the GENERAL RADIO Experimenter

Since 1915 – Manufacturers of Electronic Apparatus for Science and Industry

VOLUME XXIX No. 10 MARCH, 1955

A STANDARD SIGNAL GENERATOR FOR THE 900- TO 2000-MC RANGE

The new TYPE 1021-AW Standard-Signal Generator covers frequencies between 900 and 2000 megacycles, which include the important band of 960 to 1220 megacycles used for DME and safety beacon transmissions in aircraft navigation.

The total range covered by the popular TYPE 1021 line of signal generators is now 40[1]- to 2000 megacycles, covered in three units, as shown in Figure 2.

The tuned circuit of the TYPE 1218-A Unit Oscillator, which was described last month, forms the basis of the TYPE 1021-AW 900-2000-Mc Standard Signal Generator shown in Figure 1. The new oscillator unit is shown at the right. The power supply and the cabinet are the same as used already on two lower-frequency signal generators which were announced March 1950.[2] These two older oscillator units are tuned by wide range butterfly circuits.

In external appearance and in operation the three oscillator units shown in Figure 2 are very much the same. They all are triode oscillators with slow-motion drives and large direct-reading frequency dials. Output can be adjusted from 1 μv to 1 volt with the second

[1] The range of the v-h-f model, TYPE 1021-AV has been extended down to 40 Mc in order to include television i-f frequencies. See page 4.

[2] Eduard Karplus, Ervin E. Gross, "A Standard-Signal Generator for Frequencies Between 50 and 920 Mc," *General Radio Experimenter*, Vol. XXIV, No. 10, 1950.

Figure 1. Panel View of the Type 1021-AW Standard-Signal Generator.

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large dial on the front panel, which controls the coupling in a calibrated mutual-inductance-type attenuator. The output level and the output impedance are established by a diode voltmeter and a termination resistor as shown schematically in the lower part of Figure 3. The output meter, which is located in the power-supply compartment, can be calibrated in terms of an accurately known 60-cycle voltage.

Modulation

Unlike the two lower-frequency generators, which are amplitude modulated by sinusoidal voltages, the new high-frequency unit is designed for amplitude modulation by square waves from an external source. Square-wave modulation, which effectively eliminates incidental frequency modulation, has many advantages in high-frequency measurements, and, in addition, is particularly desirable in this generator, which has a high-Q tuned circuit between the oscillator and the attenuator.

Tuning

The frequency-determining element of the oscillator is a quarter-wave line between plate and grid of a pencil-type triode, and output from the oscillator is obtained by a coupling loop located in the movable shorting plunger of the line. The attenuator must be coupled to an element that carries high current at all frequencies and is stationary in space. This is made possible by a quarter-wave circuit with movable center

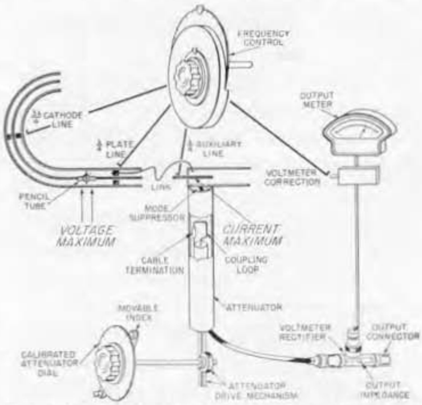
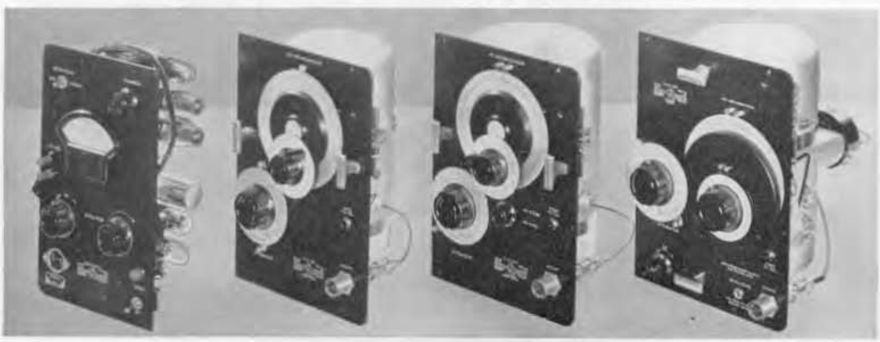


Figure 3. Functional schematic diagram of the new oscillator unit, Type 1021-P4.

