has been thoroughly evaluated by several independent laboratories cooperating with the Subcommittee on Precision Coaxial Connectors and has been found to meet the specifications for the 14-mm general precision connector. Ever since the formation of the original committee in 1960, our engineers have cooperated with that group and have freely exchanged technical information on connector design problems and on improved measurement methods. General Radio's cooperation with the Subcommittee has extended to the waiving of patent and other proprietary rights to the basic dimensioning and design of the GR900 Connector.

HIGH-FREQUENCY TRANSISTOR MEASUREMENT STANDARD

Another standards committee, that of the EIA, recently agreed on a proposed JEDEC standard on high-frequency transistor *Y* and *H* parameters and sent the standard out to industry for review. All transistor measurements specified can be performed by GR's Type 1607-A Transfer-Function and Immittance Bridge and the new transistor mounts described below.

MOUNTS FOR TRANSISTOR MEASUREMENTS WITH THE TRANSFER-FUNCTION BRIDGE

Accurate measurements of high-frequency transistors rapidly became commonplace after the introduction, in 1959,[1] of commercially available transistor mounts for use with the Type 1607-A Transfer-Function and Immittance Bridge. These mounts, designed primarily for development applications, left some problems for the production tester, who had either to clip the leads of his transistors or to leave most of the leads exposed and in circuit.

A new series of transistor mounts now permits the insertion and accurate measurement of transistors with leads up to two inches long. The leads are hidden from the field, the connection point is just below the transistor header, and parasitic lead inductance and capacitance are just about eliminated. In the new mounts, the transistor leads are inserted into hollow inner conductors of tiny coaxial lines. A short section of each inner conductor, near the top, is compressed to a narrow diameter to make a stable electrical contact with the transistor lead. An incidental feature, useful to the circuit designer, is that the transistor can be connected to the mount with just the right amount of lead left in circuit to simulate its

[1] W. R. Thurston, R. A. Soderman, "The Type 1607-A Transfer-Function and Immittance Bridge," *General Radio Experimenter*, Vol 33 No 5, May 1959.

Figure 1. One of the new transistor mounts, with transistor fully seated in socket.

File Courtesy of GRWiki.org

eventual connection. The transistor can thus be measured to include the parasitic lead effects that will be present in the circuit. Four such mounts are now available: two for transistors with a 0.2-inch-diameter pin circle (TO-5 packages) and two for the 0.1-inch pin circle (TO-18 packages). A grounded-base and a grounded-emitter mount are available for each size. (The grounded-emitter mounts can also be used for the grounded-collector configuration; the transistor is simply oriented differently upon insertion.) Four-hole sockets in all mounts include a connection for dc or metallic ground.

INTERNAL CONFIGURATION

The internal configuration of the new mounts is shown in Figure 2. Two jogs

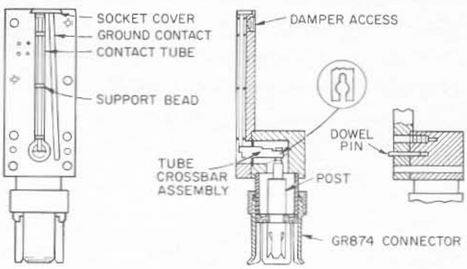

Figure 2. Cross-section drawings showing internal configuration of new mounts.

in the internal coaxial line are used to make the substantial transition from GR874 Connector to the small transistor lead spacing. A more obvious design would have employed tilted conical tapers converging to the small socket size. The step transition was chosen because it allows the transistor leads to go straight into the socket, it is easier to control in manufacture, and it is not at all difficult to compensate locally for the discontinuities existing at the 90°

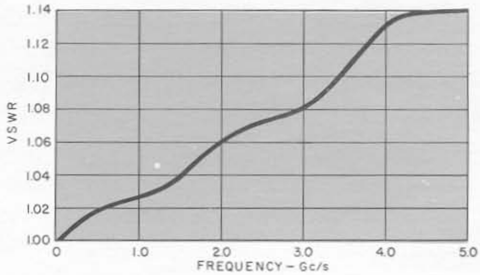

Figure 3. Typical VSWR characteristics of new transistor mounts.

jogs. How well this has been done is shown by the mounts' VSWR characteristics (Figure 3).

The small coaxial lines inside the mounts consist of square outer conductors and round inner conductors (see Figure 4). This configuration was necessary to achieve the close spacing of the coaxial line pair, corresponding to the transistor lead spacing. In the 0.2-inch pin-circle mounts, the coaxial-line dimensions are 0.132 inch (square) and 0.062 inch (diameter of the round inner conductor). In the 0.1-inch pin-circle mounts, these dimensions are 0.068 and 0.032 inch, respectively.

The use of such small coaxial lines in the mounts offers several advantages. Discontinuities between coaxial lines and transistor leads are minimized; a colinear relation exists between lines and leads; and the damper (a 50-ohm dc-block resistor assembly used to suppress transistor oscillation) can be located closer to the reference plane (ac-

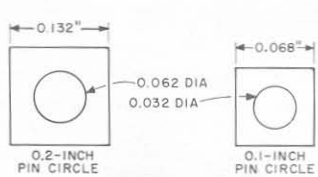

Figure 4. Cross section of internal coaxial leads.

File Courtesy of GRWiki.org

tual distance is 3/32 inch) to reduce its effect on the measurement. All these factors add up to greatly increased accuracy of transistor measurements.

The reference plane of the new mounts (the point on the transistor lead to which the measured values apply) is 0.025 inch below the top of the mount socket, or 0.025 inch below the header when the transistor is firmly seated in the mount. The electrical length from the reference plane to the short-circuit plane of a Type 874-WN Short-Circuit Termination is 9.5 cm.

