

TYPE N2 CARRIER TELEPHONE SYSTEM
MESSAGE AND SCHEDULE C AND D PROGRAM
CHANNEL MODEM UNITS

DESCRIPTION

	PAGE		PAGE
1. GENERAL	1	7. TRANSMISSION PERFORMANCE	14
A. System Function of Channel Modem Unit	1	8. DRAWINGS	15
B. Description and Features	2	1. GENERAL	
C. General Circuit Description	3	A. System Function of Channel Modem Unit	
2. MODULATOR CIRCUIT — MESSAGE CHANNEL MODEM UNIT	4	1.01 This section describes the channel modem units used for message and for schedule C and D program service. These units are component parts of the channel equipment of the N2 carrier telephone system.	
A. Circuit Description	4	1.02 This section is reissued to add information on the earlier channel modem units which have been modified to include crystal filters. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.	
B. Modulator Input Pad	4	1.03 A complete 12-channel terminal for the N2 carrier system includes 12 channel modem units. Each channel modem unit is a single plug-in assembly providing two independent circuits: a modulator circuit and a demodulator circuit.	
C. Modulator Filters	4	1.04 A modulator circuit is used in each channel at the transmitting terminal to translate the voice frequencies into 1 of 12 carrier frequency channels for transmission over the high-frequency line.	
D. Modulator	5	1.05 A demodulator circuit is used in each channel at the receiving terminal to select 1 of 12 incoming carrier frequency channels and translate it back to voice frequencies.	
E. Bias Supply and Carrier Level Adjustment	6		
F. Modulator Output Pad	6		
G. Carrier Oscillator	6		
3. MODULATOR CIRCUIT — SCHEDULE C AND D PROGRAM CHANNEL MODEM UNIT	6		
4. DEMODULATOR CIRCUIT — MESSAGE CHANNEL MODEM UNIT	6		
A. Circuit Description	6		
B. Channel Bandpass Filter	6		
C. Regulating Amplifier	8		
D. Demodulator	9		
E. Receiving Low-Pass Filter and Output Transformer	10		
F. DC Amplifier and Control Thermistor	10		
5. DEMODULATOR CIRCUIT — SCHEDULE C AND D PROGRAM CHANNEL MODEM UNIT	13		
6. TESTING AND MAINTENANCE FEATURES	13		
A. Terminal Mounting	13		
B. Test Points	14		
C. Trouble Locating	14		

1.06 A channel modem unit for message circuit use may be replaced by a schedule C and D program channel modem unit. The schedule C and D program channel modem unit provides the same functions as a message channel modem unit and has increased bandwidth.

B. Description and Features

1.07 The channel modem unit for the N2 carrier system is a single plug-in modular unit. For convenience, a modulator and a demodulator have been assembled together and share a 20-pin plug. These two circuits function independently, except for a common connection to the power supply.

1.08 Transistors and silicon diodes have been used to provide highly stable and precise performance, service reliability, and small power requirements. Since long life is anticipated, the transistors and diodes are wired directly into the circuits.

1.09 Transformers, inductors, and other components are of minimum permissible size, consistent with design objectives.

Message Channel Modem Units

1.10 Two versions of message channel modem units have been manufactured. In the earlier unit, J99272F, circuit components are mounted on a poured epoxy board and on two printed wiring boards. The epoxy board is surrounded by a die-cast frame attached to the face plate. One of the printed wiring boards is mounted on the epoxy board, parallel to and spaced from it. The receiving channel bandpass filter is an inductor-capacitor (LC) structure with components placed individually on the other mounting board. The newer message channel modem unit, J99272BF, differs from the earlier unit in that the epoxy board has been replaced by a printed wiring board and the bandpass filter is a crystal network assembled in an individual container. The filters are coded 688A through 688N for channels 1 through 13, respectively. A photograph of the J99272BF channel modem unit is shown in Fig. 1. Since the channel gain frequency response is determined mainly by the receiving channel bandpass filter in the channel modem unit, there should be no problem in using



Fig. 1 — Channel Modem Unit

a J99272BF channel modem unit at one end of the channel and a J99272F channel modem unit at the other end. With the advent of the J99272BF channel modem unit, the J99272F message channel modem unit is rated "Manufacture Discontinued". However, a modification program is underway to replace the LC filters with crystal filters in J99272F units which were manufactured prior to 1964. As a result, the following types of J99272F channel modem units will be in use in the field after the program has been completed.

