N3 CARRIER TELEPHONE SYSTEM
VF AMPLIFIER UNIT AND
J99272CA THROUGH-CHANNEL CONNECTOR AND PAD UNIT
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the J99300AM VF amplifier unit and J99272CA through-channel connector and pad unit.

1.02 This section is reissued to include the use of J99272CA through-channel connector and pad units for channel interconnections. Arrows indicate changes in this section.

A. Function

1.03 ▶VF amplifiers are substituted for compandors when a noncompandored N3 channel is desired for data service or VF carrier telegraph and at offices where an N3 channel is connected in tandem with another for extended data or telegraph service. For N3 channels connected in tandem for extended message service, VF amplifiers or compandors may be used at the interconnecting office, but compandors should be used at the terminating ends for noise reduction. Compandors and VF amplifiers are not individually interchangeable; the requirements for a compandored channel are a compressor at the transmitting terminal and an expandor at the receiving terminal.

1.04 A J99272CA,L1 through-channel connector and pad unit is used with each N3 VF amplifier or compandor at the interconnecting office involved in an interconnection. The J99272CA unit contains a loss pad for each direction of transmission to reduce the level from one channel for transmission on the connecting channel. For an N3-to-N3 or -N2 channel connection, the interconnected terminals contain VF amplifiers (or compandors) and the associated J99272CA units (see Fig. 1). For an N3-to-N1, -O, or -ON channel connection, the J99272CA through-channel connector and pad unit in the N3 terminal connects to a J98703AH through-channel unit for N1 or a J98705AF through-channel unit for O and ON (see Fig. 2).◀

B. Description and Features

1.05 The VF amplifier is a single-module, plug-in unit which is identical to the compandor in size, external connections, and power requirements. Except for the common power supply connections, the transmit amplifier and the receive amplifier in the unit operate independently and replace the compressor and expandor, respectively. Figure 3 shows the VF amplifier.

1.06 Circuit components are mounted on a printed circuit board which is contained in a die-cast metal frame. All interconnecting wiring to and

