACT

Fort Lauderdale, Fla.

June 1, 1963

Those of our customers who require the quality and performance of OKI millimeter-wave klystron tubes, but who hesitate to place orders because of the so-called "Buy American" Act of 1933, may be interested in the following.

Over the past few years, OKI millimeter-wave klystron tubes have earned a well-deserved reputation for excellent overall performance, reliability and availability. Our immediate and unquestioning compliance with warranty provisions has further enhanced the value of these OKI products in the U. S. market.

In the U. S. our steady klystron customers now number many hundreds, and include almost every organization active in the millimeter-wave field, both in private industry as well as in government. Users of OKI tubes include the U. S. Army, U. S. Air Force, U. S. Navy, NASA, National Bureau of Standards, etc. OKI tubes contributed to the success of Bell Telephone Labs'. "TELSTAR" project, and many similar scientific projects.

Typical of the formal acknowledgments of the superiority of OKI klystrons in official U. S. Government publications is the following:

> "THE OKI KLYSTRONS HAVE PROVEN TO BE THE MOST RELIABLE"
>
> (Page 18, ASTIA AD-284652, Report No. 4, Dept. of the Army, Project No. 3A991500102, Contract DA-36-039-SC-87321 placed by U. S. Army Signal Supply Agency, Fort Monmouth, N. J.)

Typical of acknowledgments in the industrial field is the following extract from a paper given by J. J. Gallagher, et al, at the 1962 Frequency Control Symposium, Atlantic City, N. J., and which is referred to by the U. S. Government publication quoted above.

> "OKI KLYSTRONS HAVE PROVEN TO BE BY FAR THE MOST RELIABLE TUBES FOR PHASE-LOCK WORK. THEY ARE RELATIVELY INSENSITIVE TO MECHANICAL VIBRATIONS, OPERATE WELL WITH FORCED AIR COOLING, AND DRIFT VERY LITTLE AFTER A FIVE MINUTE WARMUP"

Reproduced on the following page is a typical document covering a U. S. Government order for OKI mm-wave tubes. The underlining is our own, to point out the most pertinent factors influencing the decision to buy OKI. Please note particularly the following:

> "THERE IS NO DOMESTIC MANUFACTURED KLYSTRON FULLY EQUAL WHICH CAN BE USED AS A REASONABLE SUBSTITUTE"
>
> "IT IS DETERMINED THAT THE REQUIRED ITEMS ARE NOT . . . MANUFACTURED . . . IN THE UNITED STATES . . . OF A SATISFACTORY QUALITY"
>
> "THE REQUIREMENTS OF THE BUY AMERICAN ACT . . . ARE NOT APPLICABLE TO THIS PROCUREMENT . . ."

Where prime considerations in procurement of mm-wave klystrons are reliability, performance, availability and a dependable warranty, the so called "Buy American" Act should therefore not deter anyone from clearly stipulating in their specifications "KLYSTRONS BY OKI".

BUTLER ROBERTS ASSOCIATES, INC.

SPECIFIC PROVISIONS OF "BUY AMERICAN" ACT AFFECTING PROCUREMENT OF "OKI" KLYSTRONS FOR U. S. GOVERNMENT END - USE.

Customers and Government Contracting Officers whose specifications call for millimeter-wave klystrons as manufactured by OKI, have, where the Government is the end - user, complied with the "Buy American" provisions under one or more of the following categories:

1. Klystrons for use outside the United States.
2. Klystrons determined by the Government not to be manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.
3. Klystrons as to which the Secretary concerned determines the domestic preference to be inconsistent with the public interest.
4. Klystrons as to which the Secretary concerned determines the cost to the Government to be unreasonable.

Production of klystron tubes by OKI is based on criteria of engineering excellence and quality of product. Nevertheless, OKI's research pre-eminence and productive capacity combine to assure the availability of this quality product at savings to our customers and the Government usually greatly exceeding the six percent or other evaluation factor applicable.

(See ASPR 6-103 and 6-104).

Prices of OKI millimeter wave tubes are shown in our standard net price list, which is freely circulated throughout the industry, and which is reproduced on the reverse side of this brochure. There are no "escalator" clauses: orders accepted by us are billed at the prices appearing on such accepted orders.

5

REPRODUCTION OF DOCUMENT ACCOMPANYING U. S. GOVERNMENT ORDER FOR OKI KLYSTRONS

DETERMINATION OF NONAVAILABILITY

Pursuant to the authority contained in Section 2, Title III of the Act of March 3, 1933 (popularly called the Buy American Act) (41 U.S.C. 10 a-d) and the authority delegated to me by [redacted] I hereby find:

a. The cost of the foreign made items described below is estimated to be $1,950.00 including duty and transportation costs.

Item	Description	Quantity	Amount
1	Klystron #55V10, Oki Electric	2	$1,950.00

b. That this equipment is manufactured by Oki Electric Industry, Ltd., Tokyo, Japan; and distributed by Butler Roberts Associates, Ft. Lauderdale, Fla.

c. The items described above are required by the [redacted] to meet R&D requirements.

d. That there is no domestic manufactured klystrons fully equal which can be used as a reasonable substitute.

DETERMINATION

Based upon these findings, it is determined that the required items are not mined, produced or manufactured, or the articles, materials or supplies from which they are manufactured are not mined, produced or manufactured, as the case may be, in the United States in sufficient and reasonable available quantities and of a satisfactory quality.

Accordingly, the requirements of the Buy American Act that procurement be made from domestic sources and that it be of domestic origin is not applicable to this procurement since said procurement is within the non-availability exception stated in the Buy American Act. Authority is granted to procure the above described items of foreign origin from Butler Roberts Associates, Ft. Lauderdale, Fla., at a total cost of $1,950.00, including duty and transportation cost to destination.

[redacted] ORDER NO [redacted]
REQ NO [redacted]
JOB ORDER NO. [redacted]

Contracting Officer

Date [redacted]

[redacted]

BUTLER ROBERTS ASSOCIATES, INC.
500 S. E. 24th STREET
FT. LAUDERDALE, FLORIDA

RECEIVED
MAY 3 - 1963

We have blocked out identifying data in the reproduction shown above. However, the original is on file here, together with other similar documents. This material can be made available to U. S. Government Purchasing Agencies and to bona fide contractors to the U. S. Government to prove precedent.

PRICE LIST (NET)

OKI

ESTABLISHED 1881

Effective June 1, 1963

OKI MILLIMETER WAVE TUBES (REFLEX KLYSTRONS)

OKI TUBE TYPE	MECH. TUNING RANGE	AVERAGE OUTPUT MILLIWATTS	PREFERRED FLANGE TYPE	PRICE F.O.B. DESTN. (CONT. U.S.A.)
24V10	21.5/26.5 Gc	200	UG-595/U	$ 435.00
24V11	21.5/26.5 Gc.	500	UG-595/U	785.00
30V10	26.5/32.0 Gc.	100	UG-599/U	455.00
30V11	26.5/32.0 Gc	240	UG-599/U	805.00
33V10	30.0/36.0 Gc.	100	UG-599/U	465.00
35V10	32.0/37.0 Gc.	100	UG-599/U	475.00
35V11	32.0/37.0 Gc.	240	UG-599/U	805.00
40V10	37.0/42.0 Gc.	100	UG-383/U	705.00
45V10	41.0/48.0 Gc.	100	UG-383/U	705.00
50V10	43.0/51.0 Gc.	80	UG-383/U & UG-385/U+	760.00
55V10	50.0/60.0 Gc.	80	UG-385/U	975.00
60V10	55.0/65.0 Gc.	60	UG-385/U	1,635.00
70V10	65.0/75.0 Gc.	40	UG-385/U & UG-387/U++	2,442.00
75V10	70.0/80.0 Gc.	40	UG-387/U	2,545.00
80V10	75.0/85.0 Gc.	30	UG-387/U	2,970.00
90V10	85.0/95.0 Gc.	20	UG-387/U	3,175.00
100V10	95.0/105.0 Gc.	20	Not yet established	3,390.00

Note + For tubes to be used principally below 50 Gc., flange type UG-383/U (waveguide type RG-97/U) is recommended. For tubes to be used principally above 50 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended.

Note ++ For tubes to be used principally below 70 Gc., flange type UG-385/U (waveguide type RG-98/U) is recommended. For tubes to be used principally above 70 Gc., flange type UG-387/U (waveguide type RG-99/U) is recommended.

OKI "LADDERTRON®" KLYSTRONS

These new high-power klystrons are completely packaged units, presently being manufactured in the 35 Gc. and 50 Gc. frequency ranges. Although conservatively rated, power output levels of as high as 15 watts are obtainable. When ordering, please specify the frequency at which maximum output is desired. Limited mechanical tuning is provided giving a range of 33.250-34.750 Gc. with the Type 35F10, and 49.000-51.000 Gc. with Type 50F10.

Laddertron Type 35F10 ---------- $2,980.00 F.O.B. Destination (Cont. U.S.A.)
Laddertron Type 50F10 ---------- $3,980.00 F.O.B. Destination (Cont. U.S.A.)

All prices shown herein include shipment to any destination within the continental U.S.A.

BUTLER ROBERTS ASSOCIATES INC. *A Subsidiary of OKI ELECTRONICS OF AMERICA INC.*

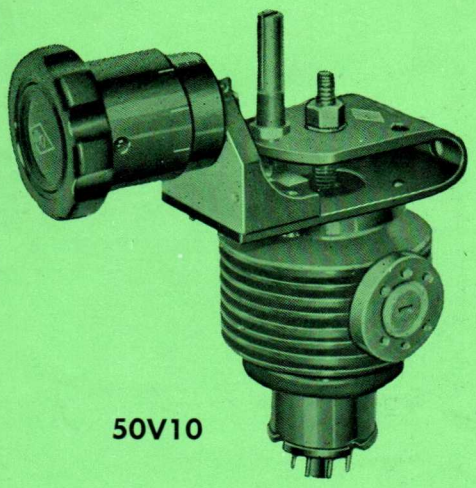
202 EAST 44TH STREET
NEW YORK 17, NEW YORK
TEL: 682-2989

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA
TEL: 523-7202

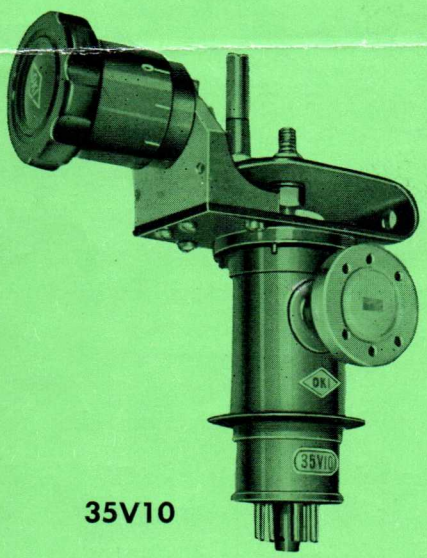
TPD. (1)

OKI

ESTABLISHED 1881



50V10



35V10

MILLIMETER WAVE KLYSTRONS

OKI
ELECTRIC INDUSTRY CO., LTD. TOKYO JAPAN

Research on millimeter wave tubes related to the new requirement for development of the millimeter wave field in Japan was first taken up by OKI ELECTRIC INDUSTRY COMPANY around 1955. Since the first practical development of millimeter wave magnetron was published in August 1957, further effort has been paid for the fabrication of different kinds of millimeter wave tubes, and recently we came out with four types of tubes including the magnetrons and the klystrons. These tubes are available for service in high definition radar systems, measuring equipments, waveguide transmission experiments and research on solid state physics such as millimeter wave spectroscopy. The new application to the field of millimeter wave diagnostics for controlled fusion research is also expected. We have pleasure in introducing our new products of 35V10 and 50V10 in the following.

