

71B MILLIWATT REFERENCE GENERATOR J94071B

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2. DESCRIPTION

A. Mechanical

2.01 The 71B generator consists of J94071B, List 1 assembly and wiring in accordance with SD-95277-01. The generator circuit is housed in a metal case 3-1/2 by 4 by 6-1/2 inches. The complete unit, shown in Fig. 1, with a KS-14370 dry cell battery weighs 6 pounds. A carrying handle is provided on the case.

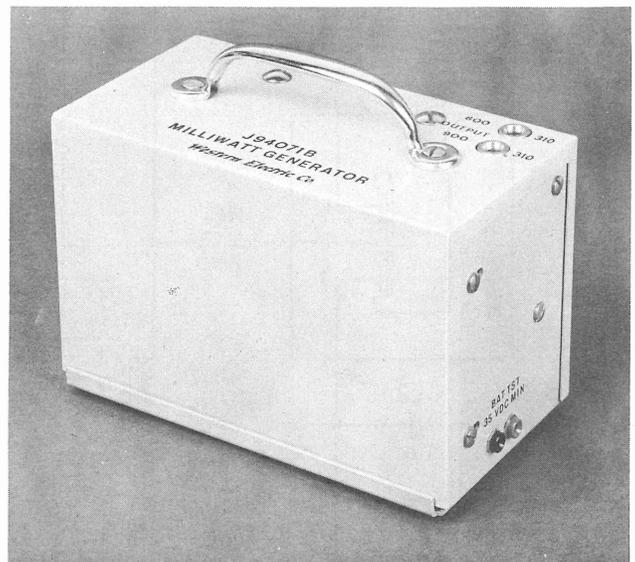


Fig. 1 - 71B Milliwatt Generator

1. GENERAL

1.01 This section describes the J94071B milliwatt reference generator (71B) used to supply 1000-cycle power for transmission testing at 600- and 900-ohm impedances where a highly stable portable unit is suitable.

1.02 The 71B milliwatt reference generator is a portable version of the basic unit used in the rack-mounted J94071A milliwatt reference generator. It is a transistorized oscillator powered by a self-contained 45-volt battery, and replaces the portable KS-5472-01, List 12 and List 15 1000-cycle machine, these two lists being rated Mfr Disc. Two 1-milliwatt outlets provide for tests at 600 ohms and at 900 ohms, and are connected to the circuit under test by patching.

1.03 The 71B generator is used for testing voice channels of transmission systems, trunks, lines, circuits, and networks. It may also be used as a reference power for checking portable test equipment such as transmission measuring sets, amplifier-rectifiers, detectors, and meters with db scales based on 1 milliwatt.

B. Circuit

2.02 The generator circuit is shown in Fig. 2. The oscillator is of the Hartley type which employs a 2N43 transistor, Q21, as the active element. The frequency of oscillation is determined by the LC network, Z21. Resistor R21 determines the amount of feedback from the emitter to the LC network. The value of R21 is chosen to ob-