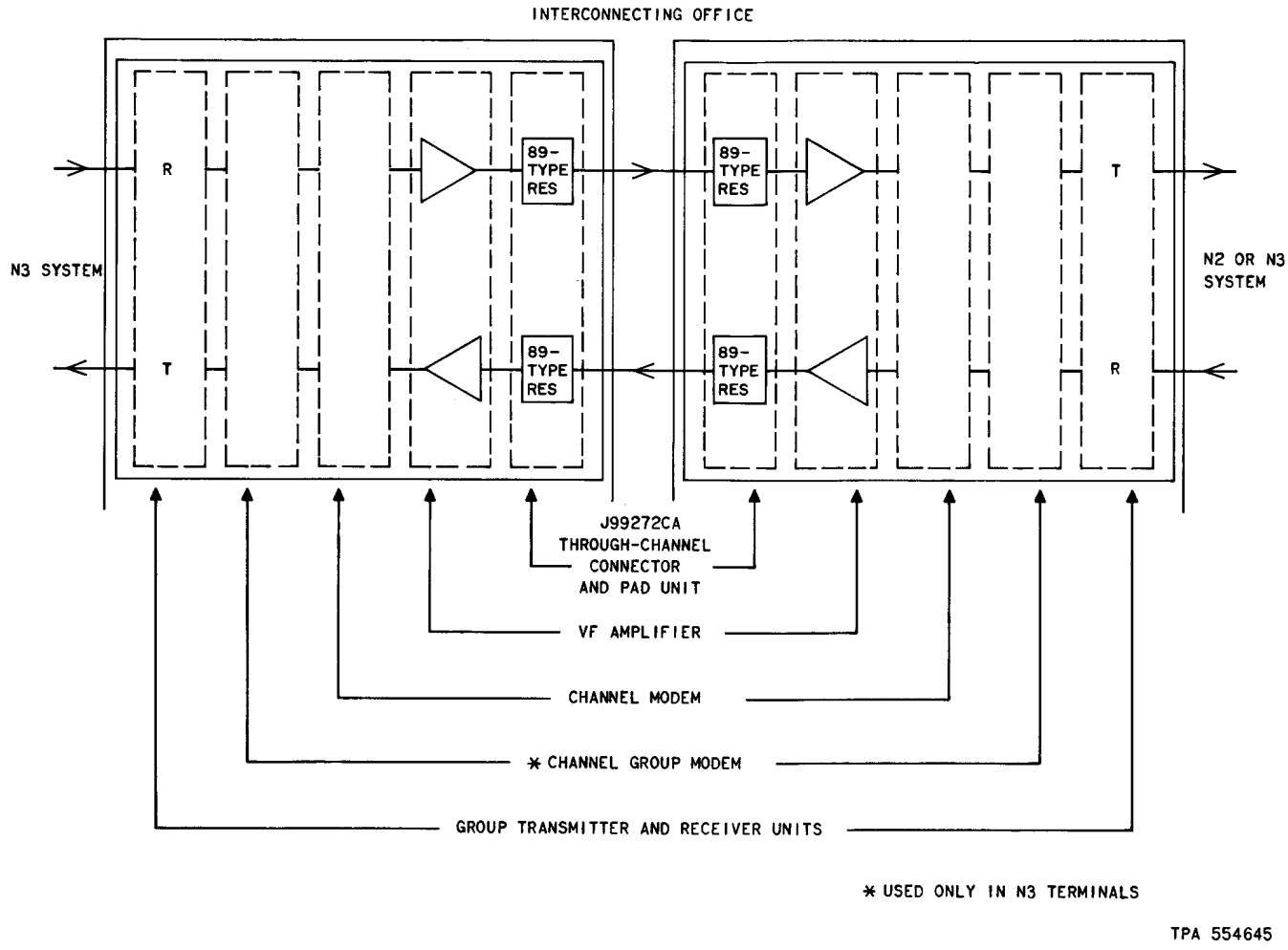


Fig. 1—N3 Through-Channel Connections With N2 or N3

from the VF amplifier unit enters the rear of the assembly via a 20-pin plug which is part of the printed circuit board. Four pin jacks for testing, two potentiometers for level adjustments, and a mechanical latch for locking the unit in position are located on the front panel.

1.07 ◗The J99272CA through-channel connector and pad unit is a single-module plug-in unit which is mounted in an E-signaling unit position. The J99272CA unit is primarily for use in N3 and N2 carrier package bays but may also be used in regular E-signaling bays in hard cabled installations. This unit contains two 1C pad sockets designated TRMTG and RCVG which accommodate 89-type resistors (see Fig. 4).◖

C. General Applications of Circuit

1.08 A VF amplifier unit is used in terminals at both ends of an N3 System when noncompandored operation is needed for private line data service or VF carrier telegraph. There is no speech transmitted in these services and little or no aural monitoring is required. N3 channels for these services may be connected in tandem with other N3, N2, N1, O, or ON channels even at terminals used primarily for voice communication.

1.09 ◗Any N3 channel can be used for through-channel message service, but the data service application is restricted when J99300AE frequency-correction units (FCU) are used. This is because the lowest frequency in the data signal interferes with the