10 SHIBA-TAKAHAMA-CHO, MINATO-KU, TOKYO, JAPAN
Cable Address : "OKIDENKI TOKYO"

OKI
ELECTRIC INDUSTRY
CO., LTD. TOKYO JAPAN

1. 35V10

The 35V10 is a reflex klystron for Q band and is tunable over the range 8–9 mm. The output is led out from a built-in resonator through the output window into the outside waveguide. The output is approximately 40 mW at 35,000 Mc. A vernier tuning mechanism is also provided to faciliate frequency selection. This klystron is available for wide service in all experiments in this wave range.

—Electrical Characteristics—

Heater Voltage	6.3V
Heater Current	0.7A
Cavity Voltage	2000V
Cavity Current	12 mA
Control Electrode Voltage	–100V
Reflector Voltage	–100 ~ –500V
Frequency Range	33,000–37,000 Mc
Power Output	40 mW
Electronic Tuning Range	60–100 Mc

2. 50V10

The 50V10 is a reflex klystron for 6 mm band and is tunable over the range 6–7 mm. The mechanical structure for leading output into the load is similar to that of the 35V10. Any frequency selection is possible over the above range by a vernier tuning mechanism. Stable and sufficient output can be obtained with this Klystron superior to that of conventional types used hitherto in this band.

—Electrical Characteristics—

Heater Voltage	6.3V
Heater Current	0.75A
Cavity Voltage	2300V
Cavity Current	25 mA
Control Electrode Voltage	–70V
Reflector Voltage	–100 ~ –500V
Frequency Range	43,000–51,000 Mc
Power Output	20 mW
Electronic Tuning Range	80–140 Mc

Printed in JAPAN

10 SHIBA-TAKAHAMA-CHO, MINATO-KU, TOKYO, JAPAN
Cable Address: "OKIDENKI TOKYO"

BUTLER ROBERTS ASSOCIATES INC.

500 S. E. 24TH STREET
FT. LAUDERDALE, FLORIDA

TELEPHONE 523-7202
AREA CODE 305

202 EAST 44TH STREET
NEW YORK 17, NEW YORK

TELEPHONE MU 2-2989

Fort Lauderdale, Florida
October 20, 1963

ADDITIONS TO THE LINE OF "OKI" MM-WAVE KLYSTRONS
TENTATIVE SPECIFICATIONS

The following mm-wave klystrons are now being added to the existing line of OKI tubes; detailed catalog sheets are being printed and will be circulated shortly.

35Gc. Band

Model 35V30 - Standard octal base, mech. tunable klystron, 32/37Gc. similar to OKI 35V10 but for LOW VOLTAGE operation. Center freq. 35Gc. Typical output 60mW. @ 800V. Price $805.00 delivered U.S.A. & Canada.

Model 35V61 - Lightweight (3½ oz.) AIRBORNE TYPE trimmable klystron, for LOW VOLTAGE operation. Any center freq. from 32/37Gc. to customer's order. Typical output 40mW. @ 800V. Price $1,195.00 delivered U.S.A. & Canada.

17Gc. Band

Model 17V10 - Standard octal base, mech. tunable klystron, 15/19Gc., similar to OKI 24V10 series. Typical output 30/150mW. @ 2,000V. Price $430.00 delivered U.S.A. & Canada.

Model 17V30 - Standard octal base, mech. tunable klystron, similar to OKI 17V10 above, but for LOW VOLTAGE operation. Typical output 30/50mW. @ 800V. Price not yet established.

Model 17V61 - Lightweight (3½ oz.) AIRBORNE TYPE trimmable klystron, for LOW VOLTAGE operation. Any center freq. from 15/19Gc. to customer's order. Typical output 30/50mW. @ 800V. Price not yet established.

Variations from above specifications can be met to customer's order.

ESTABLISHED 1881

OKI MM-WAVE REFLEX KLYSTRON TUBES

TYPICAL PERFORMANCE CURVES

In response to numerous requests, we have prepared the enclosed copies of typical OKI mm-wave klystron curves.

Performance data published by OKI is extremely conservative, output power usually being expressed as the minimum obtainable.

The enclosed curves represent the average performance of production tubes under varying conditions.

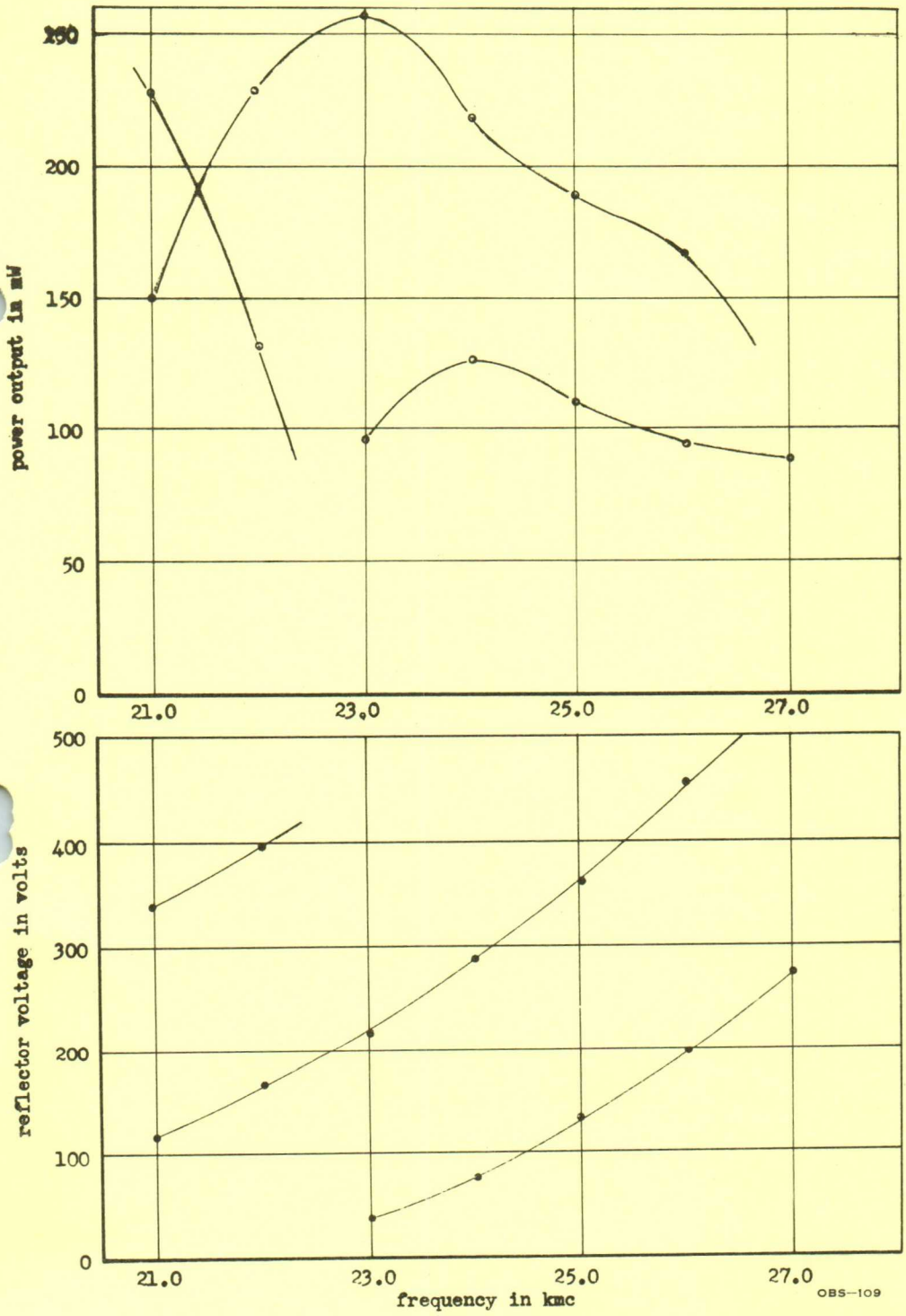
Index

OKI electric industry co., ltd. TOKYO JAPAN

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

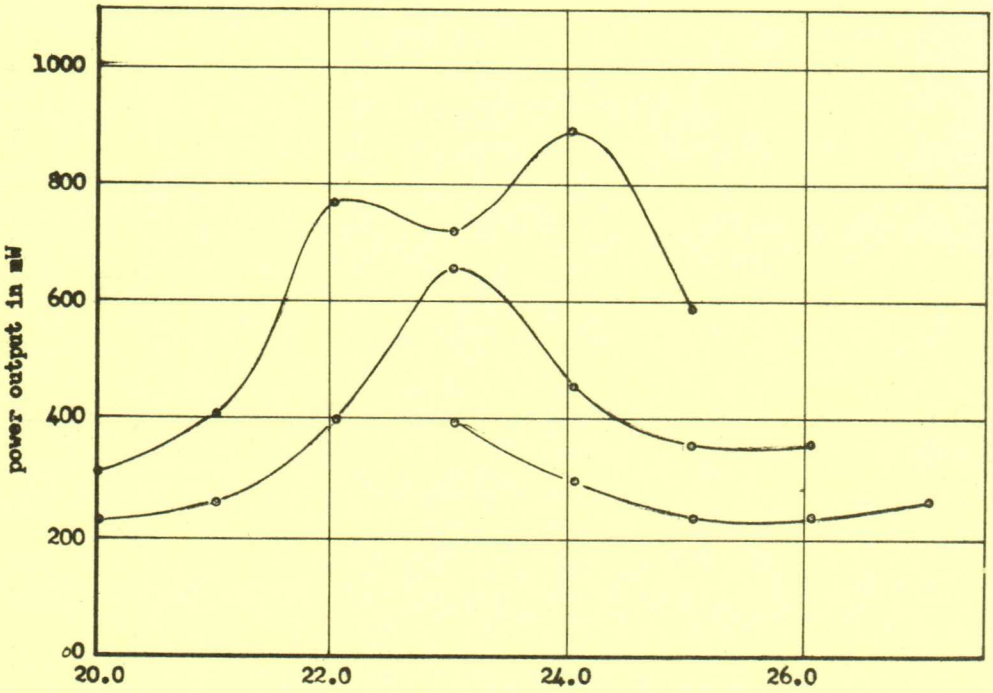
Typical operation data of 24V10
Tube # 113

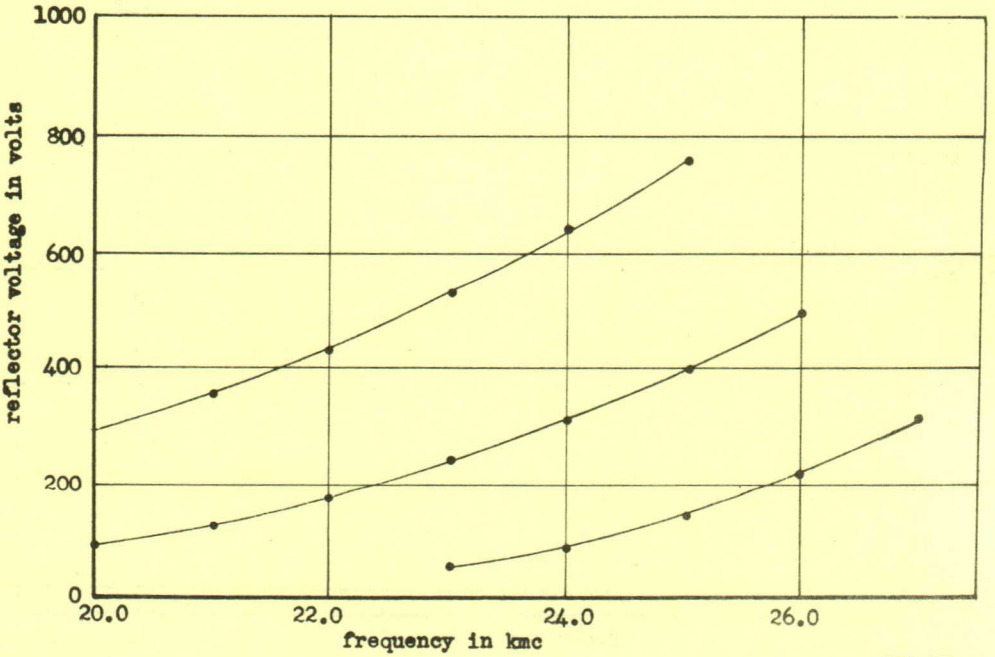


BUTLER ROBERTS ASSOCIATES, INC.
500 S.E. 24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 24 V 11
Tube # 143

OKI ELECTRIC INDUSTRY CO., LTD.



