Section 6683/6684/6685-101/3
6683 and 6684, Equipment Issue 2
6685, Equipment Issue 1
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6683, 6684, and 6685 Terminating Sets

CONTENTS PAGE

1. GENERAL

1.01 This Practice provides circuit description, installation procedures and basic testing information for Wescom® 6683, 6684, and 6685 Terminating Sets.

1.02 The 6683 (Figure 1), 6684, and 6685 Terminating Sets are plug-in modules used to provide 2-wire termination of a 4-wire facility. They are identical except for 2-wire drop impedance; the 6683 matches a 900-ohm drop, the 6684 matches a 600-ohm drop, and the 6685 can be arranged to match either a 600- or a 900-ohm drop. Each module consists of a two-transformer hybrid, Network Building-Out (NBO) capacitors, and a compromise balance network. Three-digit thumbwheel attenuators are provided in the 4-wire transmit and receive ports, and an A- and B-lead isolation inductor is included to isolate the external A- and B-lead impedance from the hybrid circuit. A precision balance network may be provided as an optional plug-in subassembly to be used in lieu of the compromise network, or an external precision balance network may be used.

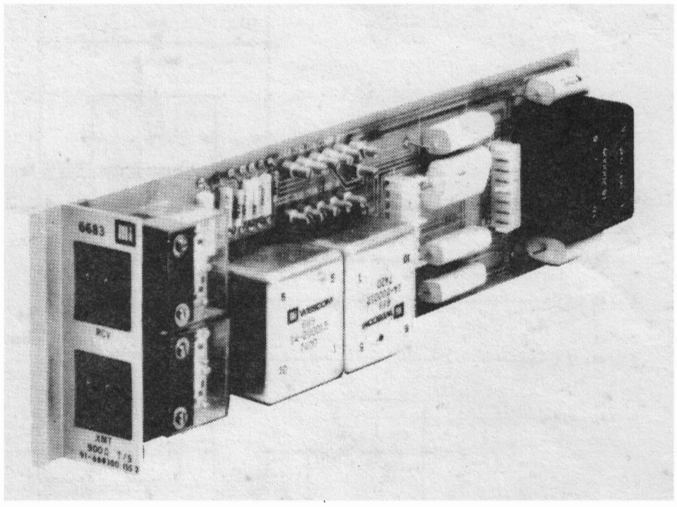

Figure 1. 6683 Terminating Set

1.03 The 6683, 6684, and 6685 are constructed as high-density modules. Each module mounts in one position of a Wescom Type 811 or 821 Mounting Assembly and makes an electrical connection through a wire-wrap connector provided as part of the mounting assembly.

2. CIRCUIT DESCRIPTION

2.01 The 6683, 6684, and 6685 consist of a 2-transformer hybrid circuit, an A- and B-lead capacitor, a compromise network, NBO capacitors, transmit and receive impedance matching networks, switchable thumbwheel attenuators, and an A- and B-lead isolation inductor. Refer to the schematic diagrams shown in Figures 2 and 3 while reading the following description.