Figure 2. View of the power supply unit and the three oscillator units that make up the Type 1021 series of signal generators. Oscillator units are interchangeable mechanically.



conductor as shown schematically in the upper part of Figure 3. This auxiliary circuit is electrically coupled to the oscillator by a link line and ganged to it by joining the movable center conductor to the movable short circuit of the oscillator.

Metering

Since the resonant frequency of the diode-type output indicator is only twice the maximum frequency of the signal generator, a frequency correction for the voltmeter error is required. The correction, which varies from about 10% at 1000 Mc to 30% at the high end of the frequency range, is obtained automatically by the potentiometer mounted on the rear end of the main shaft.

Stability

Tuning a 1000-Mc oscillator to produce an audio beat note requires high precision, and maintaining the beat note requires unusual stability. The sliding contacts of the new oscillator perform well under these critical conditions. Compared to tuning systems which depend on close mechanical spacings, the new oscillator is remarkably free from noise modulation caused by microphonics and vibrations. A variable resistor in the grid circuit of the oscillator tube is used for fine frequency adjustment. The heater voltage is rectified and filtered to reduce modulation by power frequency components.

Figure 4. Interior view of the oscillator unit with shield cover removed.

R-F Filtering

The power supply leads are filtered by small inductors imbedded in Carbonyl powder.

SPECIFICATIONS

Frequency Range: 900–2000 Mc

Circuit: Grid separation triode oscillator. Line sections with sliding contact shorts are used to tune plate and cathode.

Frequency Control: A 6″ dial with direct-reading frequency calibration over 200°. Slow-motion drive, 8 turns.

Frequency Calibration Accuracy: ± 1%.

Frequency Drift: Under 0.1% per day.

Output Voltage: Continuously adjustable from 0.5 μv to 1.0 volt open circuit.

Output Impedance: 50 ohms ± 10%.

Output Voltage Accuracy: Over-all accuracy of output voltage is better than ± 20%.

Modulation: Square-wave modulation from 100-10,000 cycles with external modulator. 30 volts peak to peak is required. 10,000-ohm input impedance.

Leakage: Stray fields and residual output voltage cannot be detected with a receiver having 2 μv sensitivity.

Terminals: Type 874 Coaxial Terminals are provided.

Power Supply: 115 or 230 volts, 50 to 60 cycles, power input approximately 50 watts.

Tubes: One Type 5675 u-h-f medium-mu triode (pencil tube) in 1021-P4; one each 6X5GT, 6K6GT, Amperite 6-4; two OC3.

Accessories Supplied: one TYPE 874-R22 3-foot Patch Cord (50 Ohms); one TYPE 874-C58 Coaxial Cable Connector; one TYPE 874-PB58 Panel Connector; one TYPE CAP-35 Power Cord, and one telephone plug.

Other Accessories Available: Not supplied, but available on order are TYPE 874-GF 20-db Attenuator Pad; TYPE 874-GG 10-db Attenuator Pad; TYPE 874-K Coupling Capacitor; and TYPE 1000-P7 Balanced Modulator.

Mounting: The aluminum cabinet has a black wrinkle finish. The left-hand side houses the TYPE 1021-P1 Power Supply; the right-hand side houses the TYPE 1021-P4 U-H-F- Unit. Panels are black crackle-finished aluminum.

Dimensions: (Height) 14⅜ × (width) 20¼ × (depth) 10$\frac{9}{16}$ inches, over-all.

Net Weight: 37½ pounds.

Type		*Code Word*	*Price*
1021-AW	Standard-Signal Generator, 900-2000 Mc....	EAGLE	$845.00
1021-P4	Oscillator Unit only *......................	EXALT	650.00

* The oscillator unit, TYPE 1021-P4, is available separately for those who use a single power supply and cabinet with interchangeable oscillators.