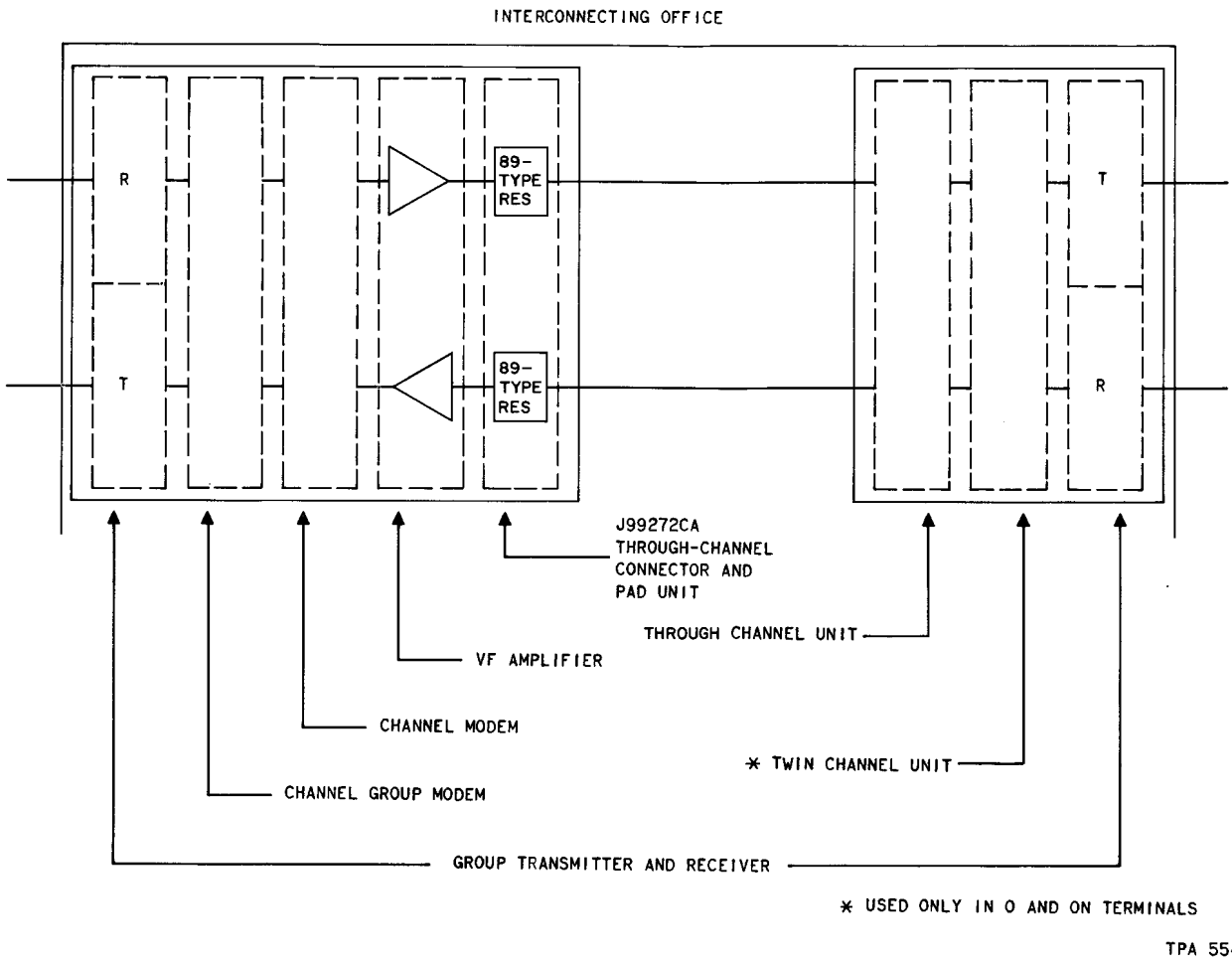


Fig. 2—N3 Through-Channel Connections With N1, O, or ON

carriers selected for frequency correction. If there is a J99300AE FCU in channel group 1 (CG1), channel 6 of CG1 cannot be used for data service. Likewise, channel 2 of CG2 cannot be used for data service if there is a J99300AE FCU for CG2. The newer J99300AS FCU with its narrowband selection filter allows the use of any N3 channel for data service also.

1.10 N3 channels cannot be connected with N2 channels 1 and 2 (channel positions A and B) when an N2 nonpackaged (carrier-only) bay at the intermediate office is involved. These channels must be equipped with E-signaling units to produce system restoral operations. Packaged N2 and N3 bays contain a restoral oscillator which supplies the tones for automatic system restoral and channels 1 and 2 can be used for through-channel connection.

1.11 An N3 channel can be connected in tandem with another N3 or N2 channel to extend data, VF-carrier telegraph, or message service. Two J99272CA through-channel connector and pad units which replace E-signaling units for the involved channels are interconnected through the intermediate distribution frame. Compandors are replaced by VF amplifiers for extended data service, but not necessarily for extended message service. The J99300AM,L1 VF amplifier is used in N3 terminals, and the J99272BD VF amplifier is rated standard for N2 terminals. The limitations of older N2 amplifiers (J99272AA and BA) are given in Section 362-808-100. The TRMTG pad in the J99272CA unit connects with the associated transmit amplifier (VF amplifier) or compressor (compandor) in the same terminal; the RCVG pad of this J99272CA unit connects with the receive amplifier (VF amplifier) or expandor (compandor). For each