- (1) Units manufactured prior to 1964 which have been modified to include crystal filters. These units are coded J99272F-1, List 1, 27 through List 13, 39; J99272F-2, List 1, 40 through List 13, 52; and J99272F-2, List 14, 53 through List 26, 65.
- (2) Units manufactured during 1964 which are *not* to be modified to include crystal filters. These units are coded J99272F-2, List 14 through List 26 and are stamped as being manufactured during 1964.
- (3) Units that for various reasons may not have been modified. These units are coded J99272F-1, List 1 through List 13; J99272F-2,

List 1 through List 13; and J99272F-2, List 14 through List 26 and are stamped as having been manufactured prior to 1964.

1.11 All interconnecting wiring to and from the channel modem unit enters via a 20-pin plug mounted on the rear of the assembly. Six pin jacks for monitoring the voice frequency and carrier frequency levels in the unit and a mechanical latch for locking the unit in position are located on the face plate.

1.12 The description of the message channel modem unit circuit and its functions contained in this section pertains to both the modified and unmodified J99272F and the J99272BF units.

Schedule C and D Program Channel Modem Units

1.13 The schedule C and D program channel modem unit is physically similar to the message channel modem units and may be used as a direct replacement at carrier frequencies for channels 3, 4, 5, 6, and 7. It is provided with the same interconnecting plug and pin jacks.

1.14 The same type components used in the message unit are used in the schedule C and D program channel modem unit. The components are mounted on two printed wiring boards. A die-cast frame, identical to the one used for the message channel modem unit, surrounds the larger printed wiring board. The smaller printed board is mounted parallel to and spaced from the larger board. The bandpass filter is an LC structure with components mounted individually on one of the printed wiring boards.

C. General Circuit Description

1.15 The channel modem unit for the N2 carrier system is composed of two independent circuits: a modulator circuit and a demodulator circuit. The essential components of each circuit are indicated in the block diagram in Fig. 2.

1.16 The modulator circuit functions in the following manner. Voice frequencies from the compressor circuit of a compandor unit or from a voice frequency amplifier unit pass through the input pad and low-pass filter to the shunt modulator. Here they are combined with the carrier