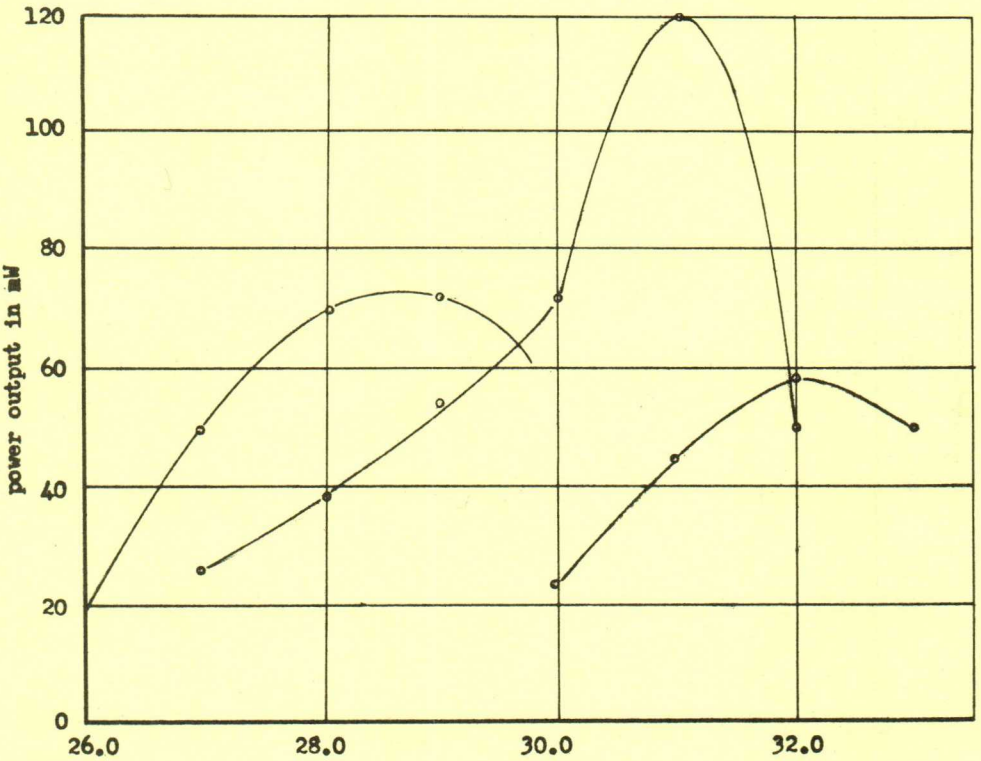


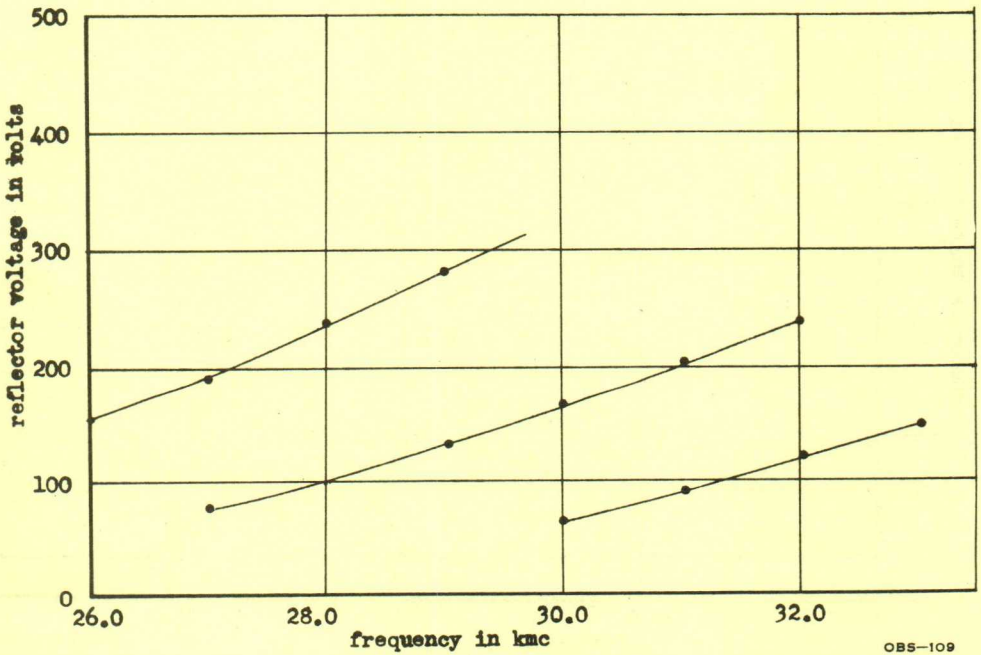
OBS—109

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

Typical operation data of 30 V 10
Tube # 124



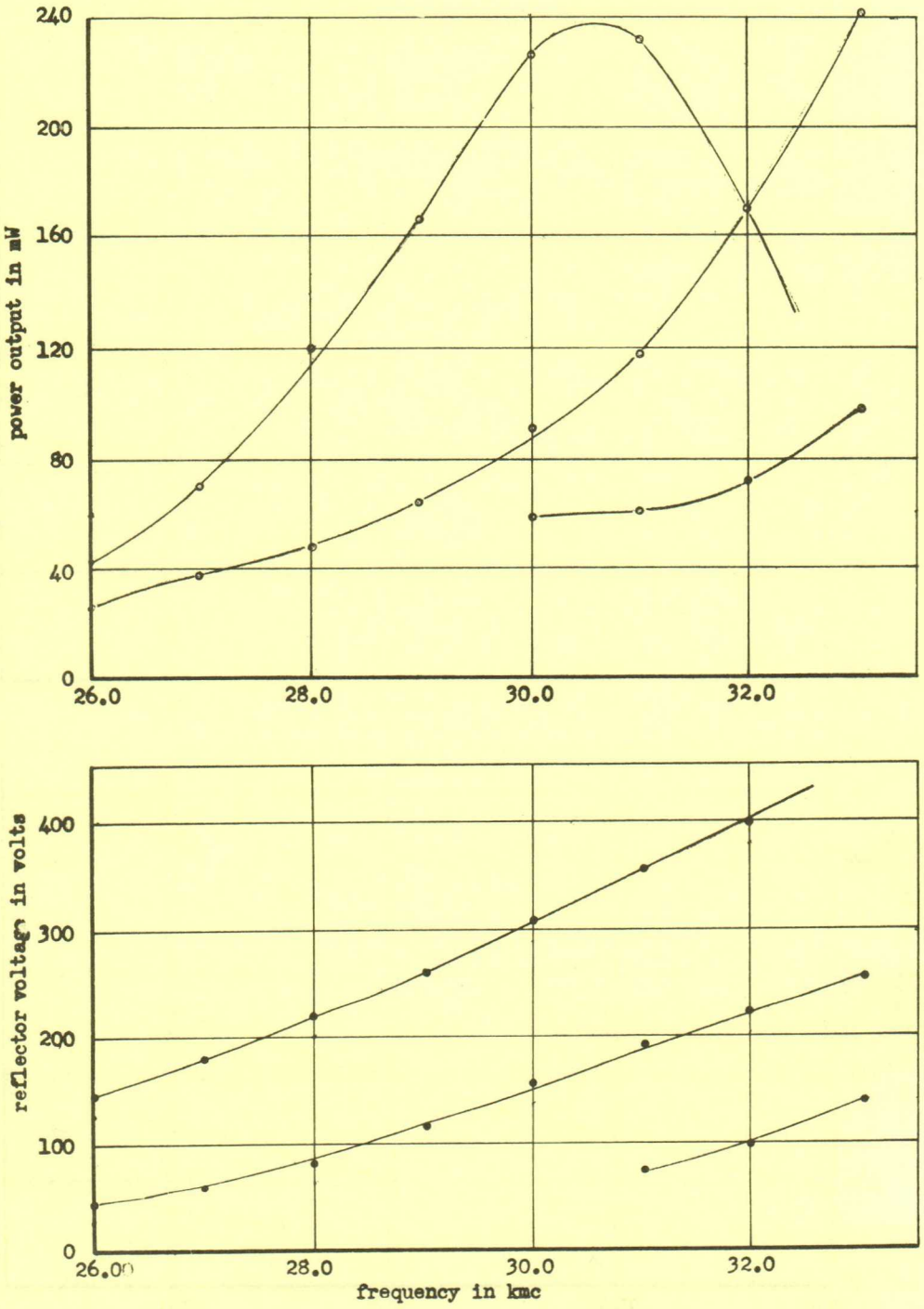


OBS—109

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 30 V 11
Tube # 170

OKI ELECTRIC INDUSTRY CO., LTD.