U. S. Patent Nos. 2,125,816 and 2,548,457.

40- TO 50-MC ADDITION TO RANGE OF TYPE 1021-AV STANDARD-SIGNAL GENERATOR

For some time, orders for TYPE 1021-AV Standard-Signal Generators and for TYPE 1021-P3 Oscillator Units have been filled with instruments that cover 40 to 50 megacycles in addition to the previous range of 50 to 250 megacycles. The range switch and the second calibration of the main dial of the new TYPE 1021-P3B Oscillator Unit can be seen in Figure 1. Most of the commonly used i-f frequencies in television receivers lie in the new range.

To obtain the added range, two 35 $\mu\mu$f capacitors are connected across the high-voltage points of the butterfly-type tuning circuit. The capacitors are mounted on two curved arms which can be seen in Figure 2. The arms are moved up and down by a cable actuated by the new panel switch. With this added capacitance, the minimum frequency of the butterfly circuit is changed from 50 to 40 Mc, and good output can be obtained over a small part of the tuning range. At higher settings, losses in the added capacitance increase rapidly.

Figure 1. Panel view of the Type 1021-P3B Oscillator Unit.

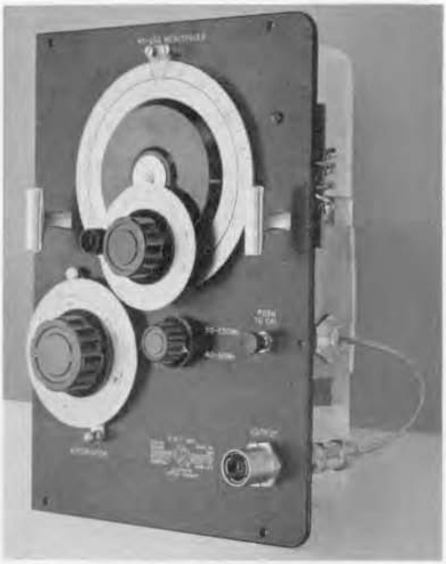


Figure 2. Interior view, showing the location of the two padding capacitors, which are switched into circuit for the 40- to 50-megacycle range extension.

While the 40- to 50-Mc range is readily installed in a new instrument, addition of the switch in older oscillators is not practical. This range can be obtained, of course, by shunting a 70-$\mu\mu$f low-loss capacitor across the gap of the butterfly circuit. To preserve the original calibration, the mounting screws of the butterfly circuit should not be disturbed, and clamps should be used to add the shunting capacitors.

SPECIFICATIONS

Same as for Type 1021-AV except:
Carrier Frequency Range: 40–250 Mc in two bands.

Type		*Code Word*	*Price*
1021-AV	**Standard Signal Generator, 40 to 250 Mc....**	EVENT	**$595.00**
1021-P3B	**Oscillator Unit only........................**	EVOKE	**$400.00**

U. S. Patent Nos. 2,125,816, 2,367,681 and 2,548,457.

THE TYPE 1803-B VACUUM-TUBE VOLTMETER

General Radio's moderately priced vacuum-tube voltmeter, the Type 1803-A[1], has proved to be a remarkably reliable and trouble-free instrument. Our service department records do not show a single instance of failure of one of these voltmeters during the one-year guarantee period. A new model now available, the Type 1803-B, combines the basic features of the older instrument with several new operating conveniences, which will still further widen its usefulness in the laboratory.

Years of experience with the Type 1800-A Voltmeter[2] have proved the desirability of having both a-c and d-c voltage ranges on a voltmeter, and so d-c ranges are an important new feature on the Type 1803-B. Another new feature is the inclusion of a 10:1 multiplier for audio and ultrasonic frequency a-c voltages, which is permanently attached to the voltmeter cabinet. The multiplier also provides convenient binding posts that can be used for a-c voltage measurements when the probe is suitably connected to the multiplier. In addition, storage space has been provided inside the cabinet for the probe cable.

[1] C. A. Woodward, Jr., "The Type 1803-A Vacuum-Tube Voltmeter", *General Radio Experimenter*, Vol. XXIV, No. 11, April, 1951, pp. 1–5.
[2] C. A. Woodward, Jr., "A New Vacuum-Tube Voltmeter", *General Radio Experimenter*, Vol. XXII, No. 4, September, 1946, pp. 1–8.