The elements used to set up the reference plane on the older mounts cannot be used for this purpose with the new mounts. A new set based on the 9.5-cm length is available as the Type 1607-P40 Termination Kit.

The new mounts will be useful to the circuit designer, the transistor developer, and the production-line tester. A procedure has been devised for the rapid production-line measurement of β, and some companies guarantee Y parameters measured with this equipment.

One especially important transistor-design application involves the use of Linvill charts.[2] Transistor parameters are measured, and the charts are then used to determine circuit parameters. Examples of this and other procedures are given in several papers.[3, 4, 5]

LEAD ACCOMMODATION

The mounts accept transistor leads as long as two inches. The Types 1607-P41 and -P42 (0.2-inch pin circle) mounts can accommodate leads with diameters from 0.014 to 0.032 inch. The Types 1607-P43 and -P44 (0.1-inch pin circle) mounts accept leads with diameters from 0.014 to 0.021 inch.

The mounts will not accept very crooked leads, and leads should be straightened and made perpendicular to the header to ensure accurate measurement.

SOCKET ACCESSIBILITY AND FEATURES

On each mount, the socket is out in the open and readily accessible. A marker indicates the proper orientation of the transistor tab. Four tapped holes surround the socket to permit attachment of a heat sink. Socket contacts are heat-treated beryllium copper and are quite rugged.

The socket itself is made of polycarbonate, an extremely tough plastic with a dielectric constant of 2.73.

APPLICATIONS

The mounts can be used with the Type 1607-A Transfer-Function and Immittance Bridge to measure all immittance and hybrid transistor parameters directly, in the frequency range from 25 Mc/s to 1.5 Gc/s. They can also be used with a slotted line to measure driving-point parameters up to about 5 Gc/s.

NOTE: The older mounts (Types 1607-P101, -P102, -P111, -P401) will continue to be available and are recommended for those applications that do not require the long-lead capability or the four-lead socket.

—J. Zorzy

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[2] Linvill and Gibson, *Transistors and Active Circuits* McGraw-Hill, 1961.

[3] V. Gelnovatch and G. E. Hambleton, "1 Gc Transistor Amplifier Stage Using Linvill Technique," *Proceedings of the IEEE*, Vol 52 No 10, p 1262.

[4] P. E. Kolk, "Design of Three UHF Transistor Circuits," *Micro Waves*, November 1964, p 32-37.

[5] G. E. Hambleton and V. Gelnovatch, "L-Band and Germanium Mesa Transistors," *Microwave Journal*, Vol 8 No 1, January 1965, p 42–46, 67–68.

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SPECIFICATIONS

	Types 1607-P41, -P42	*Types 1607-P43, -P44*
Transistor Packages Accepted:	TO-5, 9, 11, 12, 16, 26, 31, 33, 37, 38, 39, 43; MD-14; MM-4, 8; MT-13, 20, 28,37; RO-2, 3, 4, 5, 10, 24, 30, 33, 34, 46, 49, 50, 61, 62, 79, etc.	TO-18 28, 52, 54; MT-30, 38; RO-44, 48, 51, 64, 65, 66, 70, 73, 78; U-3; X-8, etc.
Characteristic Impedance (of coaxial lines):	50 Ω ± 0.8%	50 Ω ± 1.6%
Pin-Circle Diameter:	0.2 inch	0.1 inch
Range of Transistor Lead Diameters:	0.014 to 0.032 inch	0.014 to 0.021 inch
Maximum Transistor Lead Length:	2 inches	
Frequency Range:	dc to 5 Gc/s	
Accessory Supplied:	One Type 1607-P30 Damper (to prevent oscillation)	
Accessory Required:	Type 1607-P40 Termination Kit	
Net Weight:	Mount, approximately 12 oz (0.4 g); Termination Kit, approximately 14.5 oz (0.5 g)	

Type		*Price*
1607-P41	**Transistor Mount** (0.2-in pin circle, grounded base)	**$115.00**
1607-P42	**Transistor Mount** (0.2-in pin circle, grounded emitter/collector)	**115.00**
1607-P43	**Transistor Mount** (0.1-in pin circle, grounded base)	**115.00**
1607-P44	**Transistor Mount** (0.1-in pin circle, grounded emitter/collector)	**115.00**
1607-P40	**Termination Kit**	**42.50**

SOUND-POWER MEASUREMENTS ABOVE A REFLECTING SURFACE

A preferred method of rating the noise output of a device is to determine the sound power radiated from it.[1] General procedures for measuring sound power are specified in an American standard (S1.2–1962, American Standard Method for the Physical Measurement of Sound), and some specialized test codes are based on that standard.

One basic test procedure requires suspending the noisy device in the middle of an anechoic chamber. Twenty microphones are placed at points uniformly distributed on a hypothetical measurement sphere surrounding the source. The sound-pressure level at each of these points is then measured, and the radiated sound power is calculated from the results of these measurements.

If the device being measured is large and heavy, suspending it in a chamber may be impractical. It is often easier and more sensible to place it on a large concrete foundation, as it might be mounted in actual use; any surrounding walls are made anechoic. Or the device may be placed on a large paved area in the open. The flat mounting surface then becomes a reflecting plane for the sound, and the measurement positions are distributed on a hypothetical hemisphere above the plane and surrounding the device. The 12 microphone positions usually chosen for these measurements have not been as satisfactory as those for the complete sphere, because four of the points are in the reflecting plane. (P. K. Baade, "Sound Radiation of Air-Conditioning Equipment; Measurement in the Free-Field Above a Reflecting Plane," *Technical papers on sound*

[1] For a general discussion of sound-power measurements and a list of references, see A. P. G. Peterson and E. E. Gross, Jr., *Handbook of Noise Measurement*, Chapter 7, General Radio Company, West Concord, Massachusetts, 1963.

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