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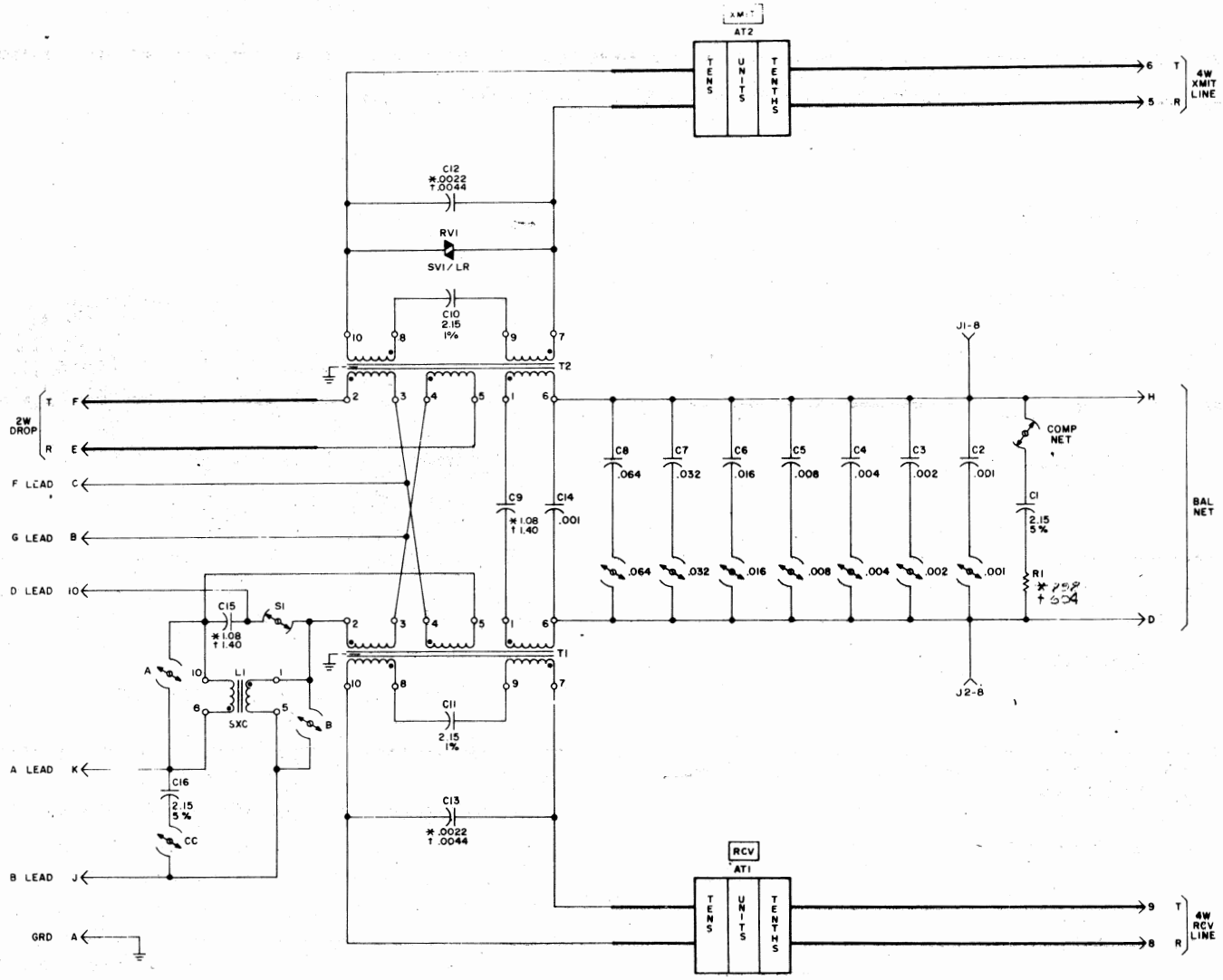
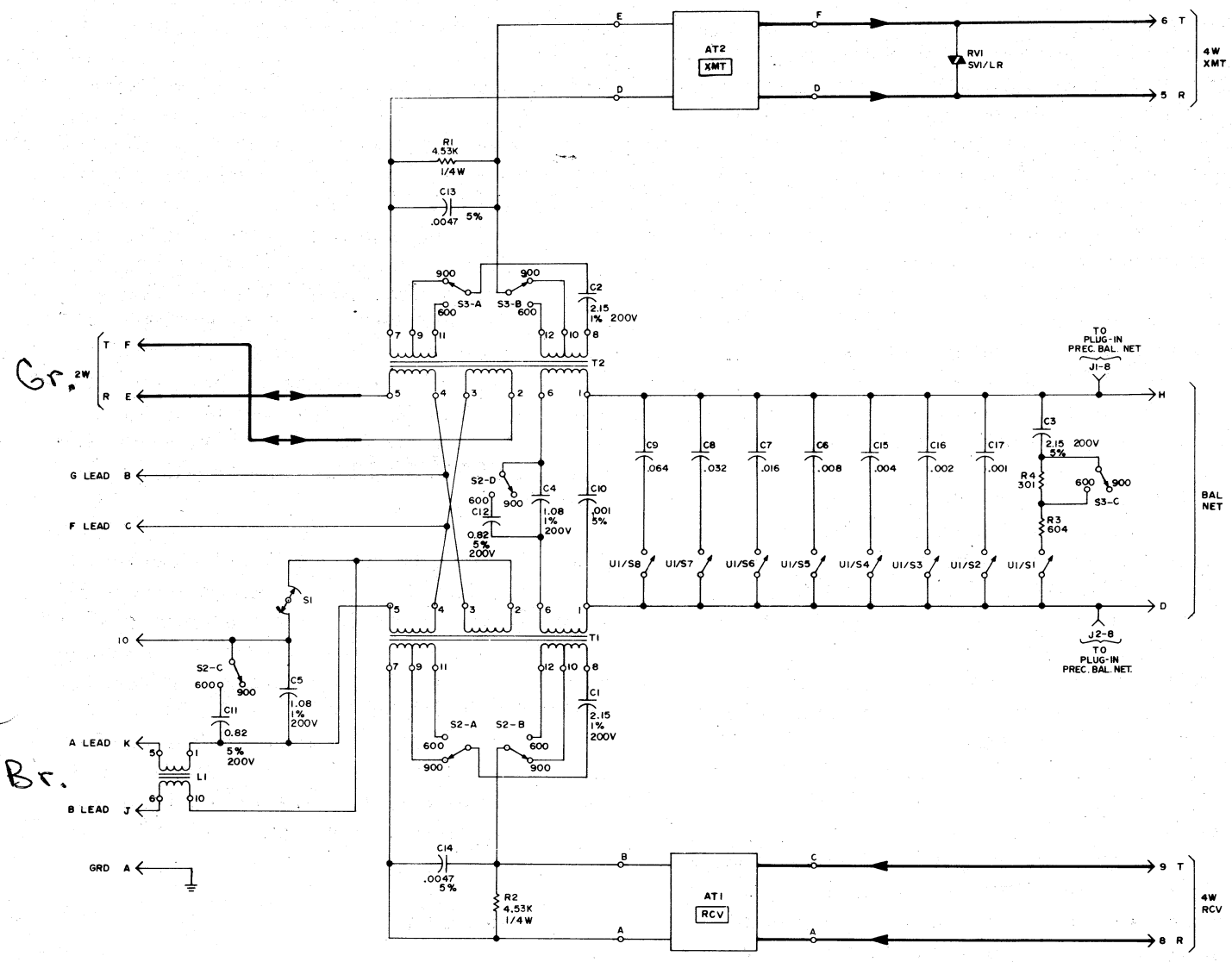


NOTES:

1. PART VALUES PRECEDED BY A * PERTAIN ONLY TO THE 6683, PART VALUES PRECEDED BY A † PERTAIN ONLY TO THE 6684. PART VALUES NOT PRECEDED BY EITHER A * OR A † PERTAIN TO BOTH THE 6683 AND 6684.
2. UNLESS OTHERWISE SPECIFIED:

   CAPACITORS ARE IN MICROFARADS.
3. ← PC BOARD CONNECTOR.
4. ═══ PRIMARY TRANSMISSION PATH.
5. [XXX] FRONT PANEL DESIGNATIONS.
6. OPEN, CLOSED SCREW OPTIONS.
7. WHEN DIAL PULSING IS NOT ADVERSELY AFFECTED, CLOSING OPTION CC WILL IMPROVE LONGITUDINAL BALANCE.

Figure 2. 6683 and 6684 Schematic Diagram (Issue 2)



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS, ±1 %, 1/2 WATT.
   CAPACITORS ARE IN MICROFARADS, ±10%, 100V.
2. ← PC BOARD CONNECTOR.
3. [XXX] FRONT PANEL DESIGNATION.
4. OPEN, CLOSED SCREW OPTIONS.
5. ——— PRIMARY TRANSMISSION PATH.
6. ◄——— SIGNAL FLOW DIRECTION.
7. C11 AND C12 ARE SUPPLIER MATCHED TO 1%.
8. FOR 600Ω 2W IMPEDANCE, SWITCH S2 & S3 TO 600Ω POSITION.
   FOR 900Ω 2W IMPEDANCE, SWITCH S2 & S3 TO 900Ω POSITION.
9. S-1 OPTION IS NORMALLY CLOSED.

Figure 3. 6685 Schematic Diagram (Issue 1)

2.02 Speech currents from the 2-wire drop flow through line windings 2-3 and 4-5 of transformers T2 and T1 and the capacitor associated with the A and B leads. Because the balancing network winding 1-6 of transformer T2 is connected in series with the network winding 1-6 of transformer T1, but is of opposing magnetic polarity, no signal voltages appear across the balancing network; therefore, the incoming speech power will divide equally between the secondaries of T1 and T2, inducing equal energy into the 9-7 plus 10-8 windings of each transformer. The power transferred across T1 is fed to the receive line, where it is blocked by one-way devices in the connecting equipment. The power transferred across T2 (one-half the input power) is applied through the switchable thumbwheel attenuator AT2 to provide the proper levels for transmission to the transmitting side of the 4-wire circuit.