A-C Voltage Measurement

The ranges provided are 1.5 5, 15, 50, and 150 volts for full-scale deflection of the indicating meter.

Experience has also shown that there is a demand for a multiplier to make it possible to measure voltages in excess of 150 volts, particularly over the audio-frequency range. This demand is

Figure 1. View of the Type 1803-B Vacuum-Tube Voltmeter.

met, not by providing a multiplier as a separate accessory, which may be misplaced or unavailable when needed, but by permanently attaching a 10:1 multiplier to the side of the voltmeter cabinet. This multiplier is a resistive voltage divider that has been compensated to have a response flat within ±2% up to 40 kilocycles.

The multiplier also serves as a storage device for the probe, which can be plugged into either of two positions. When the probe is plugged into the forward jacks on the bottom of the multiplier, the voltmeter reads one tenth of any voltage applied to the X10 binding posts on the top of the multiplier. When the probe is plugged into the rear jacks, the voltmeter reads directly the voltage applied to the DIRECT binding posts on the top of the multiplier.

The frequency response is shown in Figure 2. The resonant frequency of the probe input circuit is about 410 megacycles.

D-C Voltage Measurement

Six d-c voltage ranges have been provided, 1.5, 5, 15, 50, 150, and 500 volts full scale.

It is felt that a 500-volt range should make it possible to measure the output voltage of the majority of the ordinary, laboratory, d-c power supplies. In most modern power supplies, high-capacitance electrolytic capacitors are used in the output filter circuit. The maximum d-c working voltage of these capacitors is less than 500 volts. Therefore, if the power-supply output voltage is greater than 500 volts, the capacitors must be connected in series. The voltage across each capacitor can be measured and the readings added to obtain the total output voltage.

The input resistance to the d-c voltmeter is 111 megohms for all ranges. However, by the removal of a soldered connection inside the instrument, connection is made directly to the grid for the 1.5, 5, 15, 50-volt ranges. The effective input resistance then depends upon the applied voltage and is between 1000 and 30,000 megohms or higher. The input resistance for 150 and 500-volt ranges remains 111 megohms.

A polarity switch is provided so that voltage of either + or − polarity may be applied to the high input terminal.

Meter Scales

The meter face, shown in Figure 3, has four scales. The two outer scales are linear and are used for measurement of all d-c voltages and all a-c voltages above 5 volts. The two inner scales are non-linear and are used only for measurement of a-c voltages of less than 5 volts.

General Construction

The basic construction features of the Type 1803-A have been retained in the Type 1803-B Vacuum-Tube Voltmeter. The instrument is of light, yet rugged

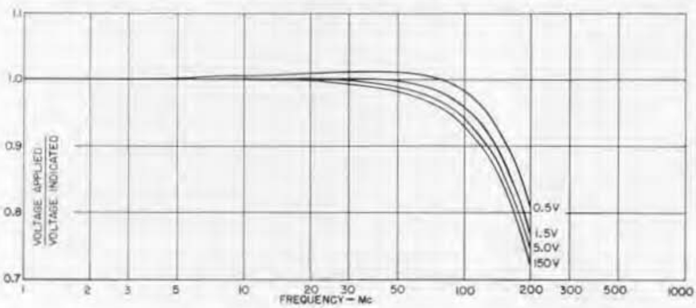


Figure 2. High-frequency correction for the Type 1803-B Vacuum-Tube Voltmeter.

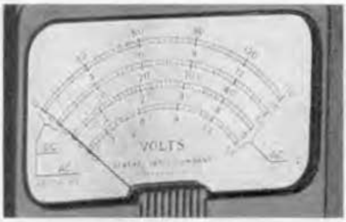


Figure 3. Meter scales

construction. The cabinet is made of heavy gauge aluminum with all joints welded. Rubber feet are provided to support the instrument with the panel either vertical or horizontal, and a simple carrying handle is located on the top.

The a-c voltage-multiplier housing is attached to the left-hand side of the cabinet where it provides a convenient means of storage for the probe. The binding posts on the top of the multiplier housing provide for direct application of applied a-c voltage to the probe and for a 10:1 reduction in the voltage before it is applied to the probe terminals.