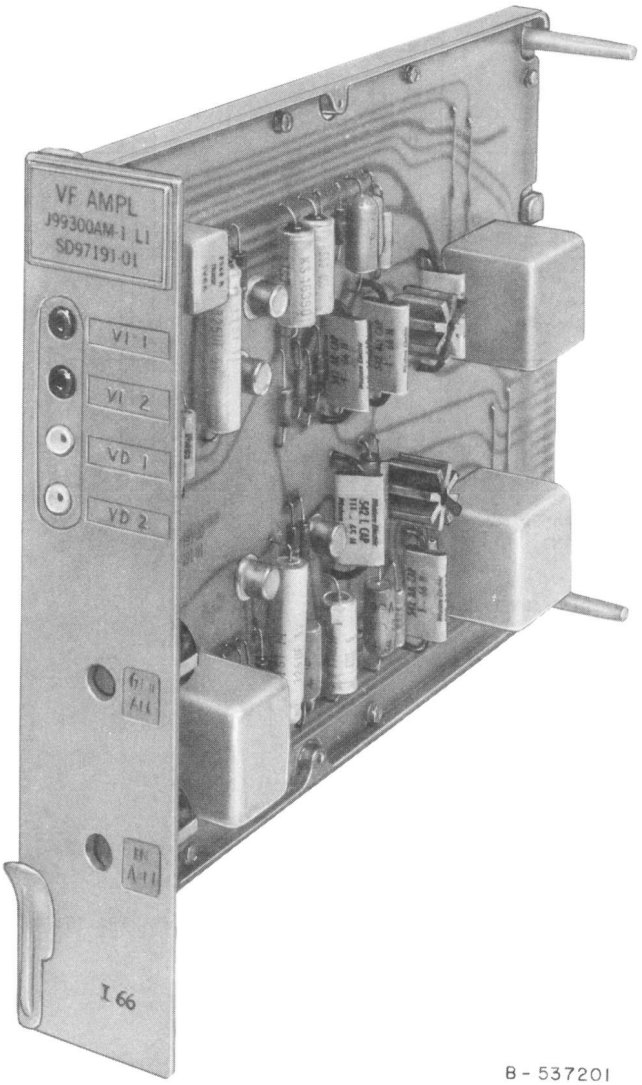


Fig. 3—VF Amplifier

direction of transmission, the 89-type resistor in the TRMTG pad of one J99272CA unit and the 89-type resistor in the RCVG pad are selected so that the level received from one channel (+7 TLP) is reduced to the level required at the input (−16 TLP) of the connecting channel (see Fig. 5). Thus the total loss (23 dB) necessary between VF amplifiers is distributed among two J99272CA units and the wiring losses. These J99272CA units are used in place of unnecessary signaling units at both terminals to establish continuity on a plug-in basis and to provide fine adjustment of the total loss.

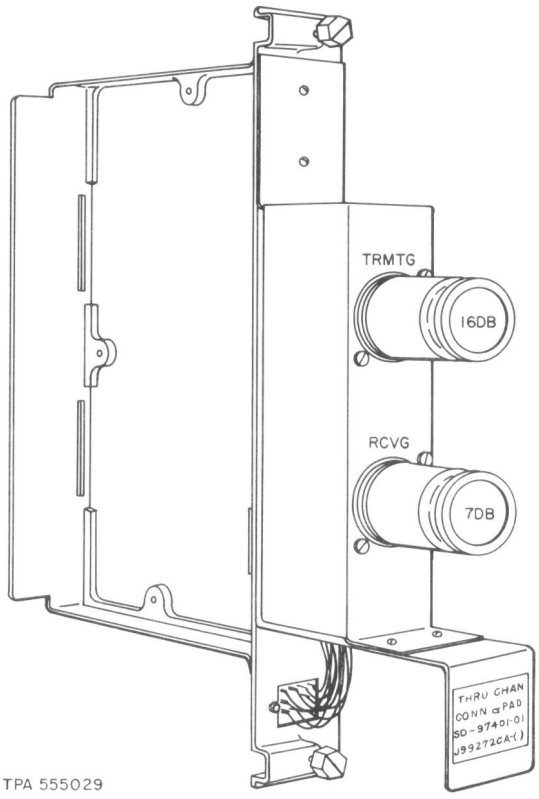
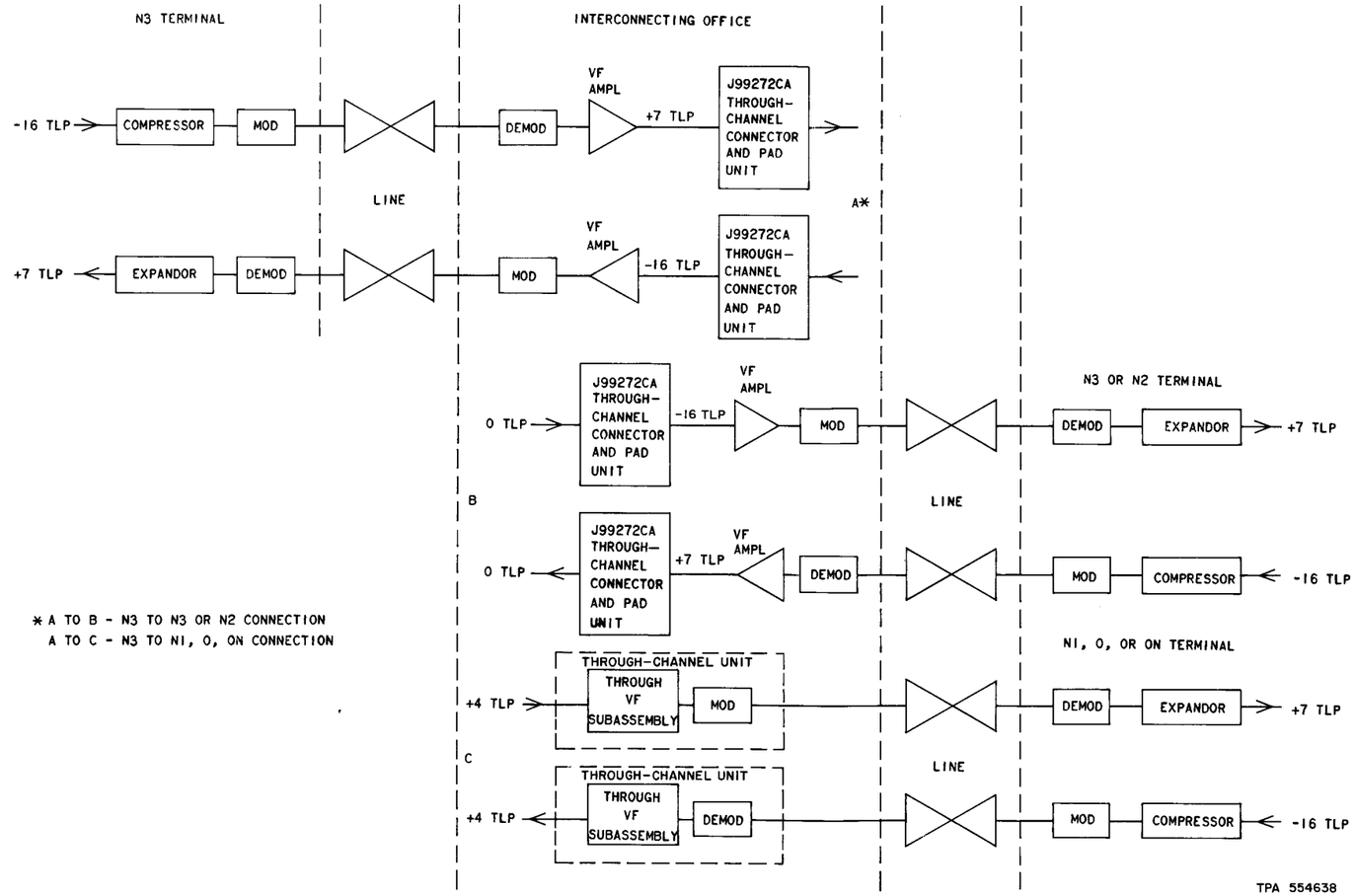