2.03 Speech signals that enter the receive side of the circuit are attenuated by the switchable thumbwheel attenuator AT1 and pass to windings 9-7 and 10-8 of transformer T1. The transformer design is such that equal voltages appearing across the 2-3, 4-5, and 1-6 windings of transformer T1 will result in equal currents flowing through the 2-3, 4-5, and 1-6 windings of transformer T2. Network winding 1-6 of T2 is polarized with respect to windings 2-3 and 4-5 of T2 such that the magnetic fluxes in T2 cancel and no signal is induced into the transmit side if the impedances terminating the two-wire and balance ports are equal. In the ideal condition, the impedance of the network exactly matches the impedance of the 2-wire drop in both magnitude and phase. One-half the receive energy will, therefore, be dissipated in the balancing network and the remaining energy will be transmitted to the 2-wire drop.

2.04 Capacitor C15 (C5 in 6685) is inserted at the midpoint of the 2-wire windings of transformer T1 and T2 where A and B leads are derived for loop signaling. The 6683 and 6684 Term Sets have A, B, D, F, and G leads brought out at the 20-pin, wire-wrap connector for use in pad control and signaling functions. In some applications, the trunk circuit opens the midpoint of the 2-wire line for signaling, and closes the connection for voice transmission. By opening the S1 option, a D lead is made available, allowing a 2-wire signaling circuit to open and close the B and D leads. The 6685 has A, B, F, and G leads brought out but is not provided with a D lead. Option S1 in the 6685 must be closed at all times.

2.05 Each terminating set has a Compromise Network (COMP NET) to balance the office 2-wire impedance, a capacitor between each of the hybrid coil network windings, to balance the S1 capacitor in the 2-wire circuit, and seven optional NBO capacitors in parallel to balance the 2-wire line. Adjustments for these options are controlled by option screws (6683 and 6684) and Dual In-Line Package (DIP) switches (6685) located on the component side of the printed circuit card. A precision balance network may be used in lieu of the COMP NET either via external connection or through the addition of an internally mounted precision balance network plug-in subassembly.

2.06 The impedance of the A- and B-lead circuit is isolated from the impedance of the midpoint capacitor, associated with the hybrid 2-wire port, by inductor L1. This arrangement provides considerable improvement in transhybrid loss and prevents transients on the A- and B-leads from entering the voice path. In the 6683 and 6684, capacitor C16 provides further isolation, but should be used only when dial pulsing is not adversely affected by its presence.

3. INSPECTION

3.01 Inspect the equipment thoroughly as soon as possible after delivery. If the equipment has been damaged in transit, report the extend of damage to the transportation company immediately.

3.02 Wescom equipment is identified by a model and issue number imprinted on the front panel. Each time a major engineering design change is made on the equipment, the issue number is advanced by one number on any following models that are manufactured. Therefore, be sure to include the issue number along with the model number when making inquiries about the equipment.

4. MOUNTING

4.01 The 6683, 6684, and 6685 are constructed as plug-in modules designed to mount in one position of either the 811 or 821 Shelf. The 811 Shelf measures 3-1/2 inches high and 19-inches wide, allowing for mounting 12 high-density modules in two vertical mounting spaces on a 19-inch relay rack. The 821 Shelf measures 3-1/2 inches high and 23-inches wide, allowing for mounting 14 high-density modules in two vertical mounting spaces of a 23-inch relay rack.

5. INSTALLER CONNECTIONS

5.01 When the 6683, 6684, or 6685 is installed in either the 811 or 821 Shelf, it makes electrical connection to associated equipment through a 20-pin, wire-wrap card connector provided as part of the mounting assembly. Make all installer connections to this connector in accordance with Table 1.

Table 1. 6683, 6684, and 6685 Term Set Installer Connections

INSTRUCTION	20-PIN CONNECTOR ASSIGNMENT
Connect:	**To:**
Transmit line T & R	6 and 5, respectively
Receive line T & R	9 and 8, respectively
2-wire drop T & R	F and E, respectively
A lead	K
B lead	J
D lead (6683 and 6684 only)	10
F lead	C
G lead	B
External balance network	H and D
Ground	A

6. OPTIONS

6.01 The 6683 and 6684 are provided with screw options to add NBO capacitance, to connect the compromise balance network, to connect capacitors across the A and B leads, and to bypass the A- and B-lead isolation inductor. The 6685 is provided with an 8-section DIP switch to add NBO capacitance and connect the compromise balance network. It is also provided with two slide switches for arranging the term set for either a 600- or 900-ohm 2-wire impedance. The 6683, 6684, and 6685 are each provided with connectors on the printed circuit board for mounting an optional precision balance network subassembly. Instructions for using each of these options are given in the following paragraphs. Refer to Figure 4 for a drawing showing the relative locations of the option screws and subassembly connectors on the 6683 and 6684 Printed Circuit (PC) boards. Refer to Figure 5 for a drawing showing the location of the DIP switch, the 2-wire impedance slide switches, and subassembly connectors on the 6685 PC board.

CAUTION

When opening an option, rotate the screw counterclockwise two revolutions to ensure that the connection is broken. When closing an option, do not overtighten as damage to the plating of the printed circuit board may result.

S1 Option (A- and B-Lead Capacitance)

6.02 Closing option S1 connects a midpoint capacitor across the A and B leads. In the 6685, this option must be closed at all times. In the 6683 and 6684, opening option S1 disconnects this capacitor and provides a D lead which may be