The input terminals for d-c voltage measurement are located at the top left-hand corner of the panel.

The power cord is permanently attached to the voltmeter chassis and is led out through a notch in the cabinet edge. When the probe is attached to the multiplier, the probe cord can be stored inside the cabinet. The cord is led out through a slot in the bottom of the cabinet, and, for storage purposes, the cord is pushed through the slot into the cabinet where it folds into the space provided for it. The probe cable is completely shielded.

Circuit

The circuit of the Type 1803-A has proved to be so free of defects that it has been adopted without change for the a-c voltage measuring circuit for the Type 1803-B.

An elementary schematic diagram of the circuit is shown in Figure 5.

For d-c measurements the voltage is applied to the d-c input terminals which are connected to a 111-megohm divider, consisting of two highly stable, deposited-carbon-film resistors. For the 1.5-volt to 50-volt ranges, the voltage is then applied through a ripple filter to the grid of the active amplifier triode. The grid of the inactive amplifier triode is connected to ground through a resistor. For the 150-volt and 500-volt d-c ranges, the voltage applied to the active grid is reduced 10:1 by the divider.

The balanced amplifier circuit insures good zero and calibration stability with changes in line voltage. A change in line voltage of 10 volts causes a zero shift of only .01 volt or less on the 1.5-volt ranges.

— C. A. Woodward, Jr.

SPECIFICATIONS

Voltage Ranges: 0.1 to 150 volts, a-c, in five ranges (1.5, 5, 15, 50, and 150 volts, full scale). A multiplier is attached for increasing the range to 1500 volts at audio and ultrasonic frequencies. 0.02 to 500 volts, d-c, in six ranges (1.5, 5, 15, 50, 150, and 500 volts, full scale).

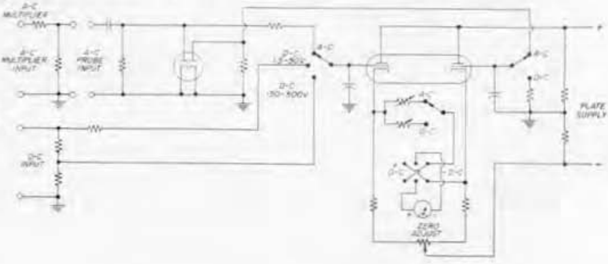


Figure 4. Elementary schematic circuit diagram of the voltmeter.

Accuracy: AC, ±3% of full scale, subject to frequency correction above 50 megacycles. Correction curve supplied in instruction book (see Figure 2). Use of the multiplier imposes an additional error of ±1%.

DC, ±3% of full scale for the 1.5, 5, 15, 50-volt ranges; ±4% of full scale for the 150 and 500-volt ranges.

Waveform Error: The instrument is calibrated to read the r-m-s value of a sine wave on all a-c ranges. On the higher ranges, the instrument is peak responding, and the reading corresponds to either the r-m-s value of a sine wave or 0.707 of the peak value of a complex wave. On distorted waveforms, the percentage deviation of the reading from the r-m-s value may be as large as the percentage of harmonics present. On the lower ranges, the response departs from peak and approaches r-m-s response. When the multiplier is used, the voltmeter is not peak responding. The multiplier is adjusted so that the voltmeter reads one-tenth of the r-m-s value of a sine-wave voltage applied to the multiplier.

Frequency Error: The plot of Figure 2 gives the frequency correction for several different voltage levels. At low voltages, the transittime and resonance effects tend to cancel, while at higher voltages, the error is almost entirely due to resonance. The resonant frequency is about 410 Mc.

At low frequencies, the response drops off because of the increasing reactance of the series capacitance of the input circuit. At 40 cycles per second, the drop is 2% or less.

The response of the multiplier is flat within ±2% up to 40 kc.

Input Impedance: The equivalent a-c input circuit is a resistance in parallel with a capacitance. At low frequencies, the equivalent parallel resistance is 7.7 megohms. At high frequencies, this resistance is reduced by losses in the shunt capacitance. The equivalent parallel capacitance at radio frequencies is 10 $\mu\mu$f. At audio frequencies, the capacitance increases to 11.5 $\mu\mu$f. The multiplier input impedance is a resistance of approximately 9 megohms in parallel with 11 $\mu\mu$f.