Fig. 4—Through-Channel Connector and Pad Unit

1.12 An interconnection between an N3 channel and an N1 or O or ON channel involves the use of a through-channel unit. This unit consists of transmitting and receiving circuitry and is used in place of a channel unit in the N1, O, or ON terminal at the interconnecting office. For transmissions toward the distant N3 terminal, the output of the through-channel receiving circuit (+4 TLP) is wired through the VF patch jacks to the J99272CA through-channel connector and pad unit where an 89-type resistor in the TRMTG socket produces the level (−16 TLP) required for the VF amplifier unit. S1 on the through-channel unit is set according to the type of terminal (N or O) containing it; and S2 on this unit is set to "off" to disconnect the 3700-Hz filter, because inband signaling is required. Transmissions from the distant N3 terminal pass through the VF amplifier unit to an 89-type resistor in the J99272CA through-connector RCVG socket which produces the level (+4 TLP) applied to the transmitting circuitry of the through-channel unit. Figure 5 shows N3 through-channel connections for message service in N1, O, or ON Systems. Distant terminals establish inband signaling



* A TO B - N3 TO N3 OR N2 CONNECTION
A TO C - N3 TO NI, O, ON CONNECTION

Fig. 5—System Level Diagram for an N3- to -N2, -N3, -N1, -O, or -ON Interconnection for Message Service

and compandored transmissions, and the through-channel equipment provides the interconnection.

1.13 ▶A signaling option template, shown on SD-97186-02-D2 (not attached), is furnished with the J99272CA through-channel connector and pad unit to simplify the optional strapping to condition N3 or N2 packaged bays for through-channel use. This template is placed on the channel terminal block on the rear of the trunk-release and make-busy panel (TR+MB) for the channel to be connected to another. The strapping, indicated on the template, provides transmit and receive paths for the J99272CA through-channel connector and pad unit while bypassing the TR+MB circuits. This optional strapping is done without the aid of a template when the old carrier group alarm (CGA) equipment is used in packaged N2 terminals because the forenamed template cannot be used and no other is available. This strapping is not necessary with nonpackaged (carrier-only) N2 bays because the external CGA equipment is eliminated for through channels.

D. Transmission Performance

1.14 The frequency response of a noncompandored N3 channel using VF amplifiers is equivalent to that of a compandored N3 channel (200 to 3450 Hz at the 3-dB points). For an N3 channel connected in tandem with another N3 channel for data or message service, the frequency response at the 3-dB points is 270 to 3350 Hz. The frequency response for an N3 channel connected in tandem with an N2 channel is 250 to 3400 Hz at the 3-dB points. An N3-to-N1, -O, or -ON channel interconnection is permissible but the compandor tracking and overall frequency response is poor. For an N3-to-N1 interconnection, the frequency response is 270 to 3100 Hz at the 3-dB points and the frequency response for an N3-to-O or -ON interconnection is even poorer, 330 to 3000 Hz at the 3-dB points.◀

2. DETAILED CIRCUIT DESCRIPTION

A. Transmit Amplifier

2.01 This circuit, as shown in Fig. 6, is designed to provide amplification to the VF or data signals received from a data set, or speech or data signals received in a through-channel application.