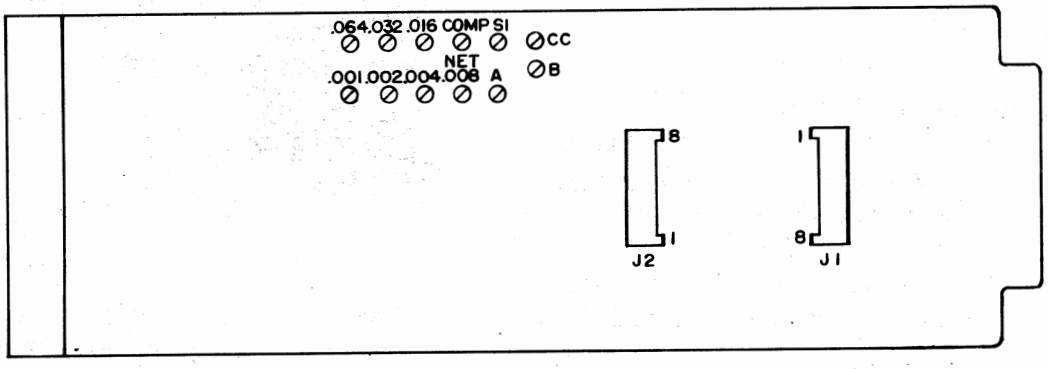


Figure 4. 6683 and 6684 Option Location Chart

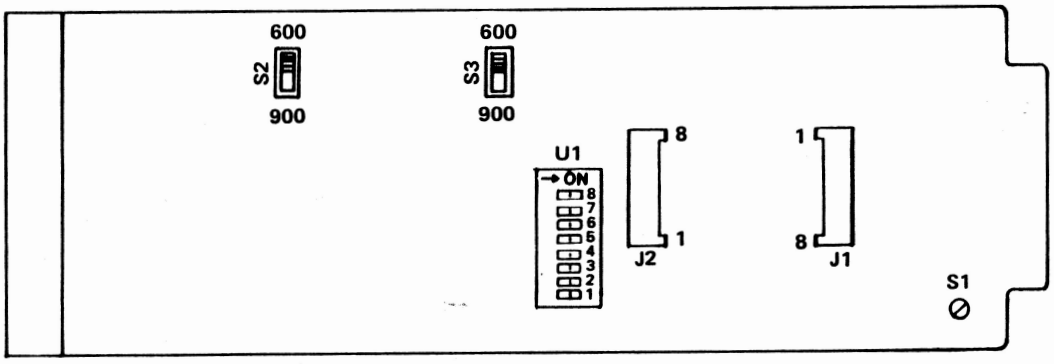


Figure 5. 6685 Option Location Chart

used by a trunk circuit in the application of pad control. For this arrangement, options A and B must be closed to bypass the A- and B-lead isolation inductor and option CC must be open.

NOTE

If an associated trunk circuit is provided with a capacitor across the A and B leads, it should be disconnected and the terminating set capacitor should be used instead.

NBO Capacitance

6.03 NBO capacitance of 0.001 to 0.127uF may be added in increments of 0.001uF to optimize transhybrid loss. The 6683 and 6684 are provided with seven option screws, each labeled with the value of capacitance it adds to the circuit, for this adjustment. The 6685 is provided with a DIP switch for these adjustments. Refer to Part 7 for the NBO capacitance adjustment procedure.

COMP NET Option

6.04 Closing the COMP NET option connects an internal balance network that provides a compromise balance for 2-wire drops with a variation in impedance. If a precision balance network is provided, open the COMP NET option screw on the 6683 and 6684 or DIP switch section U1/S1 on the 6685.

Precision Balance Network

6.05 Precision hybrid balance may be obtained by using an external precision balance network or one of five optional plug-in precision balance subassemblies in lieu of the COMP NET option. The type of balance network required is dependent on the characteristics of the associated 2-wire drop. Table 2 lists each plug-in balance subassembly by model number and describes the type of balance it provides. The subassembly is supported by two 8-pin connectors (J1 and J2), which also provide electrical connection to the terminating set. Figure 6 shows the subassembly installation on the terminating set circuit board. Refer to the appropriate Precision Balance Network Section in the Wescom Practices for balance network conditioning instructions.

Table 2. Precision Balance Network Subassembly Applications

SUBASSEMBLY	APPLICATION	
	CABLE TYPE	CABLE GAUGE
7430	H-88 loaded	16, 29, or 22
7431	H-88 loaded	24
7432	H-88 loaded	26
7433	nonloaded	all
7435	D-66 loaded	all

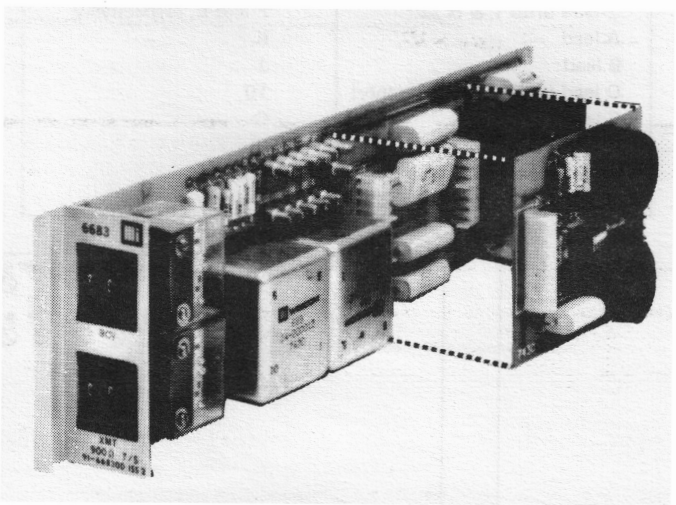


Figure 6. Precision Balance Network Subassembly Installation

A- and B-Lead Isolation Inductor

6.06 The isolation inductor in the A- and B-lead circuit of the 6683 and 6684 should be employed to improve both transhybrid loss and 2-wire return loss when the A and B leads are connected externally to battery and ground. By closing option CC, a capacitor may be connected across the A and B leads that provides further improvement. When a D lead is derived from the term set, the isolation inductor must be bypassed, by closing option screws A and B, and the additional A- and B-lead capacitor must be disconnected by opening option screw CC. An additional condition requiring the opening of option screw CC exists when the associated capacitor adversely affects dial pulsing.

6.07 Because a D lead is not provided in the 6685, no provision has been made to bypass the A- and B-lead inductor. The 6685 is not provided with the optional A- and B-lead capacitor (option screw CC).

2-Wire Impedance Selection (6685 only)

6.08 The 6685 is provided with two slide switches, S2 and S3, for changing the 2-wire impedance from 900 to 600 ohms. To condition the 6685 for a 900-ohm 2-wire impedance, place both S2 and S3 in the 900 position. For a 600 ohm impedance, place both S2 and S3 in the 600 position.

7. ALIGNMENT

7.01 The alignment procedure for the 6683, 6684, and 6685 (Table 3) is divided into three parts: receive alignment, transmit alignment, and NBO adjustment to maximize transhybrid loss. If the required amount of transmit and receive attenuation is already known, the transmit and receive alignment parts of the procedure may be omitted. In this case, allow for hybrid insertion loss by subtracting 4dB from the required amount