The d-c input resistance is 111 megohms. By removal of an internal connection, open-grid input can be obtained for the 1.5, 5, 15, and 50-volt ranges.

Power Supply: 105 to 125 (or 210 to 250) volts, 50 to 60 cycles. The power input is about 11 watts.

Tubes: 1-6AL5 1-6SU7-GTY 1-6X4. All are supplied.

Dimensions of Cabinet: (Width) 8¼ × (depth) 6½ × (height) 11¾ inches over-all.

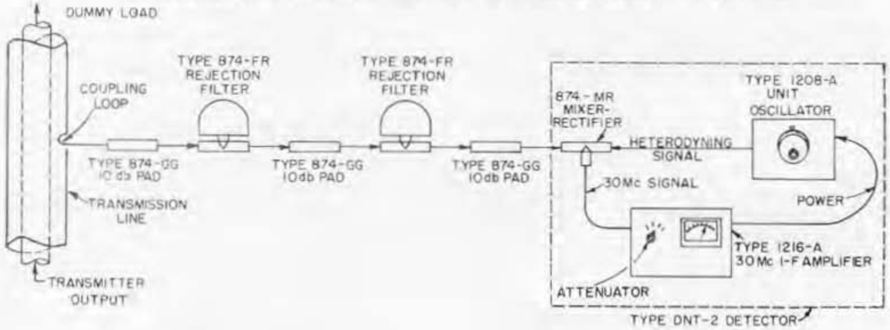
Net Weight: 9½ pounds.

Type		*Code Word*	*Price*
1803	**Vacuum-Tube Voltmeter**....................	ABOOM	**$180.00**

HARMONIC MEASUREMENTS ON VHF-TV TRANSMITTERS

The Federal Communications Commission has recently inserted in its rules a maximum permissible harmonic content of the visual and aural transmitter outputs of television transmitters. For VHF stations, all harmonics up to the tenth, but below 1000 Mc, in the signal at the transmitter output terminals, must be at least 60 db below the level of the fundamental. As a result, many television broadcasters will be faced with the problem of measuring

Figure 1. Block diagram of the system for measuring transmitter harmonics. The two rejection filters are isolated by the 10-db pad, which also makes the impedance level 50 ohms.



the harmonic content of their transmitters.

In general, this problem can be solved by terminating the output transmission line in a dummy load and coupling a small amount of the r-f power from the line to a selective calibrated detector by means of a coupling loop or probe. The receiver is tuned first to the fundamental and then to the various harmonic frequencies, and the relative amplitudes of the components determined.

If a directional coupler is used to couple to the transmission line, it is not necessary to replace the antenna with a dummy load.

One relatively simple method of making the measurement is to use a General Radio Type DNT-2 Detector[1] in combination with two Type 874-FR Rejection Filters for the fundamental frequency, three 874-GG 10-db Pads, and a small single-turn coupling loop fitted with a coaxial connector for sampling the field in the main transmission line. A block diagram of this arrangement is shown in Figure 1. The calibrated attenuator and meter in the i-f amplifier are used to determine relative signal levels. An initial measurement is made of the fundamental level with the rejection filters out of the circuit. The filters are then inserted and tuned to produce a minimum detector indication. The detector is next tuned to the various harmonic frequencies in turn and the relative signal levels are measured with the calibrated detector. At frequencies between 54 and 530 Mc, the detector can be used with the mixer operating on the fundamental of the local-oscillator frequency. At frequencies above 530 Mc, the second harmonic of the local oscillator can be used and the difference in conversion efficiency must be determined. This is easily done by measuring the same harmonic by both fundamental and second harmonic operation in the overlapping frequency region.

Since the rejection filters are designed to have a flat response characteristic in a 50-ohm system up to the tenth harmonic of the rejection frequency, or 1000 Mc, and, since the sensitivity of the detector is reasonably constant with frequency when the source impedance is 50 ohms[1], the relative levels of the harmonics with respect to the fundamental are equal to the differences in the signal levels measured by the detector, corrected for the frequency response of the coupling device. Therefore, if the coupling-loop frequency response is known, the measurement can be made without requiring a signal generator for calibration of the frequency response of the entire system.