2.02 The circuit consists of three direct-coupled common-emitter stages with negative loop feedback. The input impedance, as determined by transformer T1, provides a match between the nominal 600-ohm VF line impedance and the amplifier input. The resistance pads R1, R2, and R3 and potentiometer R6 serve two functions: (a) They provide the necessary input termination on transformer T1, and (b) with the IN ADJ potentiometer R6, provide a means for adjusting the gain over a range of approximately 14 dB. The other transformer T3 in the circuit coupled with resistor R35 matches the amplifier output circuit to the modulator input circuit on the channel modem unit.

2.03 Negative loop shunt feedback is used for net gain stability and is established by resistors RB1 and RB2. The divider circuit loss at RB1 and RB2 plus the setting of potentiometer R6 determines the forward gain of the circuit.

2.04 Out-of-band high-frequency stability is ensured by two shaping circuits Ra, Ca and Rc, Cb. Low-frequency control is maintained essentially by the emitter bypass capacitors.

2.05 The system performance requirements for the transmit amplifier call for a reasonably flat response over the VF range from 200 to 3450 Hz. Figure 7 shows a typical gain-frequency characteristic.

2.06 The expected VF input power can be as high as −12 dBm; therefore, the power handling capabilities of the transmit amplifier must be adequate to provide the proper gain with margin for signal peaks. Figure 8 shows a typical gain-versus-output power characteristic ▶of the transmit amplifier with a −12 dBm input. The gain remains flat from +4 to approximately +11 dBm; further increase of output power causes distortion shown by decreasing gain.◀

B. Receive Amplifier

2.07 The low-level demodulated VF signals received from the modem unit demodulator are amplified by the receive amplifier circuit shown in Fig. 9.

2.08 The input transformer T4 provides an impedance match between the modem unit demodulator and the amplifier input circuitry. Resistors R41, R45, and R44 and OUT ADJ