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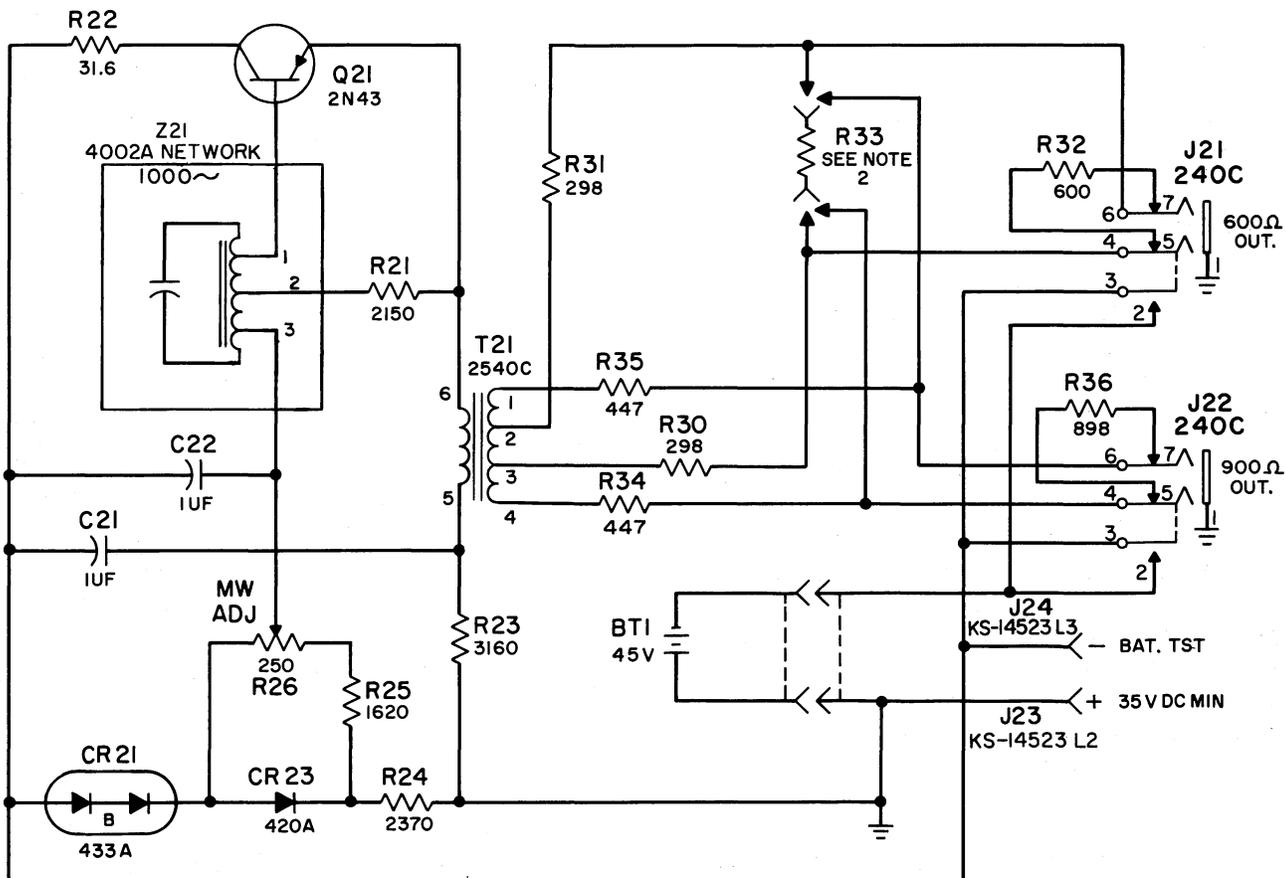
tain that critical amount of feedback which permits the peak AC base voltage to equal the DC collector-to-base voltage. When the base is at collector potential, limiting occurs, thus stabilizing the oscillating amplitude. The transformer, T21, provides a balanced output. Connecting T21 between collector and emitter permits efficient power transfer to the load.

2.03 The amplitude of oscillation is proportional to the DC voltage applied between base and collector of the transistor. The DC base-collector voltage is regulated by diodes CR21 and CR23. R25 and R26 comprise a divider network across CR23 which permits changing the transistor base-collector voltage, and hence the output, by adjustment of potentiometer R26. Designated MW ADJ, R26 is used to adjust the output power

and provides a range of adjustment of approximately 0.75 db.

2.04 Additional regulation by R22 makes the oscillating amplitude almost completely insensitive to battery-voltage changes. A decrease in the battery voltage causes a small decrease in the voltage across the regulating diodes. The corresponding decrease in collector current, however, causes a decrease in the voltage drop across R22, thus keeping the voltage between the base and collector of the transistor substantially constant. Resistor R24 limits the diode current and R23 limits the transistor current.

2.05 Taps for 600- and 900-ohm outputs are provided on the secondary of transformer



NOTE 1 : ALL RESISTANCE VALUES ARE IN OHMS.
NOTE 2 : VALUE AND CONNECTION OF R33 DETERMINED BY TEST AT TIME OF MANUFACTURE.

Fig. 2 - Circuit

T21. The impedance looking toward the transformer is about 6 ohms for the full winding. The two outlets, 600-ohm and 900-ohm, are shown in Fig. 2. The 600-ohm outlet is built out to 600 ohms by resistors R30 and R31 and terminated by a 600-ohm resistor, R32. Resistor R33 is connected at time of manufacture across either the 600-ohm or the 900-ohm outlet to equalize the power from both outlets; this resistor compensates for manufacturing tolerances. The 900-ohm outlet is built out to 900 ohms by R34 and R35 and terminated by an 898-ohm resistor, R36. The terminating resistors are disconnected by opening the contacts of the jacks when a 310-type plug is inserted to connect the circuit under test. (Contacts on the jacks serve to turn on battery power when a plug is inserted into either the 600- or 900-ohm jack.)