If a small coupling loop is used, the voltage induced in it with a constant current flowing in the main transmission line will be directly proportional to the frequency. If the effective source impedance of the loop is small compared to 50 ohms at the highest frequency measured, or is constant with frequency, the voltage developed across

[1] Soderman, R. A., "A Sensitive, High-Frequency, General-Purpose Detector", *General Radio Experimenter*, Vol. XXVIII, No. 12, May, 1954.

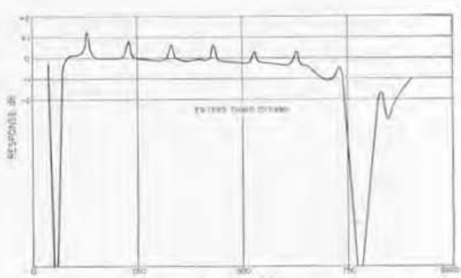


Figure 2. Insertion loss of a Type 874-FR Rejection Filter.

the 50-ohm input to the detector will also be directly proportional to frequency. Therefore, the true level of the second harmonic will be 6 db lower than indicated by the detector; the third harmonic will be 9 db lower; the fourth, 12 db; the fifth, 14 db; etc.

A loop-type of directional coupler can also be used as a coupling device if its coupling element is short compared to a wavelength at the highest harmonic frequency. Most couplers also have a response which increases linearly with frequency.

The Type 874-FR Rejection Filters are tunable series-resonant circuits each of which attenuates the fundamental about 35 db when properly adjusted, and which have a relatively flat pass-band response up to the tenth harmonic of the fundamental. A typical response curve is shown in Figure 2.

If the range of levels to be measured is beyond the linear range of the detector (80 db), additional pads can be inserted when the fundamental level is measured. The 10-db pad shown between the filter and the mixer in the detector is used to keep at a minimum the variations with frequency of the local-oscillator voltage applied to the mixer crystal.

The Type DNT-2 Detector consists of an untuned mixer, a local oscillator and a 30-Mc i-f amplifier with a calibrated output meter and a calibrated attenuator. Since only the fundamental is rejected in the above procedure, all harmonics are impressed across the mixer, and since the mixer will produce a 30-Mc output whenever the frequency difference between a harmonic of the signal and a harmonic of the local oscillator is 30 Mc, numerous responses can be obtained in the frequency range covered by the local oscillator. The desired responses can be easily identified by tuning the local oscillator to a frequency 30 Mc above or below the frequency of the desired harmonic. A low-pass filter inserted between the second rejection filter and the second pad (see Figure 1) is recommended to eliminate spurious responses and to simplify the identification of harmonics.

The method outlined makes possible simple measurements, with an accuracy of about 3 db, of the harmonic content of VHF-TV transmitters with compact equipment, most of which is suited to a variety of other common measurements. Actual field measurements indicate that the method is practical and convenient.

A detailed description of the equipment, with prices, is available on request.

— R. A. Soderman

SEE THE LATEST*

At the 1955 Radio Engineering Show, General Radio presents a display of modern, up-to-date instruments for your laboratory and plant — today's instruments, that will make basic, necessary measurements better, and faster than yesterday's. And these are truly general-purpose instruments, designed, not for a single job, but for many — adaptable, flexible, and fitted to a variety of applications. These instruments have G-R's built-in quality: the accuracy and stability and durability that results from good basic design.

* And, for old timers, an anniversary showing of some of the earliest.

The new Type 1750-A Sweep Drive and Type 1263-A Amplitude-Regulating Power Supply, driving a Type 1209-A Unit Oscillator.

carefully selected components, and rugged construction based on 40 years of manufacturing experience.

Be sure to drop in at the General Radio booth — 251 to 255 Instruments Avenue — to talk over your measurement problems with our engineers and to see the new products listed below.

SWEEP DRIVES

Automatic presentation of data is the modern time saver in the multitudinous series of measurements encountered in circuit development and component design. The General Radio solution is not a battery of individual sweep generators, but simple, precise motor drives that can be used with the oscillators already in your laboratory, drives that can be quickly and conveniently adjusted to sweep wide ranges or narrow ones.