Table 3. 6683, 6684, and 6685 Alignment Procedure

STEP	INSTRUCTION
	Receive Alignment
1	Arrange for the distant end to send 1000Hz test tone at the associated level and impedance specified on the CLR card.
2	Arrange the TMS for 600-ohm terminated measurement and connect it into the 4W RCV SHELF jack provided on the 6699. The level measured should be within ±1dB of the level specified on the CLR card for the 4-wire receive line. If this condition is not met, check the facility and restore it to proper operation.
3	Move the TMS to the 2W UNIT jack provided on the 6699 and condition the TMS for terminated measurement at the impedance of the 2-wire drop: 900 ohms for the 6683, 600 ohms for the 6684, or 600 or 900 ohms as required for the 6685.
4	Adjust the RCV attenuator thumbwheels until the TMS reads the level specified for the 2-wire drop on the CLR card.
5	Disconnect the TMS and arrange for the distant terminal to discontinue test tone transmission.
	Transmit Alignment
6	Arrange the VFO to provide a 1000Hz test tone at the level and impedance specified on the CLR card for the 2-wire drop. Connect the VFO into the 2W UNIT jack on the 6699 front panel.
7	Arrange the TMS for 600-ohm terminated measurement and connect it into the 4W XMT UNIT jack provided on the 6699. Adjust the XMT attenuator thumbwheels until the TMS reads the level specified for the 4-wire transmit line on the CLR card.
	NBO Adjustment
8	Move the VFO to the 4W RCV UNIT jack provided on the 6699 and arrange it to provide 1000Hz test tone at 600 ohms impedance and at the level specified on the CLR card for the 4-wire receive line. The TMS should be connected as in Step 7.
9	Place the 2-wire drop equipment in the off-hook condition.
10	Open or close NBO option screws (0.001 through 0.064) on the 6683 or 6684 as required to minimize the TMS reading (optimize transhybrid loss). In the 6685, use DIP switch sections U1/S2 through U1/S8 to add capacitors of 0.001 through 0.064uF to perform this adjustment. This concludes the alignment procedure; disocnnect the TMS and VFO, remove the terminating set from the 6699 and re-install it in the mounting assembly.

of attenuation. Rotate the corresponding thumbwheel attenuator (transmit or receive) to indicate the remaining amount of required attenuation to complete the level adjustment.

Preparation for Alignment

7.02 Before beginning the alignment procedure, double check all installer connections and option conditioning. If a precision balance network is used, verify that it is conditioned for the appropriate type of 2-wire drop. Remove the terminating set from the mounting assembly and reinstall it using a Wescom 6699 Test Extender.

Required Test Equipment

7.03 The following test equipment is required at both local and distant terminals to align and test the 6683, 6684, and 6685 Terminating Sets:

(a) Transmission Measuring Set (TMS): WECo 23A, Hewlett-Packard 3550, or equivalent with self-contained Variable Frequency Oscillator (VFO).

(b) Associated Test Cords: Two 2- or 3-conductor test cords with a 310 plug at each end.

(c) Wescom Model 6699 Test Extender.

8. TESTING

8.01 Perform a talk test on the facility to verify transmission quality. If trouble is encountered with the facility, use the alignment procedure (Part 7) to determine whether its cause is in the terminating set or elsewhere in the circuit. If technical assistance is required, contact the Wescom Technical Services Department by calling:

(312) 971-2010 or
TWX 910-695-4735

Canadian Customers:

(416) 453-2222 or
TWX 610-492-2697

9. WARRANTY

9.01 STANDARD WARRANTY: Wescom products are warranted to be free from defects in material, workmanship, and design given proper installation and regular maintenance. Wescom's obligations under this warranty are limited to correction and replacement at Wescom's production facility of any defective items received by Wescom, transportation prepaid, for a period of 18 months from the date of original shipment. Warranty and remedies on products not manufactured by Wescom are in accordance with the warranty of the respective manufacturer. WESCOM MAKES NO OTHER WARRANTY OF ANY KIND WHATEVER, EXPRESSED OR IMPLIED; AND ALL IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE AFORESAID OBLIGATIONS IS HEREBY DISCLAIMED BY WESCOM.

9.02 Field repairs involving the replacement of components within a unit are not recommended. If an item is found to be defective, contact Wescom, Inc., by telephone or TWX, for instructions regarding replacement or repair.

9.03 If a replacement unit is required, it will be shipped in the fastest manner consistent with the urgency of the situation. Upon receipt of a replacement unit, return the defective unit in the carton in which the replacement was shipped, using the shipping label provided, to:

Wescom, Inc.
8245 Lemont Road
Downers Grove, Illinois 60515

Canadian Customers:

Wescom Canada, Ltd.
287 Glidden Road
Brampton, Ontario L6W1H9
Canada

Repair or Exchange Services

9.04 In addition to the standard Wescom Warranty Service, Wescom offers a repair or exchange service for those items out of warranty.

Under this arrangement, faulty units may be shipped to Wescom for either complete repair and quality testing or exchanged for a replacement unit. To obtain details of this service and a schedule of prices, contact your local Wescom Sales Representative.

10. SPECIFICATIONS

10.01 The electrical and physical characteristics of the 6683, 6684, and 6685 are as follows:

(a) TWO-WIRE IMPEDANCE: 6683, 900 ohms +2.15uF; 6684, 600 ohms +2.15uF; 6685, 900 or 600 ohms +2.15uF.

(b) FOUR-WIRE IMPEDANCE: 600 ohms, resistive.

(c) TRANSMIT AND RECEIVE ATTENUATION: 0 to 39.9 ±0.1dB adjustable in steps of 0.1dB.

(d) TWO-WIRE RETURN LOSS: As specified graphically. Refer to Figure 7 for the 6683 and 6684 and to Figure 8 for the 6685.

(e) TRANSHYBRID LOSS (WITH PRECISION TERMINATION): As specified graphically. Refer to Figure 9 for the 6683 and 6684 and to Figure 10 for the 6685.

(f) HYBRID INSERTION LOSS: As specified graphically. Refer to Figure 11 for the 6683, to Figure 12 for the 6684, and to Figures 13 and 14 for the 6685.

(g) NETWORK BUILDING-OUT (NBO) CAPACITANCE: 0.001 to 0.127uF in steps of 0.001uF.

(h) COMPROMISE BALANCE NETWORK: 6683, 2.15uF in series with 900 ohms; 6684, 2.15uF in series with 600 ohms; 6685, 2.15uF in series with 900 or 600 ohms.

(i) ENVELOPE DELAY DISTORTION: As specified graphically. Refer to Figure 15 for the 6683 and 6684 and to Figure 16 for the 6685.

(j) LONGITUDINAL BALANCE: As specified graphically. Refer to Figure 17 for the 6683 and 6684 and to Figure 18 for the 6685.

(l) A- AND B-LEAD ISOLATION: Inductor affords additional voice frequency isolation between the A- and B-leads and the voice path.

(m) OPERATING ENVIRONMENT: Temperature, 32° to 120°F (0° to 49°C); humidity to 95% (no condensation).

(n) DIMENSIONS: Height, 3.2 inches (8.1cm); width, 1.4 inches (3.5cm); depth, 13 inches (33cm).

(o) WEIGHT: 1 lb 12 oz (0.794kg).

(p) MOUNTING: Requires one position in a Wescom 811 or 821 High Density Mounting Shelf.