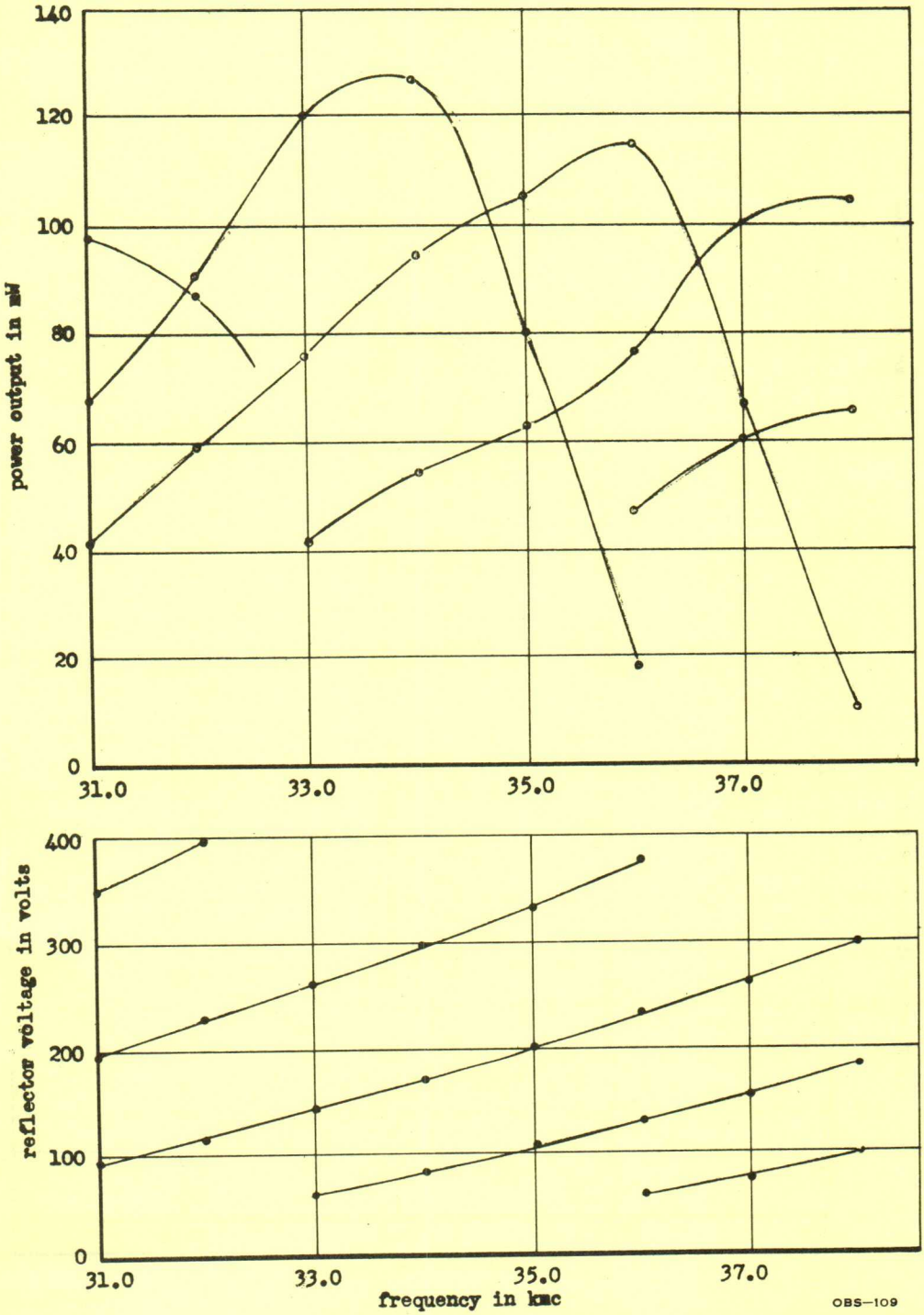


OBS—109

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

Typical operation data of 35 V 10
Tube # 701

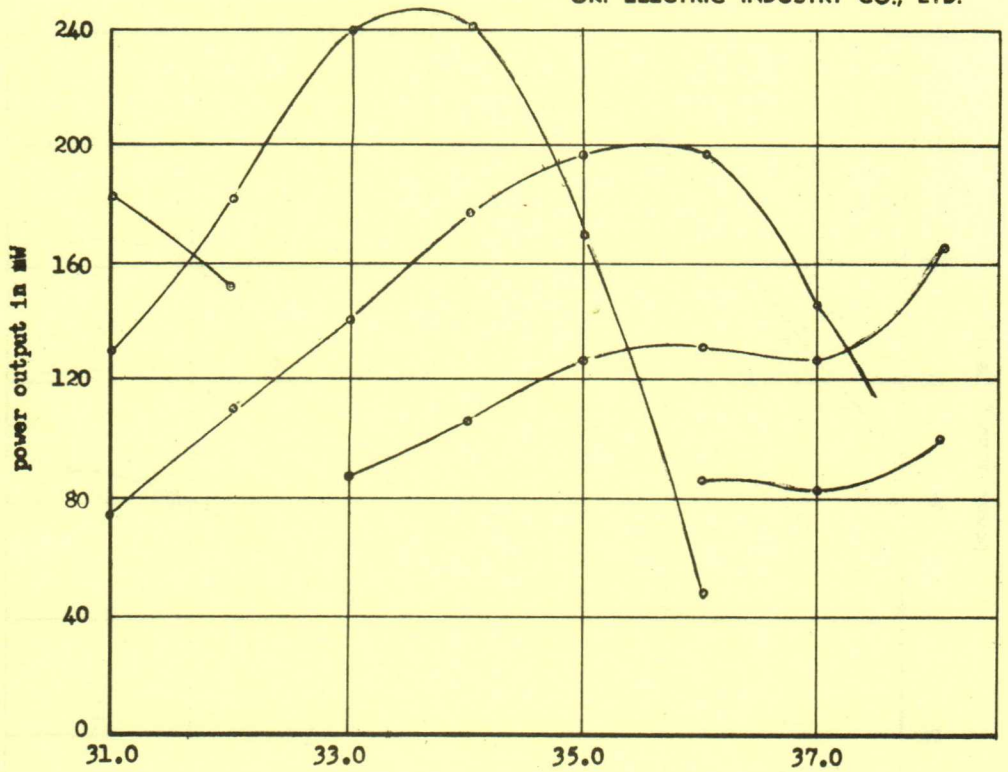


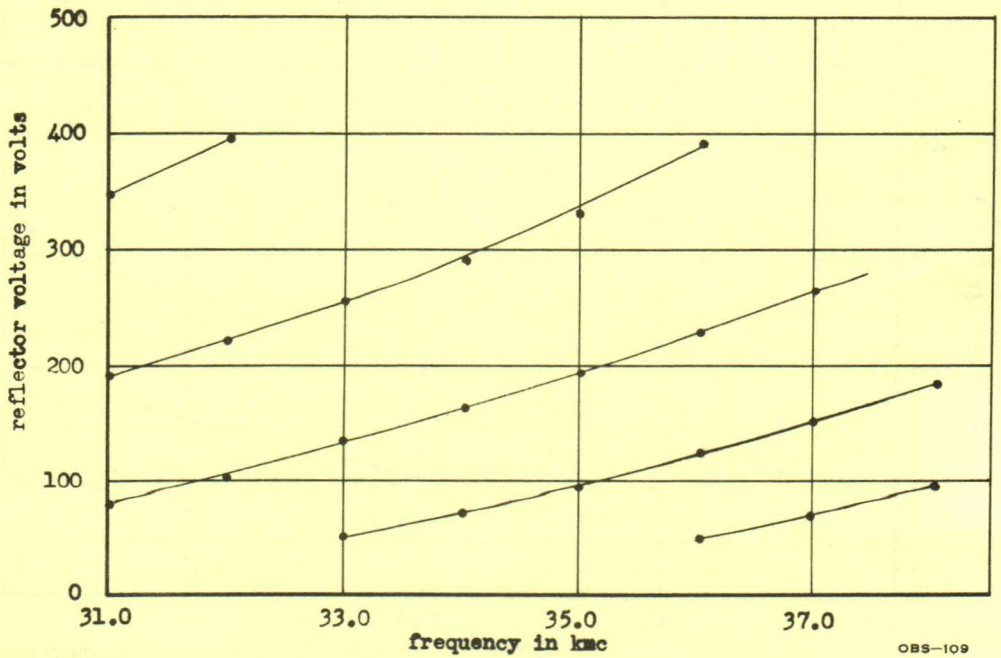
OBS—109

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 35 V111
Tube # 356

OKI ELECTRIC INDUSTRY CO., LTD.