The synchronous dial drives described previously[1] do this job for audio frequencies, making possible the display of amplitude-frequency plots on a recorder or oscilloscope, by driving the beat-frequency oscillator dial. The new Type 1750-A Sweep Drive and the Type 1263-A Amplitude-Regulating Power Supply bring this same convenience and adaptability to the v-h-f and u-h-f ranges.

SLOTTED-LINE DRIVE

The new Type 874-LBA Slotted Line will be shown with a motor-drive attachment that sweeps the probe over any desired portion of its total travel, so that standing-wave ratio can be determined directly from an oscilloscope screen.

BRIDGES

The determination of impedance is a basic measurement in the laboratory and in the plant, and General Radio brings you two additions to its already extensive line of impedance bridges.

Z-Y Bridge

The new Type 1603-A Z-Y Bridge measures, either as an impedance or as an admittance, literally any impedance, irrespective of phase angle, between zero and infinity. Connect a "black box" to the terminals of the bridge and balance the bridge to a null; the dial settings will then tell you either its impedance or its admittance. The uses of the bridge are legion. Lines, transformers, resistors, capacitors, inductors, resonant circuits, filters, transducers — all of these can be measured, plus the conductivity of solutions. Negative parameters can be measured as well as positive; motional impedance diagrams of transducers can be determined.

R-F Bridge

For radio frequencies, we have the new Type 1606-A Radio-Frequency Bridge, a more compact, modern successor to the widely used Type 916-A. Frequency range, 400 kc to 60 Mc.

[1] Littlejohn, H. C., "Motor Drives for Precision Dials and Beat-Frequency Oscillators", *General Radio Experimenter*, Vol. XXIX, No. 6, November, 1954.

Limit Testing

For the measurement, selection and matching of components to close tolerances, a precise bridge is needed. The Type 1604-B Comparison Bridge is designed for just this purpose and has an accuracy of 0.1%. Try it and see for yourself.

POTENTIOMETERS

You read about the new 970 series of potentiometers in the January issue of the *Experimenter*. See them here and inspect them. You'll like their simple, well-thought-out design, modern in every detail. They're used in new General Radio instruments. They have to be good.

STANDARD-SIGNAL GENERATORS

The new Type 1021-AW Standard-Signal Generator, described in this issue, will be on display, as will the new Type 1021-P3B Oscillator Unit for the Type 1021-AV Standard-Signal Generator. You can see its construction and better appreciate its many features.

U-H-F DETECTOR

The Type 1216-A Unit I-F Amplifier is an indispensable item for the laboratory where v-h-f and u-h-f measurements are made. A null detector and a voltmeter for relative signal levels, it can be used to measure attenuation, crosstalk, and signal strength.

PULSES

See the Type 1217-A Unit Pulser, compact and inexpensive, but with performance far beyond what you would expect from its size and price — an excellent example of the high quality at moderate prices that General Radio builds into its Unit Instrument line.

FOR CONSTANT LINE VOLTAGE

The Automatic-Voltage Regulator, Type 1570-A is an excellent remedy for fluctuating line voltage in the laboratory. You'll always see it in GR displays, because it's just as useful in keeping a display running properly under the constantly changing load conditions encountered in shows. With its 6 KVA capacity, it really fills the bill.

40 YEARS OF ELECTRONICS— OLD TIMERS' DISPLAY

Founded in 1915, the General Radio Company celebrates this year its 40th Anniversary. Throughout the past 40 years General Radio has been supplying the basic standards and measuring instruments to the electronics industry.

We have arranged a display of General Radio products built in the first few years of the Company's existence, which will bring back fond memories to those who are old timers in the industry.

CORRECTION

In the February issue of the *Experimenter*, page 8, the relay-rack panel for either Type 1203 and Type 1211 Unit Instruments or for Type 1203 and Type 1215 was incorrectly listed. The correct type number is 480-P5UC1.

GENERAL RADIO COMPANY
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CAMBRIDGE 39 MASSACHUSETTS
TELEPHONE: TRowbridge 6-4400