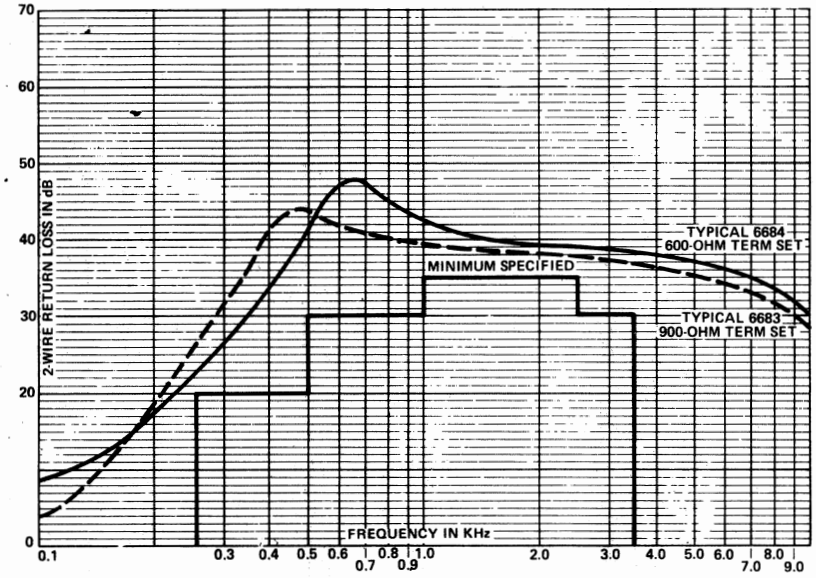


Figure 7. 2-Wire Return Loss Specification for 6683 and 6684

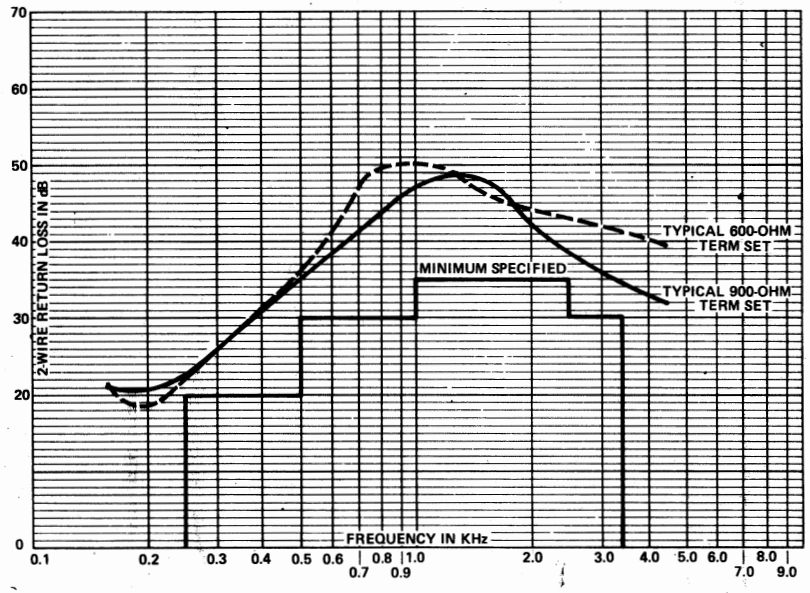


Figure 8. 2-Wire Return Loss Specification for 6685

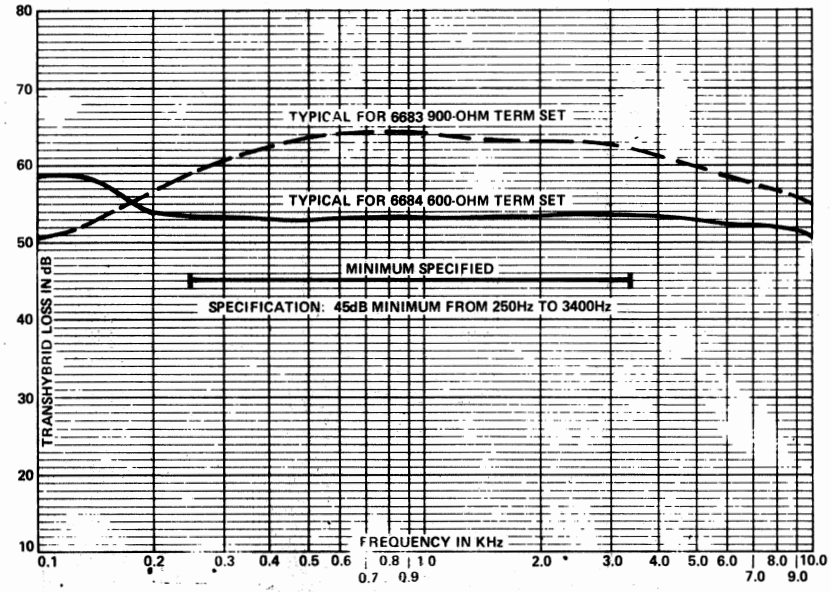


Figure 9. Transhybrid Loss Specification for 6683 and 6684

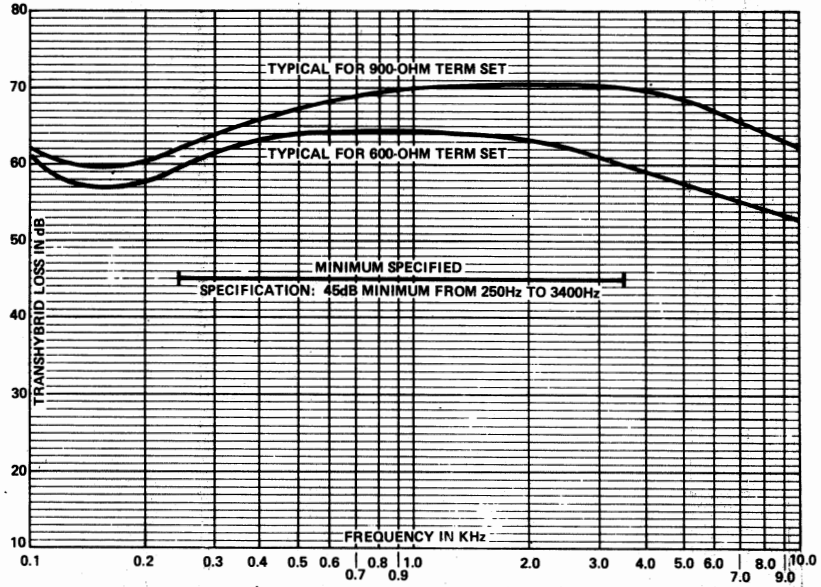


Figure 10. Transhybrid Loss Specification for 6685

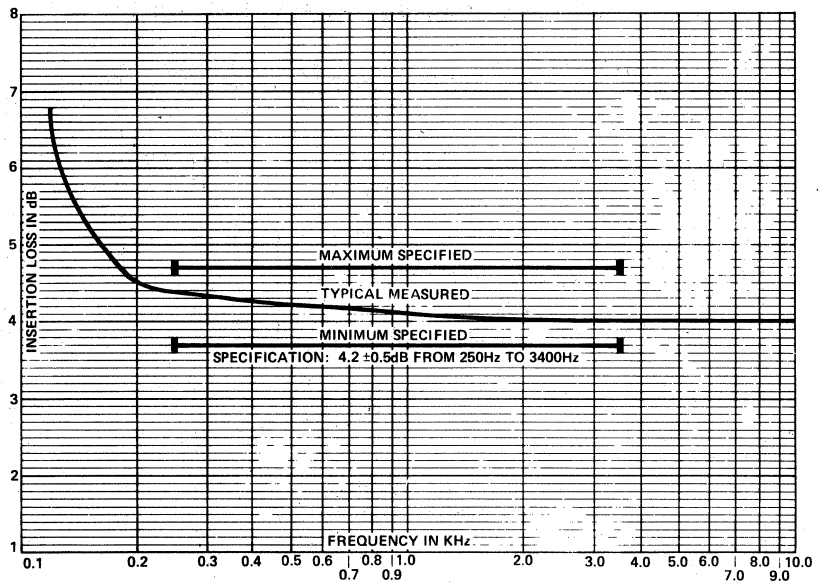