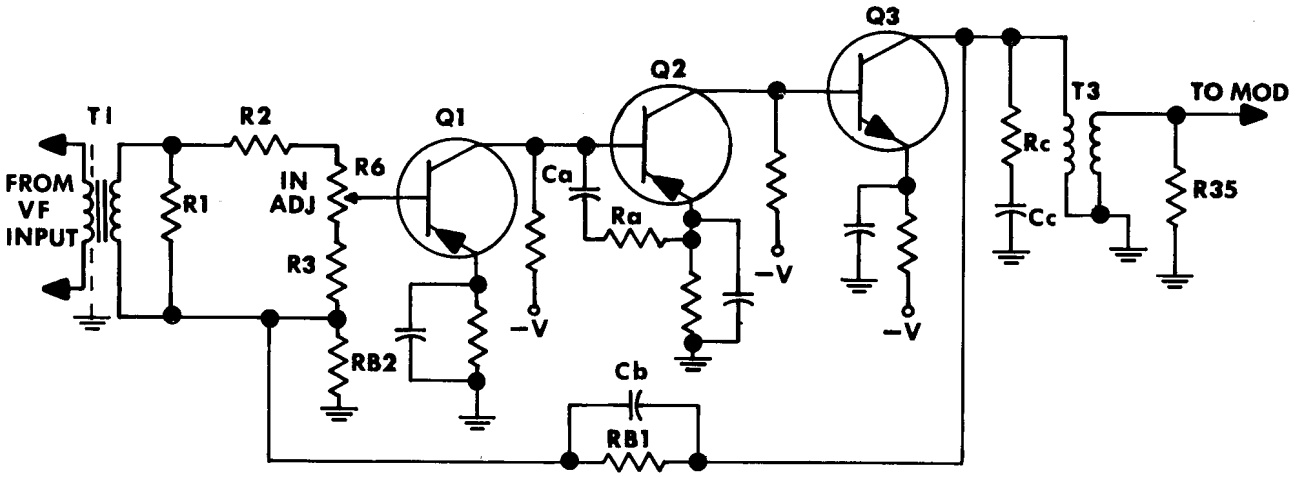


Fig. 6—Transmit Amplifier

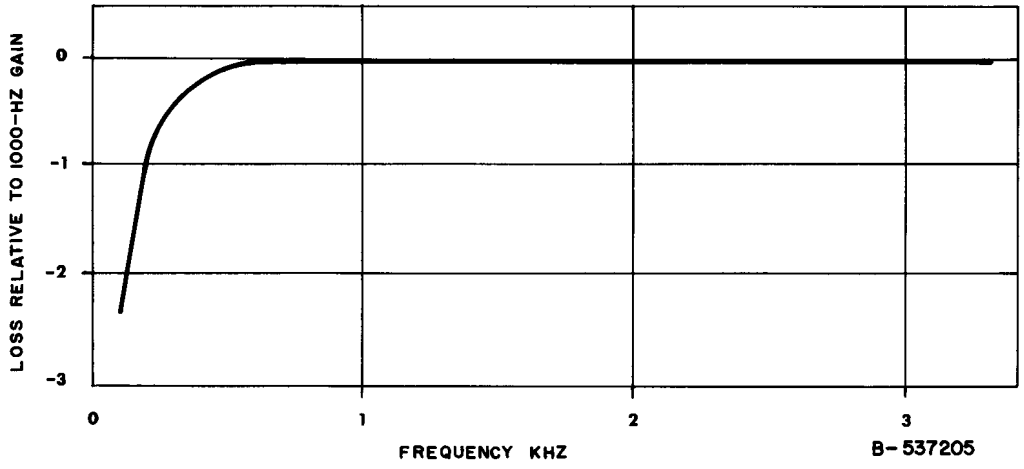


Fig. 7—Gain Versus Frequency—Transmit Amplifier

potentiometer R43 not only provide a termination on transformer T4 but also provide a means of adjusting the amplifier gain over a 16-dB range for lineup purposes.

2.09 The receive amplifier circuit consists of a 3-stage direct-coupled transistor amplifier with negative loop feedback provided through a hybrid connection at the output and series connection at the input. Local series feedback in the form of an unbypassed emitter resistance is used on the output transistor Q6. Resistors RB1, RB2, and RB3 and the hybrid ratio determine the fixed gain of the circuit.

2.10 High-frequency stability is provided by shaping circuits Ra, Ca, Rc, and Cc. Low-frequency

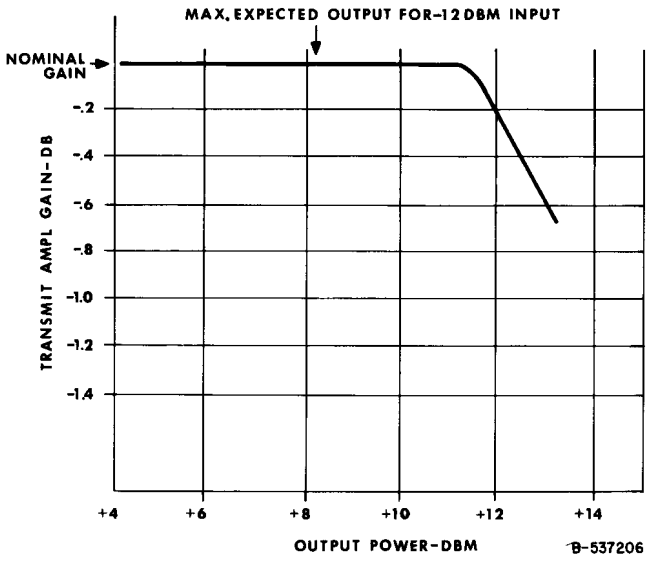


Fig. 8—Gain Versus Output Power—Transmit Amplifier

stability is established through the use of emitter bypass capacitors.

2.11 The frequency response shown in Fig. 10 is consistent with the performance objectives of the N3 terminal. The gain-versus-output power characteristic shown in Fig. 11 indicates sufficient margin to handle the maximum +11 dBm output expected.