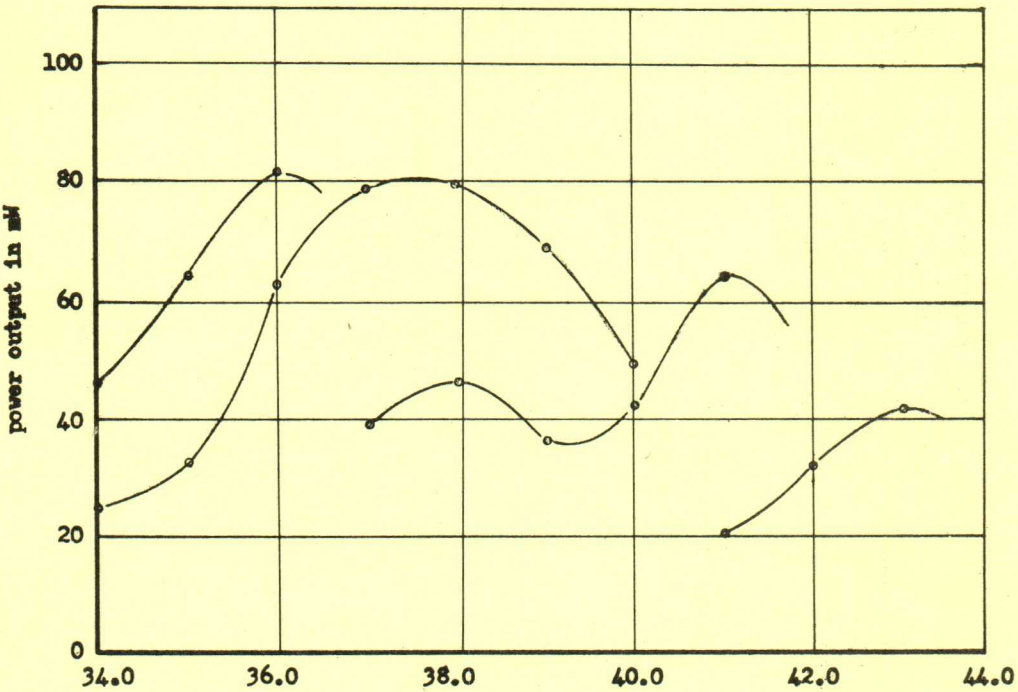


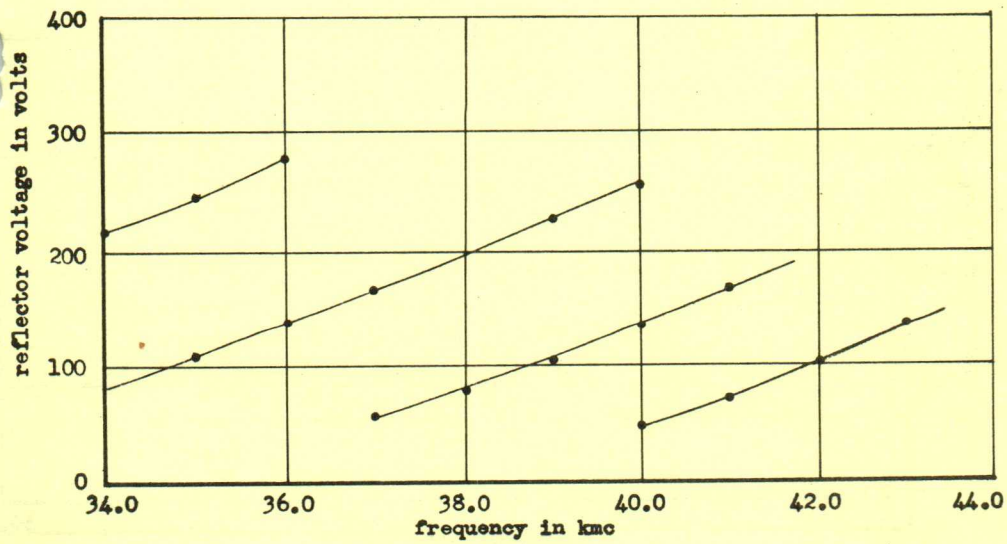
OBS—109

BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

Typical operation data of 40 V 10
Tube # 103

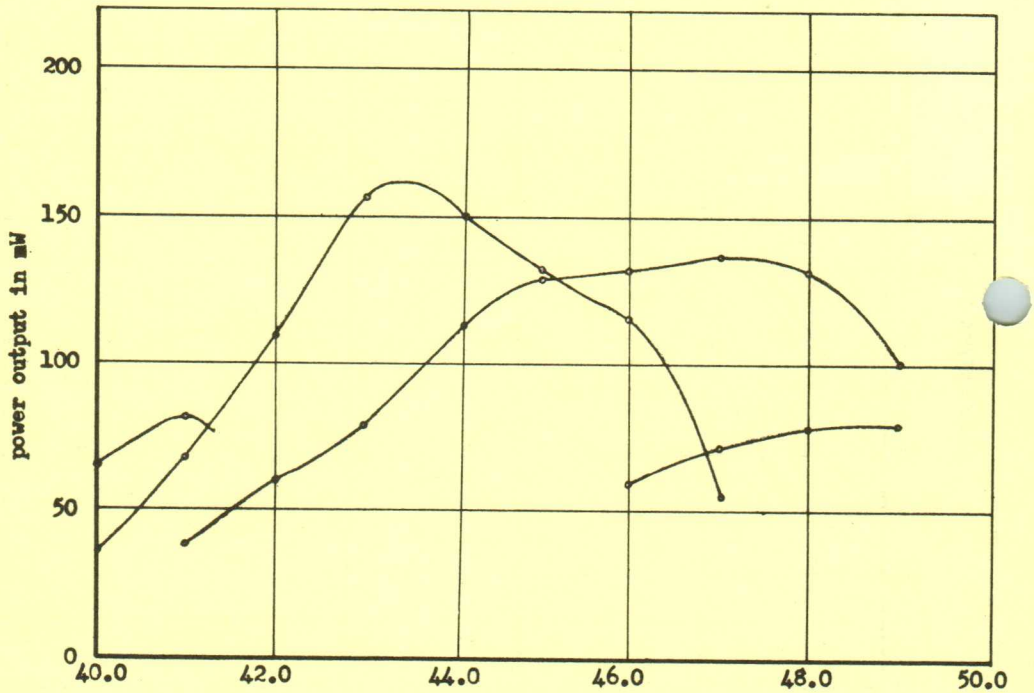


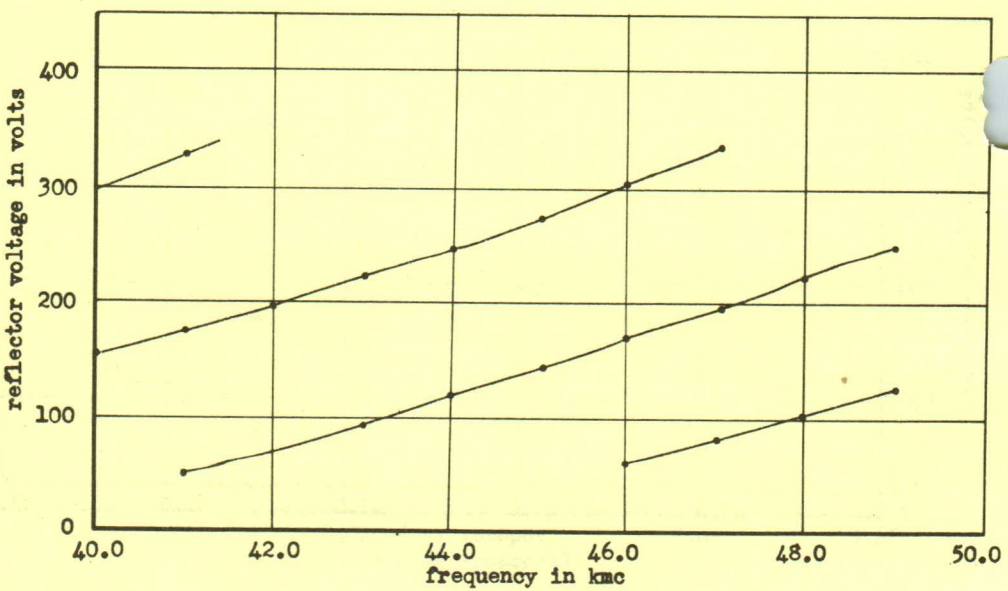


BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 45 V 10
Tube # 189

OKI ELECTRIC INDUSTRY CO., LTD.

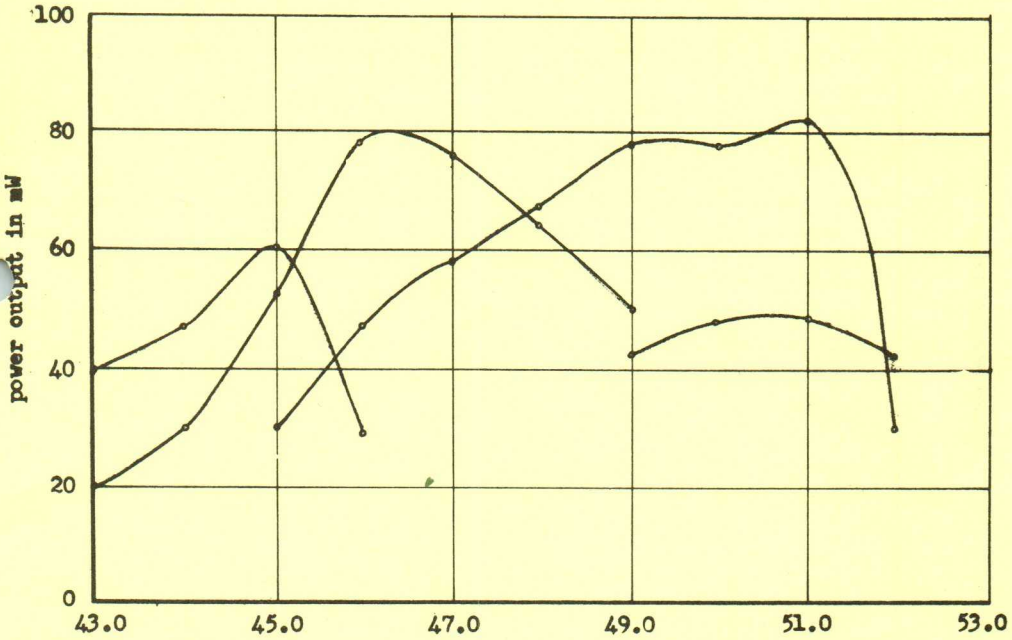


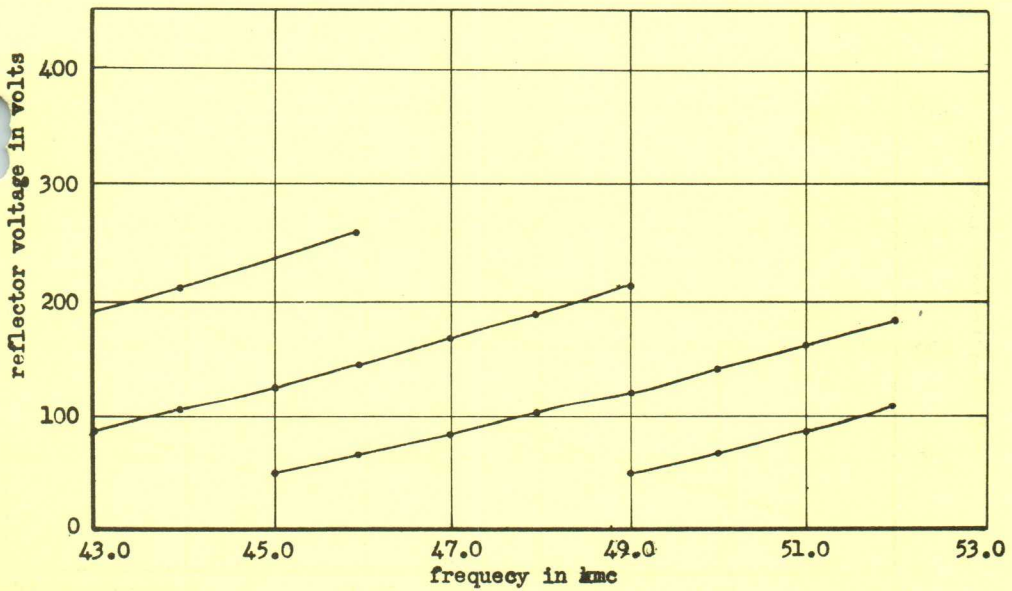


BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

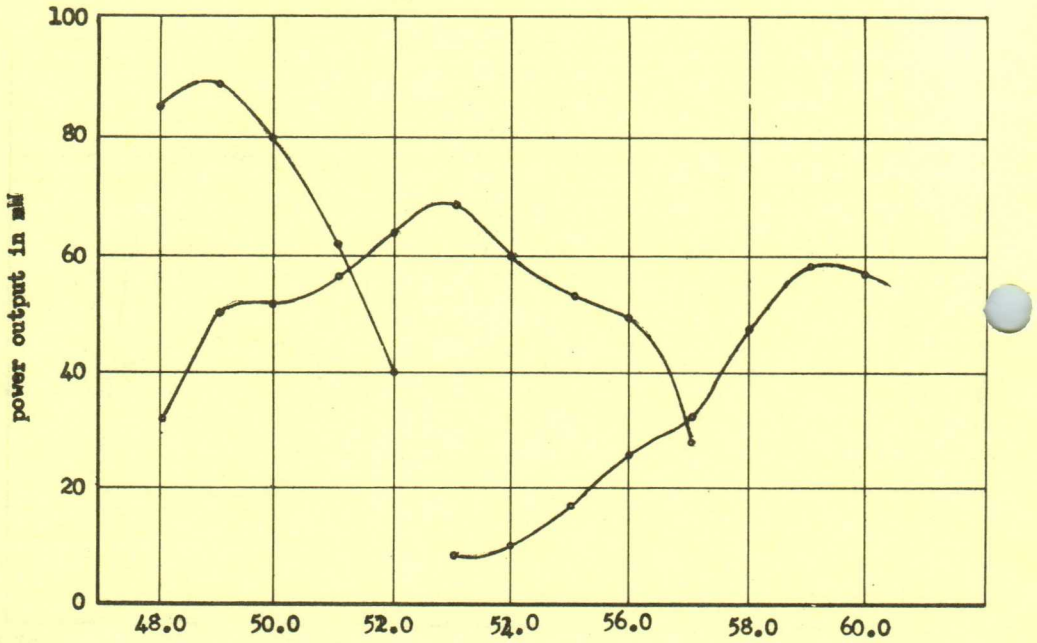
Typical operation data of 50 V 10
Tube # 772

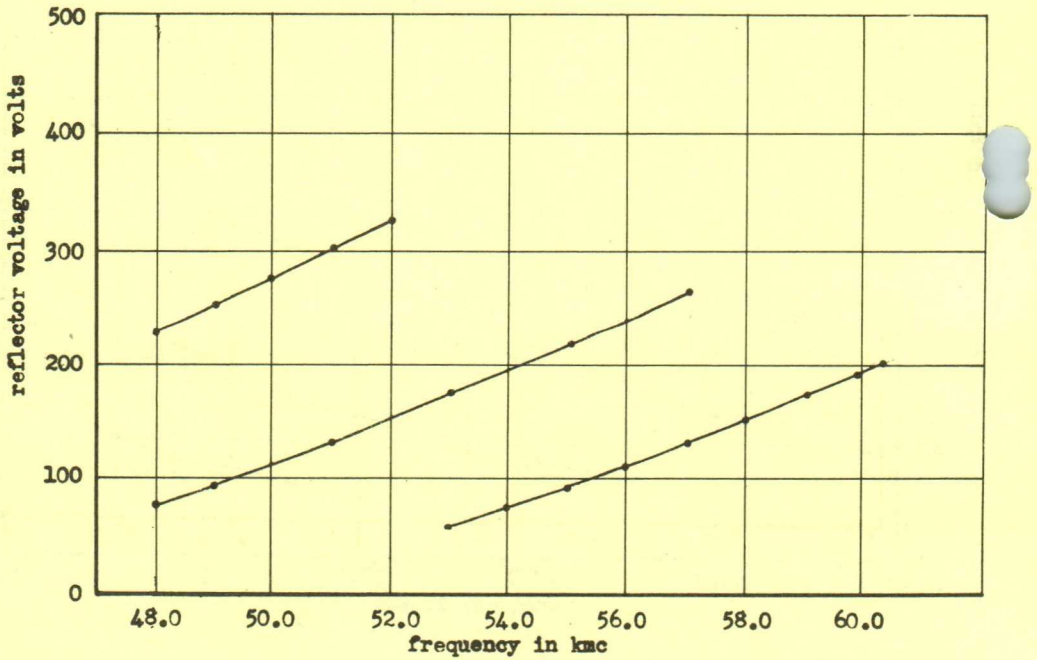




BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 55 V 10 OKI ELECTRIC INDUSTRY CO., LTD.
Tube # 587