Figure 11. Hybrid Insertion Loss Specification for 6683

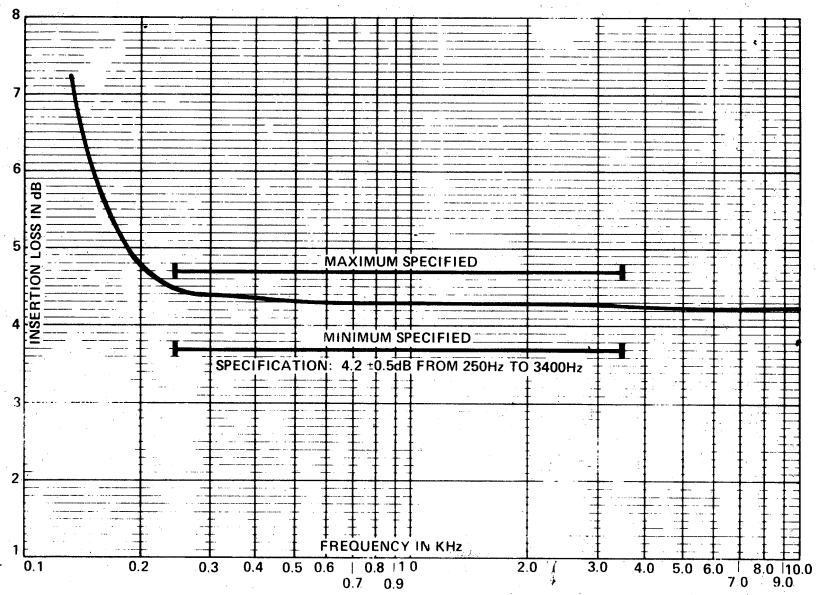


Figure 12. Hybrid Insertion Loss Specification for 6684

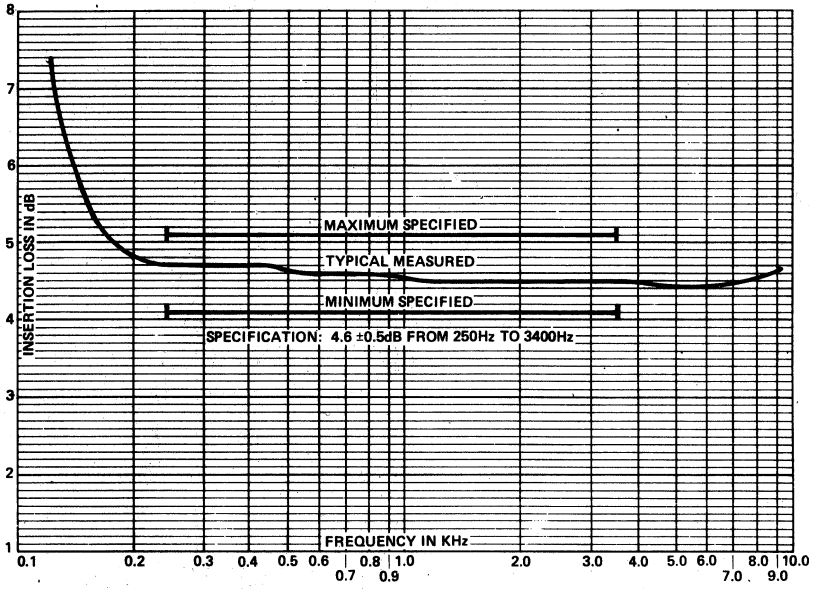


Figure 13. Hybrid Insertion Loss Specification for 6685 Arranged for 900-Ohm 2-Wire Impedance

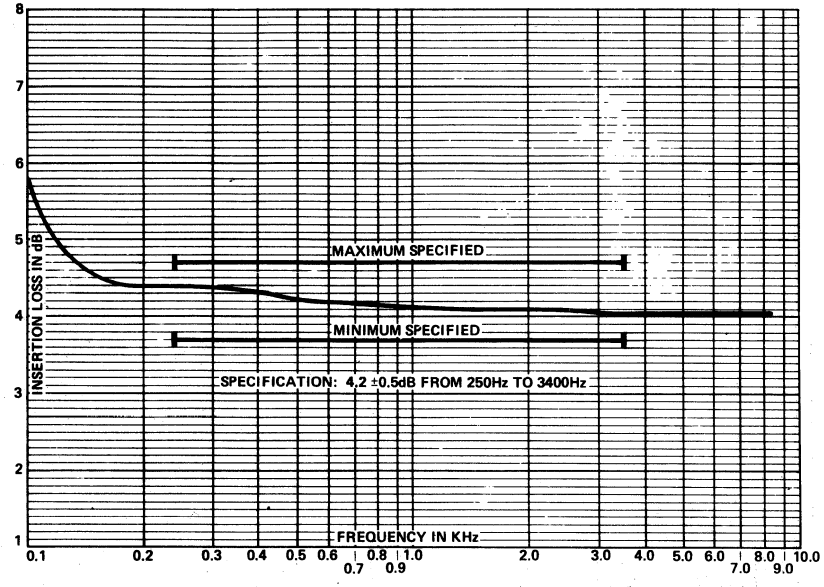


Figure 14. Hybrid Insertion Loss Specification for 6685 Arranged for 600-Ohm 2-Wire Impedance