3. TRANSMISSION PERFORMANCE

3.01 The output power from both outlets is calibrated to 0 ± 0.03 dbm. Under most conditions the output is stable within ± 0.03 db, including: (a) changes in temperature in the range from 32 to 120 F, (b) changes in battery voltage in the range from 47 to 35 volts, (c) aging of components, and (d) normal handling as a portable instrument. Assuming a normal distribution of variations due to all causes, the output may be expected to be 0 ± 0.05 dbm. Because of warmup of semiconductor devices, measure-

ments where maximum accuracy is desired should not be made during the first 90 seconds after the generator has been turned on.

3.02 The frequency of the 71B is 1000 cycles ± 1 per cent under the environmental conditions stated in 3.01.

3.03 Typical curves showing the effects of temperature and battery voltage changes on the generator are shown in Fig. 3 and 4. The output power, shown within the shaded area of these curves, is determined by the manufacturing tolerances of circuit components and the setting of the MW ADJ potentiometer. All the extreme variations in level shown will not usually be found with any one generator. The 600- and 900-ohm outputs are set at time of manufacture to 0 dbm at approximately 75 F, with a supply voltage of 42 volts, using special calibrating equipment.

3.04 The output impedance of each outlet is within 1 per cent of its nominal value.

3.05 One open or shorted outlet has an effect on the other outlet of $+0.04$ and -0.04 db, respectively.

3.06 The harmonic content of the output power in terms of the fundamental (1000-cycle) value is such that the sum of all harmonics is at least 40 db below the fundamental.