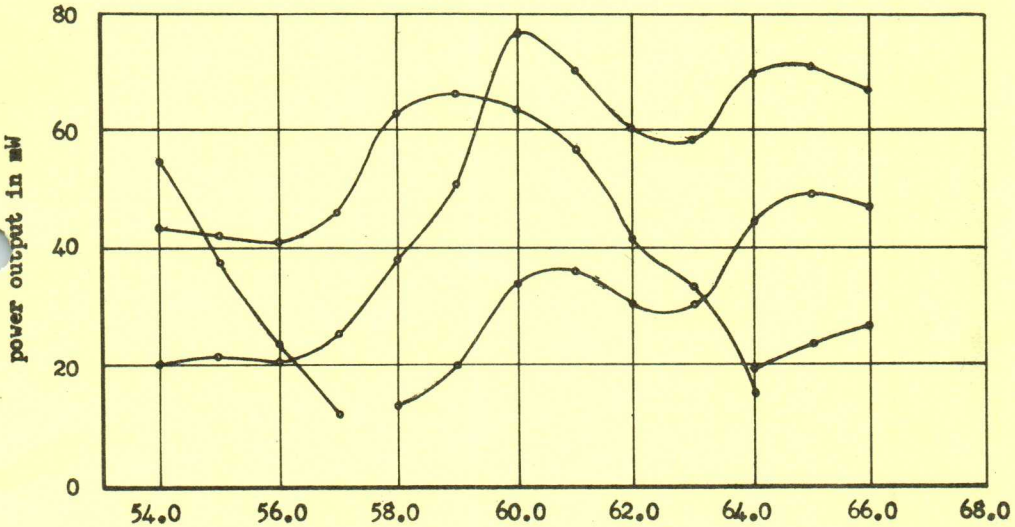


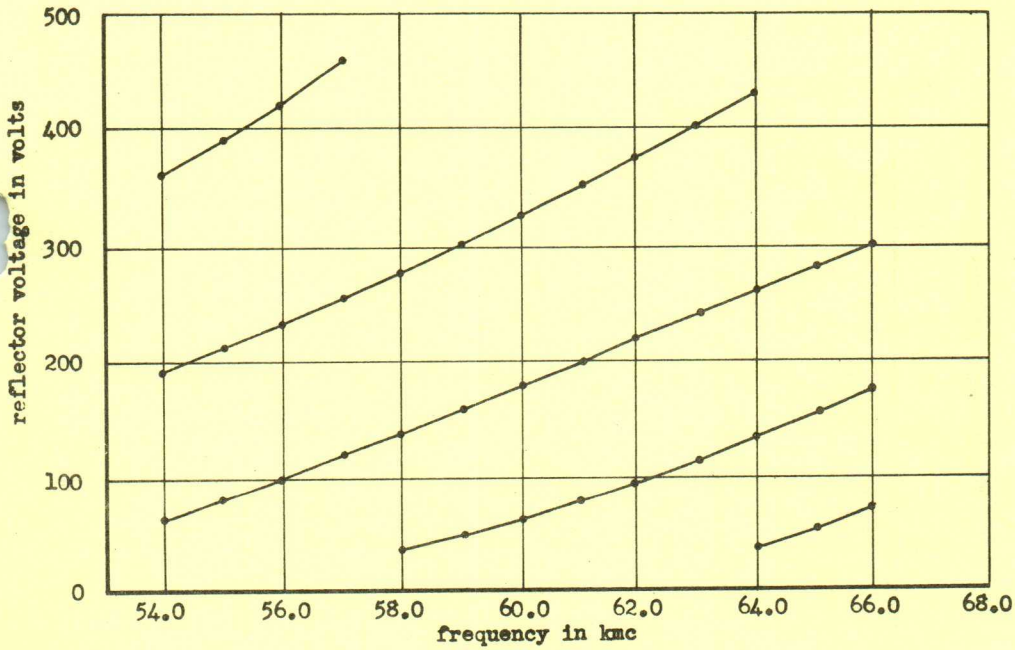


BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

OKI ELECTRIC INDUSTRY CO., LTD.

Typical operation data of 60 V 10 tube # 324

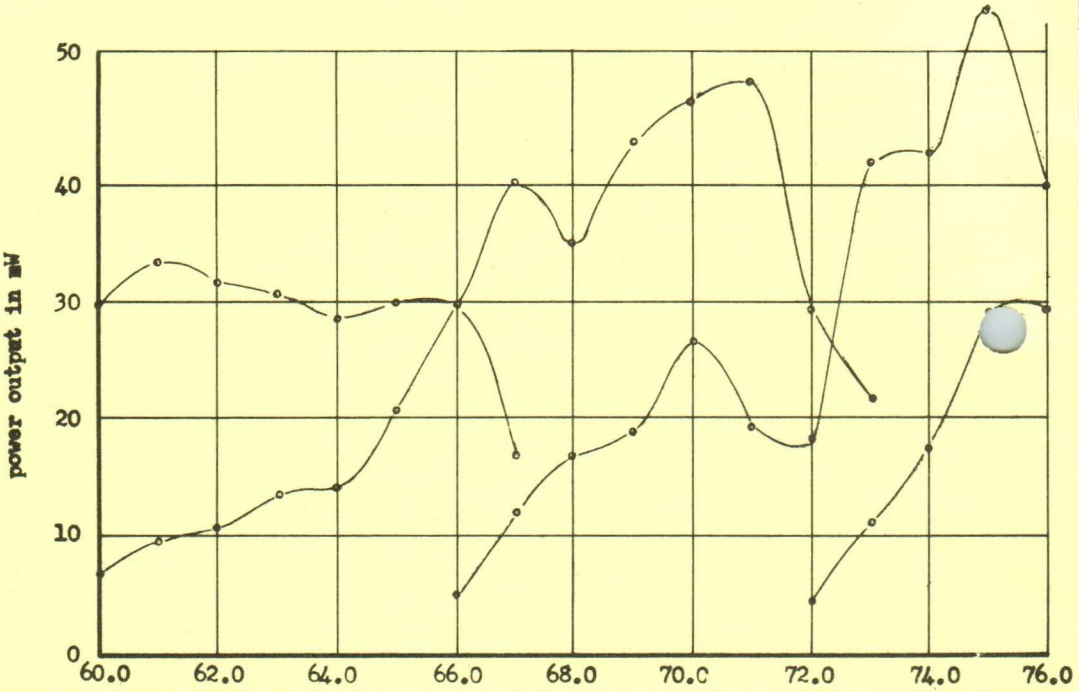


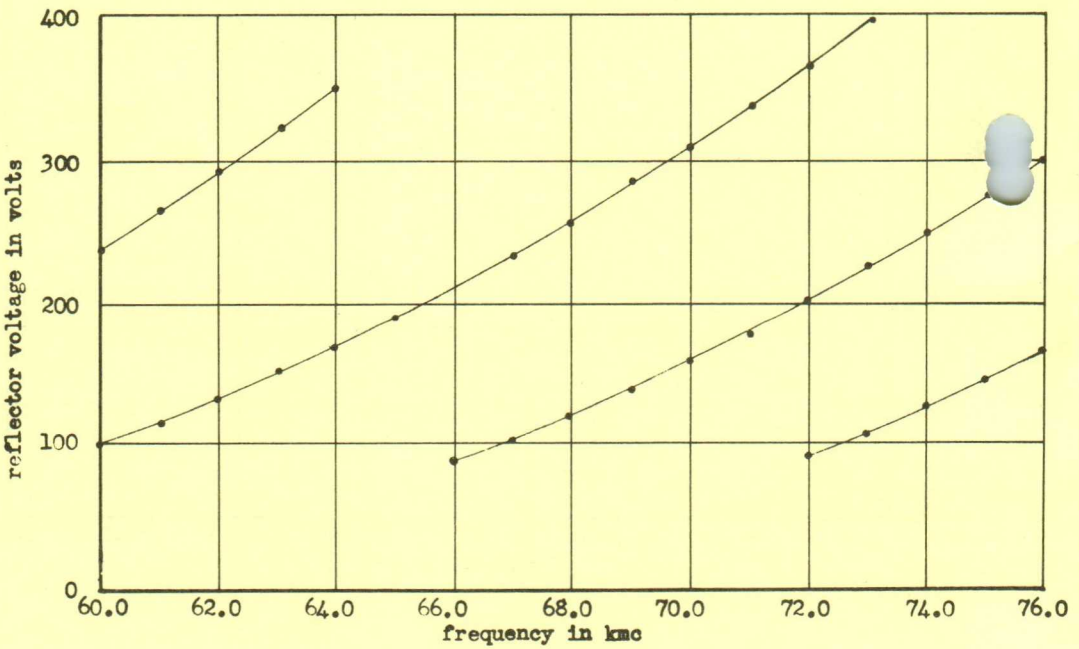


BUTLER ROBERTS ASSOCIATES, INC.
500 S.E.24th STREET
FT. LAUDERDALE, FLORIDA
TELEPHONE 523-7202

Typical operation data of 70 V 10
Tube # 380

OKI ELECTRIC INDUSTRY CO., LTD.