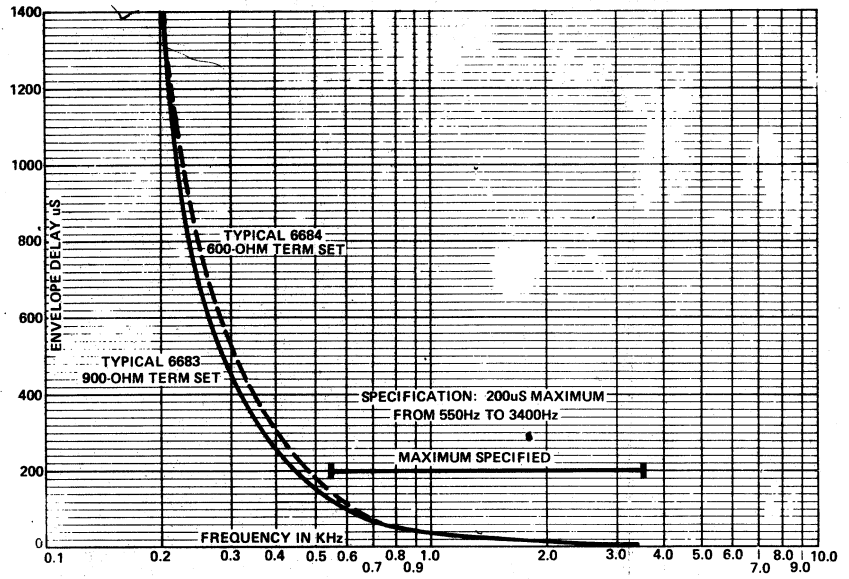


Figure 15. Envelope Delay Distortion Specification for 6683 and 6684

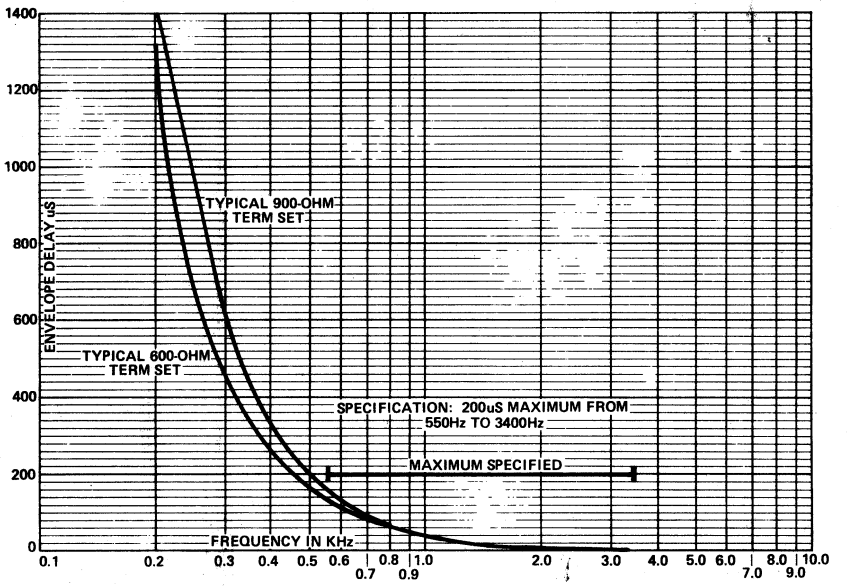


Figure 16. Envelope Delay Distortion Specification for 6685

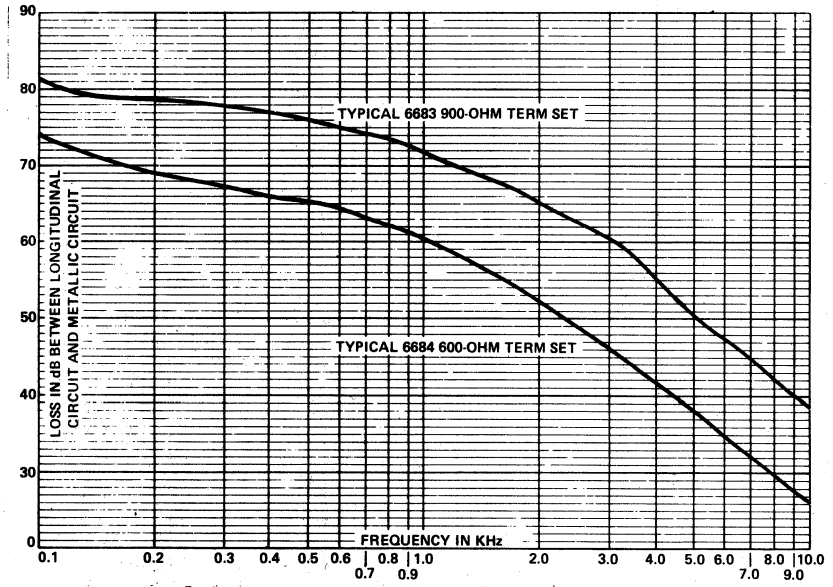


Figure 17. Longitudinal Balance Specification for 6683 and 6684

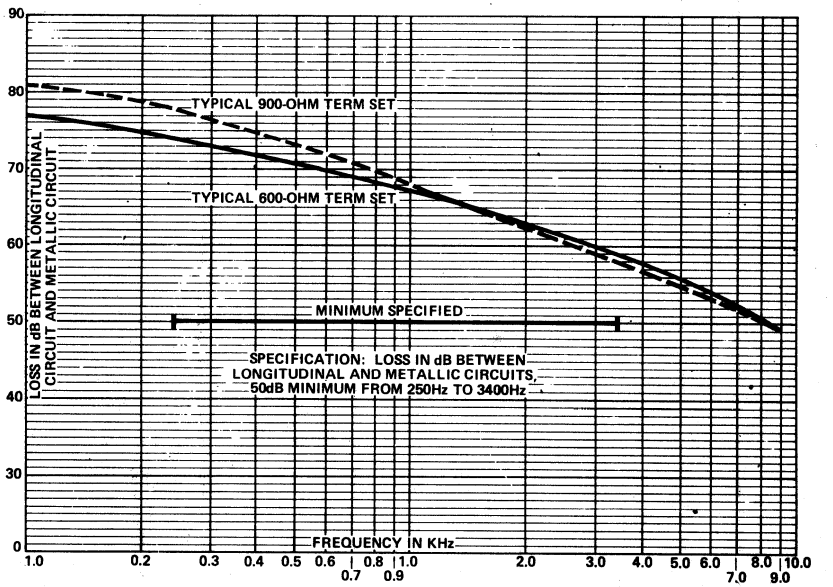


Figure 18. Longitudinal Balance Specification for 6685