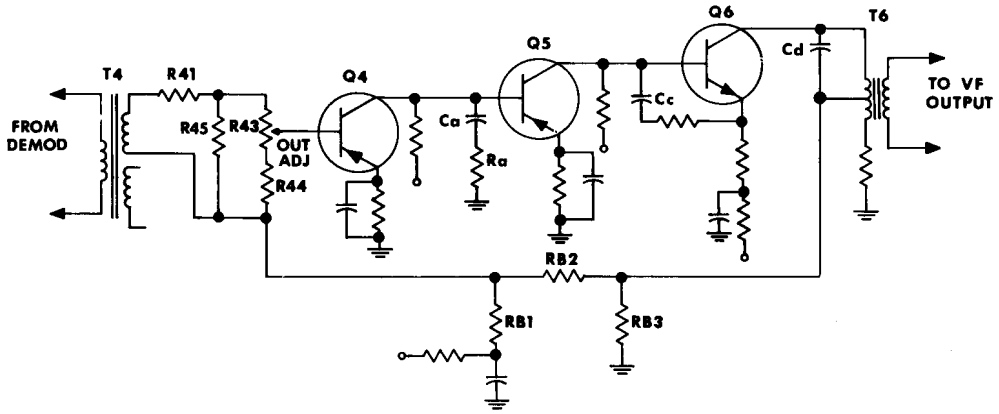


Fig. 9—Receive Amplifier

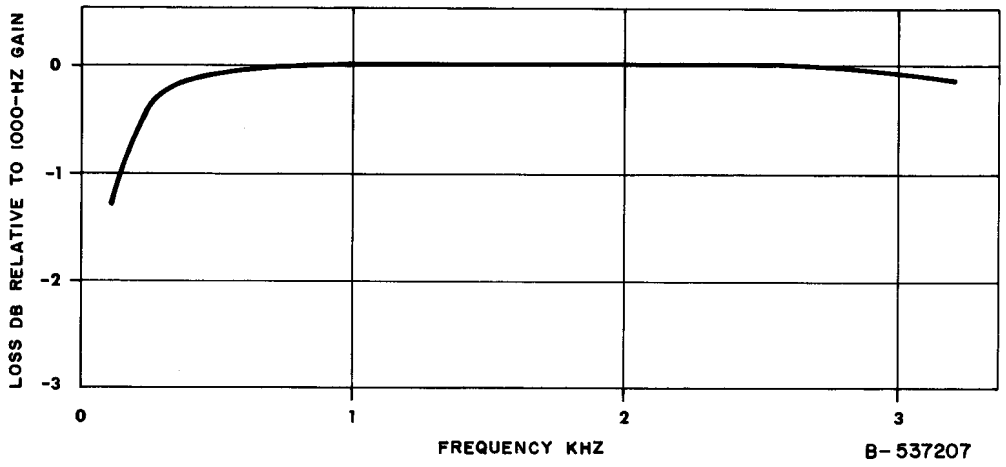


Fig. 10—Gain Versus Frequency—Receive Amplifier

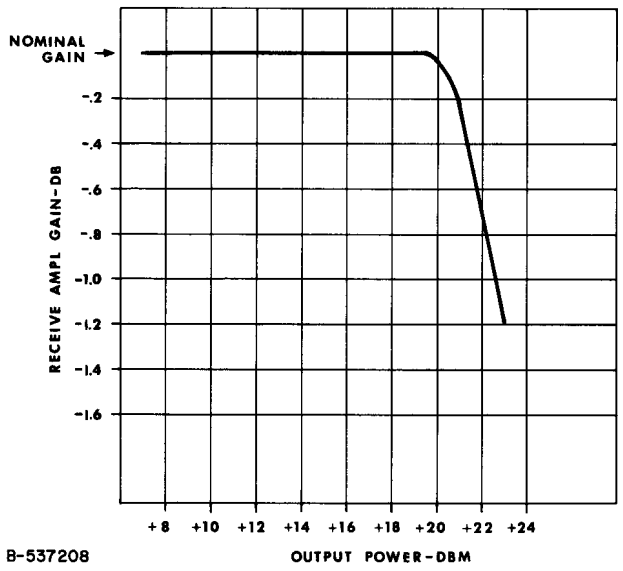


Fig. 11—Gain Versus Output Power—Receive Amplifier

PIN	ASSIGNMENT
1	Frame Ground
2,3	VF Input (transmit)
4,5,6,7	No Connections
9	VF Output (transmit)
8	Bias Test (transmit)
10	No Connection
11	−21 Volts
12	No Connection
13	Circuit Ground
14	Bias Test (receive)
15,16,	VF Output (receive)
17,20,	No Connection
18,19,	VF Input (receive)

3. TESTING AND MAINTENANCE FEATURES

A. Terminal Assignments

3.01 In the N3 VF amplifier unit, all connecting wiring to and from the N3 terminal is made through a 20-pin plug at the rear of the unit. The plug terminal assignments are shown in the following table:

B. Test Points and Adjustments

3.02 Four test points (pin jacks) and two screwdriver adjustments are located on the front panel of the VF amplifier.

3.03 One pair of pin jacks is designated VI1 and VI2 and allows for in-service measurement of the transmit amplifier input power. The other pair of pin jacks VO1 and VO2 allows for in-service measurement of the receive amplifier output power.

3.04 The two screw-type adjustments are designated IN ADJ for the transmit amplifier and OUT ADJ for the receive amplifier. The proper adjustment procedure for the IN ADJ and OUT ADJ is covered in Section 362-900-510.

4. DRAWINGS

4.01 The following schematic and equipment drawings (not attached) show detailed information on the VF amplifier unit:

NUMBER	TITLE
J99300AM-( )	VF Amplifier Unit
J99272CA-( )	▶Through-Channel Connector and Pad Unit◀
SD-97191-01	VF Amplifier Circuits
SD-97186-02	N3 Carrier—Trunk-Release and Make-Busy Circuit and E-Type Signaling Connectors
SD-97401-01	▶Through-Channel Connector and Pad Circuit◀