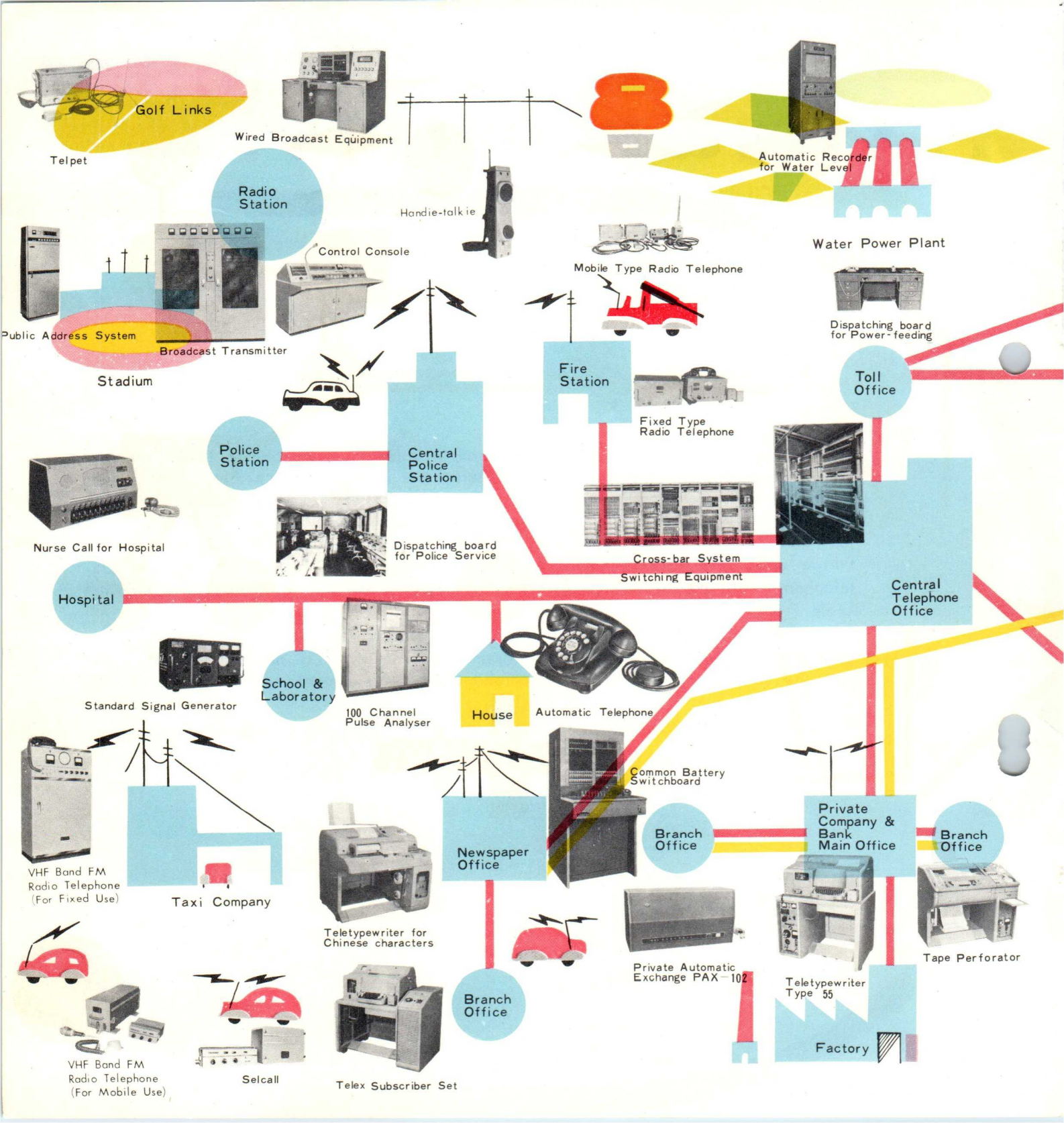
PLANTS & PRODUCTS

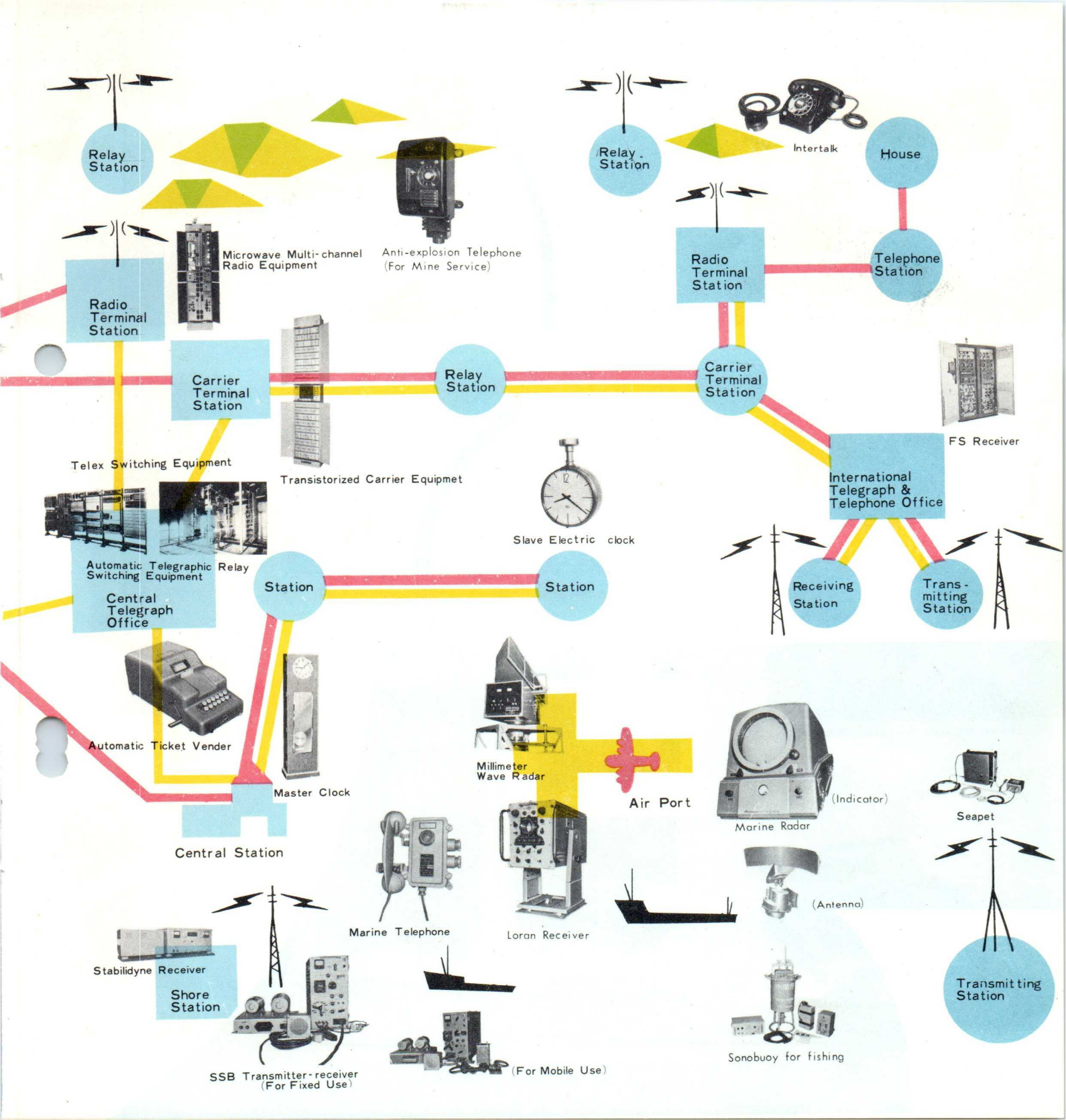
OKI
electric industry
co., ltd. TOKYO JAPAN

Two years after Alexander Graham Bell invented the telephone in 1876, Kibataro Oki first test-manufactured a similar telephone in Japan. Since then, with a view of manufacturing telecommunication equipment, he established the Meiko Sha (Meiko Company) in 1881. This was the birth of Oki Electric. Not satisfied with the performance of the Bell telephone, Kibataro Oki proceeded his research to the Edison carbon telephone and in the same year produced a fruit of a new Oki telephone. It was also the first year when telephones were manufactured on full scale.

Since then, for 80 years Oki Products have incessantly contributed much to the expansion of telecommunications in Japan. Therefore, it is no exaggeration to say that the history of Japan's Telecommunications Development is the history of Oki Electric.

Following is an outline of our products and plants.


Golf Links
Telpet
Wired Broadcast Equipment
Automatic Recorder for Water Level
Water Power Plant
Radio Station
Handie-talkie
Control Console
Public Address System
Broadcast Transmitter
Stadium
Mobile Type Radio Telephone
Dispatching board for Power-feeding
Fire Station
Toll Office
Fixed Type Radio Telephone
Police Station
Central Police Station
Nurse Call for Hospital
Dispatching board for Police Service
Cross-bar System Switching Equipment
Central Telephone Office
Hospital
Standard Signal Generator
School & Laboratory
100 Channel Pulse Analyser
House
Automatic Telephone
Common Battery Switchboard
VHF Band FM Radio Telephone (For Fixed Use)
Taxi Company
Newspaper Office
Branch Office
Private Company & Bank Main Office
Branch Office
Teletypewriter for Chinese characters
Private Automatic Exchange PAX-102
Teletypewriter Type 55
Tape Perforator
Branch Office
Factory
VHF Band FM Radio Telephone (For Mobile Use)
Selcall
Telex Subscriber Set

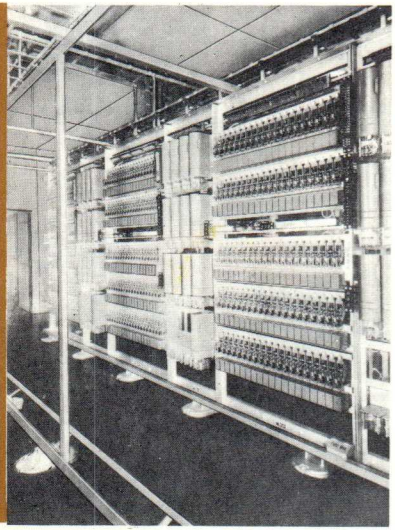

Relay Station
Microwave Multi-channel Radio Equipment
Anti-explosion Telephone (For Mine Service)
Relay Station
Intertalk
House
Radio Terminal Station
Telephone Station
Radio Terminal Station
Carrier Terminal Station
Relay Station
Carrier Terminal Station
FS Receiver
Telex Switching Equipment
Transistorized Carrier Equipmet
Slave Electric clock
International Telegraph & Telephone Office
Automatic Telegraphic Relay Switching Equipment
Central Telegraph Office
Station
Station
Receiving Station
Trans-mitting Station
Automatic Ticket Vender
Master Clock
Central Station
Millimeter Wave Radar
Air Port
Marine Radar
(Indicator)
Seapet
Marine Telephone
Loran Receiver
(Antenna)
Stabilidyne Receiver
Shore Station
Transmitting Station
SSB Transmitter-receiver (For Fixed Use)
(For Mobile Use)
Sonobuoy for fishing

Shinagawa Plant :

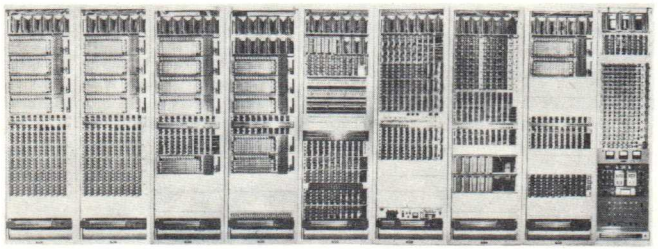
10 Shiba-Takahama-cho,
Minato-ku, Tokyo

Main Products :

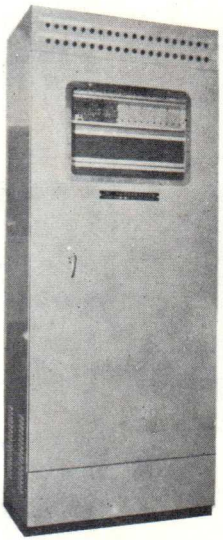
Automatic Exchange
Equipment.
Manual Exchange
Equipment.