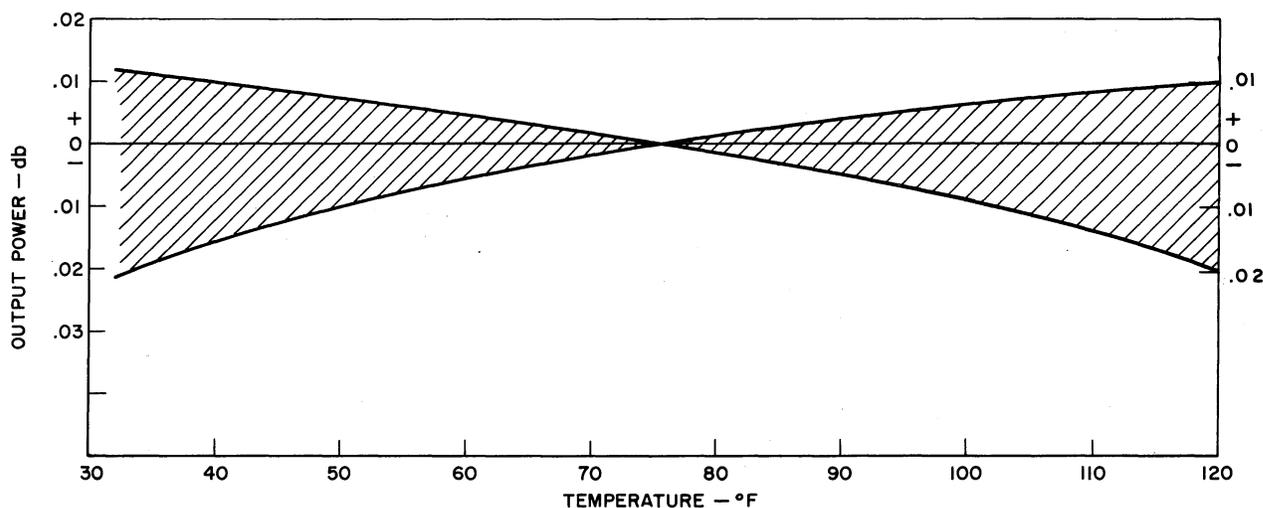


Fig. 3 - Output Power Versus Temperature

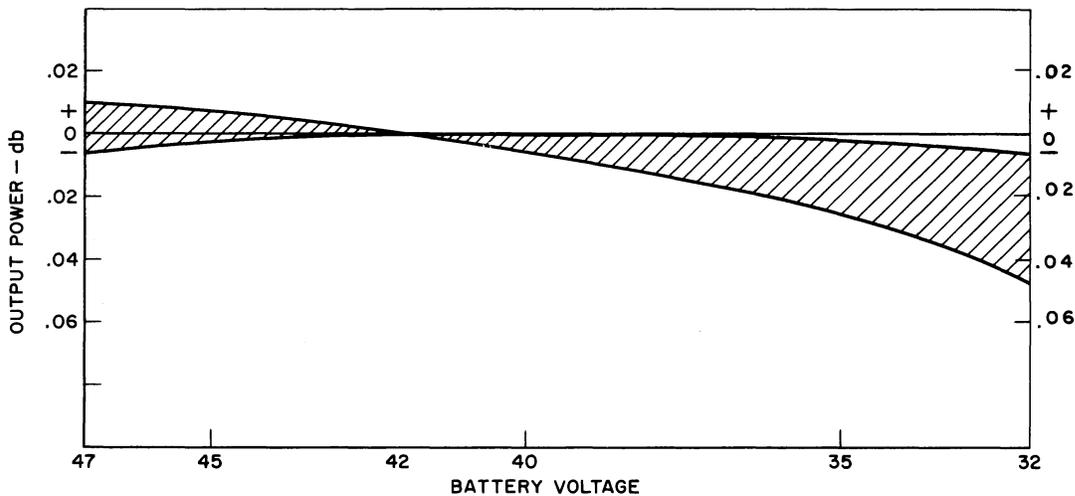


Fig. 4 - Output Power Versus Battery Voltage

4. OPERATING FEATURES

4.01 The 71B generator is equipped with one 600- and one 900-ohm output jack suitable for patching with a 310-type plug or equivalent. Each outlet is provided with an idle termination which is automatically disconnected when a plug is inserted.

4.02 No provision has been made in the 71B for circuit holding features or for blocking DC from the generator circuit. These may be provided where necessary by using the 2AB auxiliary transmission test set or equivalent. Connecting 48 volts to the output of the 71B will not damage the generator but may change its output power as much as 0.2 db.

4.03 If both outlets of the generator are used simultaneously, it is important to avoid conditions where the termination of an outlet differs from its nominal impedance, such as occurs with an open or a short circuit. Refer to 3.05. To avoid these conditions, remove the plug not terminated in its proper impedance from the outlet jack.

4.04 Contacts on the outlet jacks turn the set on when a plug is inserted into either jack. No other battery switch is provided.

4.05 Pin jacks labeled BAT TST 35V DC MIN are located on the side of the case to pro-

vide test access to the battery under load. The set must be *turned on before the battery voltage can be measured.*

4.06 The output power is adjusted at the factory by a screwdriver-adjusted potentiometer designated MW ADJ located in the generator circuit. (*Because this generator is a reference source of power and is expected to retain its calibration for long periods of time, this potentiometer should be adjusted only when accurate means of measuring the output power are available.* Refer to 5.04.) To discourage unwarranted changes in the setting of the potentiometer, it is accessible only after removing the cover from the case.

5. MAINTENANCE

5.01 The principal maintenance of the portable milliwatt generator concerns the dry cell battery and its DC voltage. Since the battery power is consumed only while a plug remains in an output jack, the operating DC voltage has been made accessible for voltmeter readings only while the battery is connected to the load. *It is important that the battery be replaced before the voltage reaches 35 volts.*

5.02 The battery is replaced as follows:

- (1) Back out the two binding head screws, located above the handle, sufficiently to release the cover.

- (2) Remove the cover.
- (3) Back out the screws located in the slotted holes (two at each end of the set) sufficiently to permit the battery support bracket to release the battery.
- (4) Slide the battery from between the chassis and the battery support bracket. Remove the connector.
- (5) Replace in reverse order, holding the battery support bracket firmly against the battery while tightening the battery support bracket screws at each end.

5.03 The following is a list of batteries which may be used for replacement when the KS-14370, 45-volt battery is not available:

| | |
|---------------------|--------------------|
| National Carbon 482 | General 109 |
| Burgess M30 | Bright Star 30-33 |
| RCA VS013 | Montgomery Ward 42 |
| Ray-O-Vac 202 | Sears 6461 |
| Mallory M202 | |

5.04 The output power may be adjusted over a range of about 0.75 db by the MW ADJ potentiometer. Changes in the setting of this potentiometer should be made only after the output power has been measured with the 22A milliwatt reference meter, or the 7A transmission

measuring set together with the 2AA milliwatt reference set.

5.05 There are no adjustments for frequency deviation.

5.06 Except for obvious defects which can be corrected locally, *repairs* such as replacement of components, *should not be attempted under field conditions.*

5.07 It is recommended that the 71B milliwatt reference generator be checked against a primary standard after the first six months of operation, and at 1-year intervals thereafter.

6. LIST OF DRAWINGS AND SPECIFICATIONS FOR REFERENCE

(A) Drawings (not attached)

| TITLE | DWG. NO. |
|-----------|---------------------|
| Circuit | SD-95277-01, Fig. 2 |
| Equipment | J94071-() |

(B) Specification (not attached)

| TITLE | SPECIFICATION |
|--|--------------------|
| 71-Type Milliwatt Reference Generators | J94071 (AA387.049) |