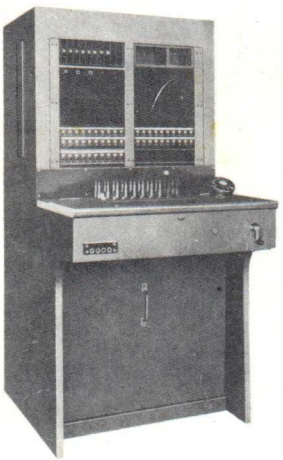
Strowger type Automatic Exchange:



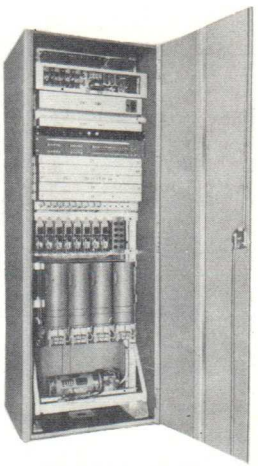
Cross-Bar type Automatic Exchange:



Electronic Telephone
Exchange:



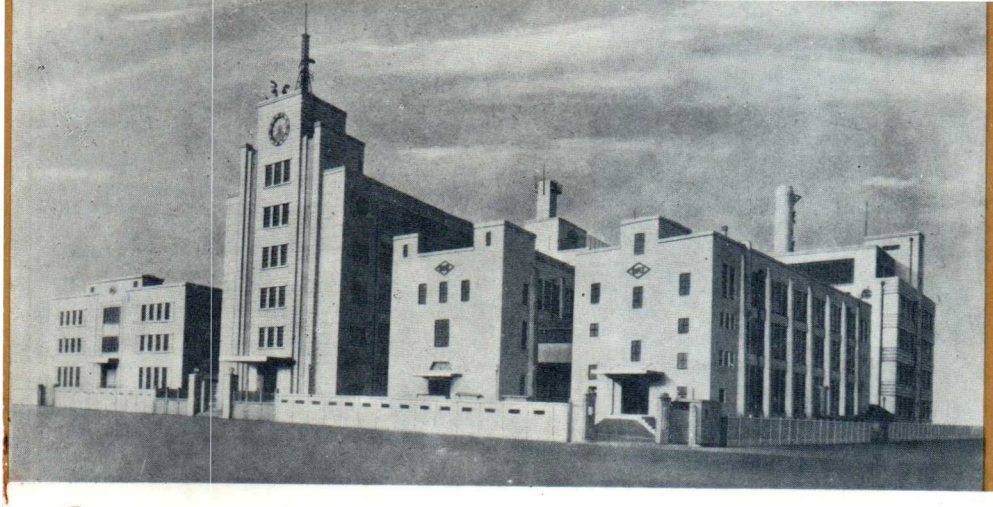
Type 32 Common
Battery Switchboard:



8200 Type PABX:

10 line Magneto Switchboard,
Cordless Type:

15 line Common Battery
Switchboard, Cordless Type:

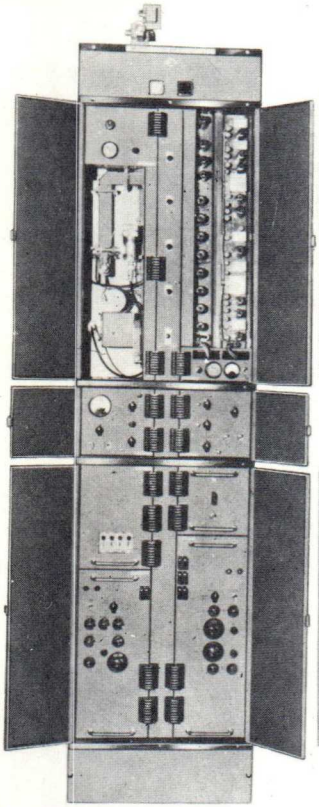


Shibaura Plant :

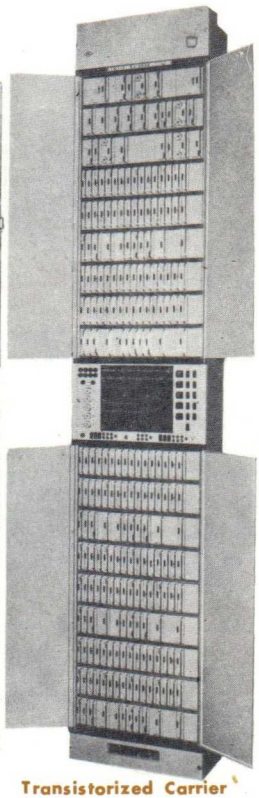
1, Nishi Shibaura 4-chome,
Minato-ku, Tokyo

Main Products :

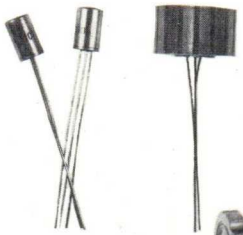
Telephone Sets, Wireless Equipment, Radar, Carrier Equipment, Echo Sounder, Measuring Equipment.



Microwave Multi-channel Radio Equipment :

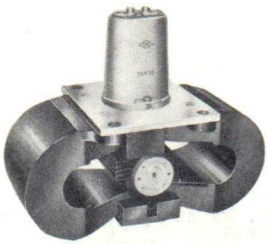


Transistorized Carrier Equipment :



Transistor :

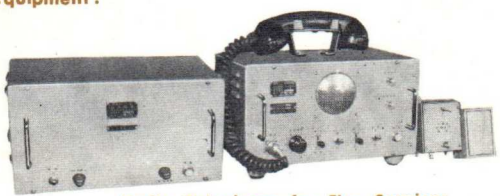
Klystron :



Magnetron :

Automatic Telephone :

VHF Radio Telephone (For Mobile Use) :



Radio Telephone for Fire Service :

SSB Transmitter-receiver (For fixed use) :

100 channel pulse Analyser :

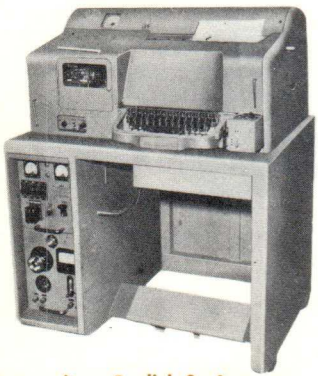
Takasaki Plant :

108, Shingokan-cho, Takasaki-shi, Gumma-ken.

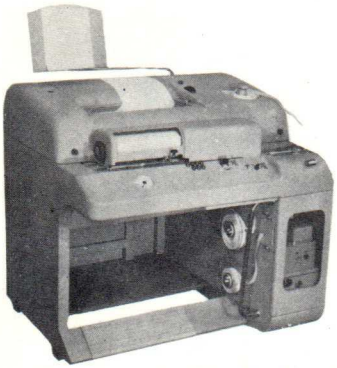
Main Products:

Telegraph Equipment

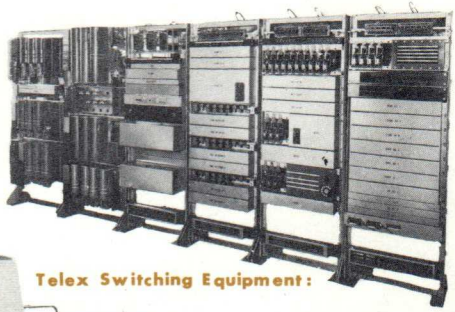
Business Machine



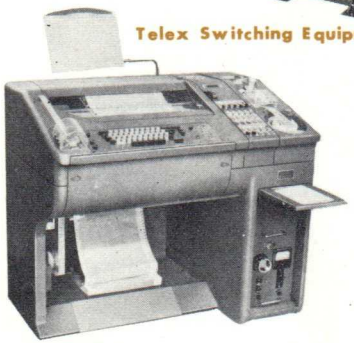
Teletypewriter, English & Japanese Character (55 type) :



Teletypewriter, 2,500 Kanji Character: (Chinese & Japanese)

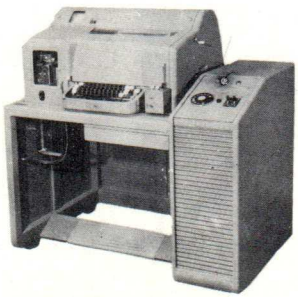


Telex Switching Equipment :



Perforator :

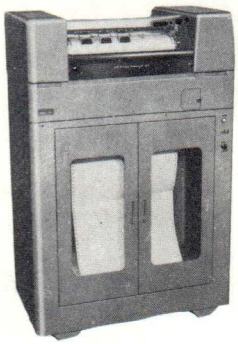
Input-output Device for Electronic Computer:



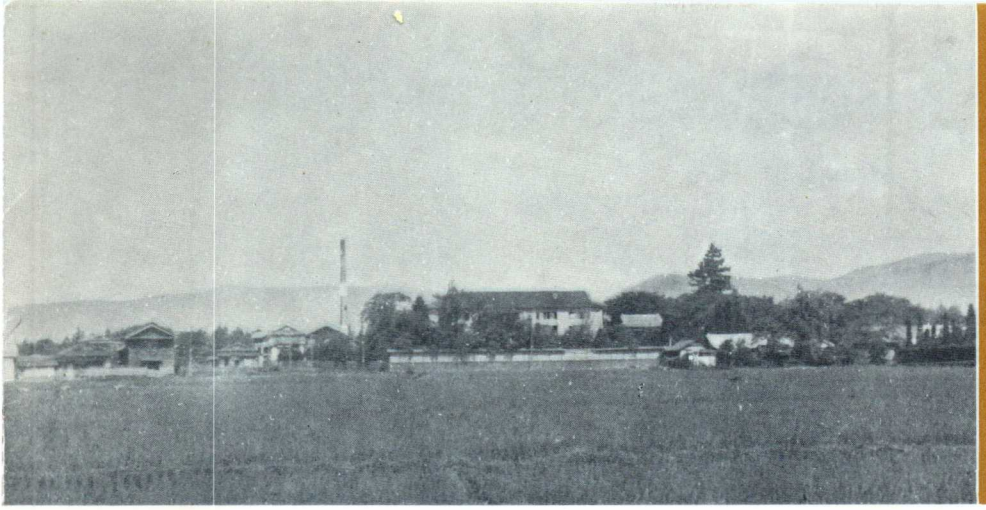
Telex Subscriber's Set :

Address Printer:

Hanguel Teletypewriter :



Line Printer :

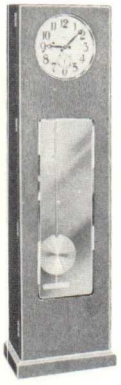


Fukushima Plant :

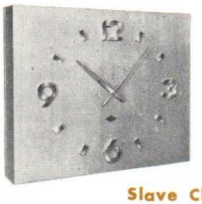
Sasakino, Azuma-mura,
Shinobu-gun, Fukushima-ken

Main Products:

Wired Broadcast Equipment,
Electric Clock, Fire Alarm,
Public Address Equipment,
Intertalk



Master Clock :



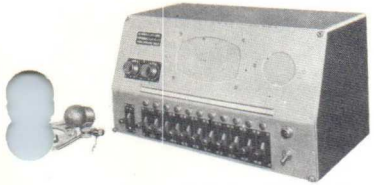
Slave Clock :

Electric Clock:

Wall Type Telephone
Speaker :

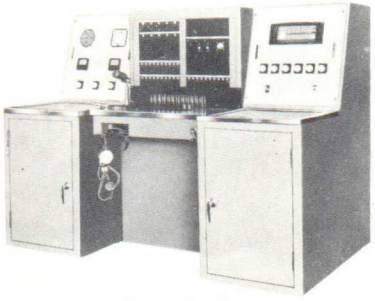
M Type Fire Alarm :

Intertalk :

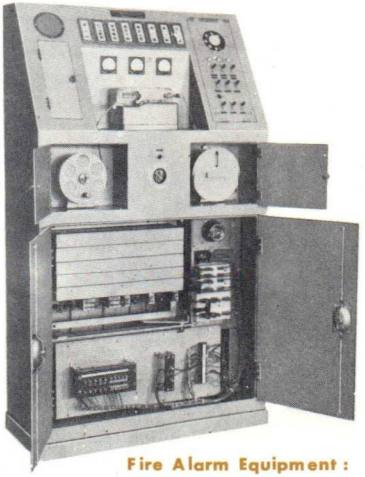


Nurse Call for Hospital :

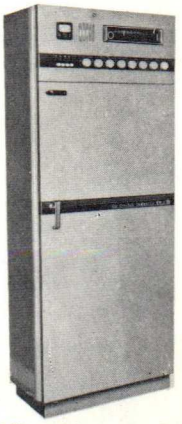
Telpet:



Wired Broadcast Equipment :



Fire Alarm Equipment :



Public Address Equipment
(Locker type)

ESTABLISHED 1881
10 SHIBA-TAKAHAMA-CHO, MINATO-KU, TOKYO, JAPAN
Cable Address : "OKIDENKI TOKYO"

MAIN PRODUCTS

Telephone Sets
Telephone Switchboards
Telegraph Equipment
Business Machines
Radio Equipment
Installation Material