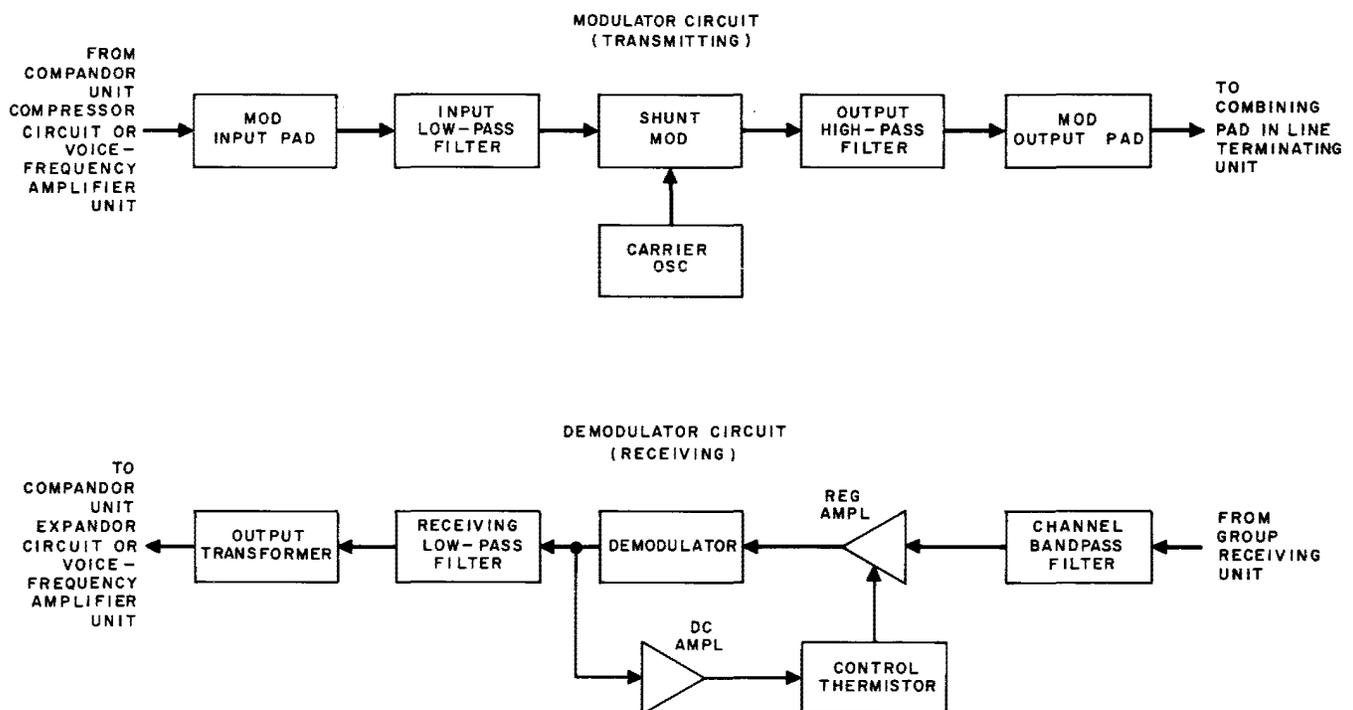


Fig. 2 — Channel Modem Unit, Block Diagram

frequency generated by a crystal-controlled carrier oscillator to produce double-sideband signals on the carrier frequency. The output high-pass filter passes the carrier frequency and its sidebands to the combining pad in the line terminating unit and suppresses transmission of direct current and voice frequencies from the modulator.

1.17 Referring to the demodulator block diagram in Fig. 2, the carrier channel band corresponding to the frequency of the modulator carrier oscillator is selected from the group receiving unit by the channel bandpass filter. The carrier frequency and its sidebands are passed on to the regulating amplifier and to the demodulator. The demodulator restores the sidebands to voice frequencies and rectifies the carrier frequency to produce a dc signal proportional to the carrier power. A portion of the dc signal is fed back through the dc amplifier to operate a gain-regulating thermistor in the amplifier circuit, thus acting to maintain a nearly constant carrier frequency amplitude at the input to the demodulator. The voice frequencies from the demodulator are fed through the receiving low-pass filter to the demodulator output transformer and are passed on to the compandor unit expander circuit, or voice frequency amplifier unit.

1.18 In the N2 carrier system, the channel modem units provide 13 carrier frequency double-sideband channels with carriers spaced at 8-kc intervals from 168 kc to 264 kc, inclusive. A complete terminal will employ 12 channels, generally utilizing channels 2 through 13. Each channel modem unit is factory-set to a prescribed channel through the selection of the quartz crystal unit in the modulator carrier oscillator and the channel bandpass filter in the demodulator circuit.

1.19 The schedule C and D program channel modem units function in the same manner as the message channel modem units but are available only with carriers spaced at 8-kc intervals from 184 kc to 216 kc (channels 3 through 7).

1.20 In order to provide the 200- to 3500-cycle band required for the schedule C and D program service, filters in both the modulator circuit and the demodulator circuit differ from the filters found in the message channel modem units. The only other difference to be noted is the demodulator output transformer, which introduces less low-frequency loss.

2. MODULATOR CIRCUIT — MESSAGE CHANNEL MODEM UNIT

A. Circuit Description

2.01 The modulator circuit accepts voice frequency signals and modulates them with the carrier frequency generated by its crystal-controlled carrier oscillator. The carrier frequency and both sidebands are then transmitted to the combining pad in the line terminating unit. The essential components of the modulator circuit are shown in the block diagram in Fig. 2, and in detail in the circuit schematic in Fig. 3.

B. Modulator Input Pad

2.02 The input pad which is comprised of R1 and R5, is designed to work from the essentially zero output impedance of the compressor or transmitting voice frequency amplifier and to provide a 3000-ohm terminating impedance for the input filter. The pad also serves to reduce the amplitude of the voice frequency input signal to that required at the modulator.

C. Modulator Filters

2.03 The input low-pass filter and the output high-pass filter are designed to present a nearly constant 3000-ohm load impedance to the modulator.

2.04 The input low-pass filter performs two functions: it limits the incoming voice frequency signal to frequencies below 3250 cycles to reduce interchannel interference, and it prevents carrier and sideband frequencies from feeding back to the compressor circuit of the compandor unit or to the voice frequency amplifier. The filter configuration is indicated in Fig. 3. Figure 4 shows a typical loss-frequency characteristic for the filter as measured by applying a constant voltage source at the modulator terminal.

2.05 The output high-pass filter permits transmission of the carrier frequency and its sidebands to the modulator output pad. Voice frequency and dc components from the modulator are attenuated. The configuration of this filter is primarily dictated by the constant resistance approximation required at the modulator rather than the voice frequency attenuation requirements. The low frequency response of the high-pass filter is also shown in Fig. 4.

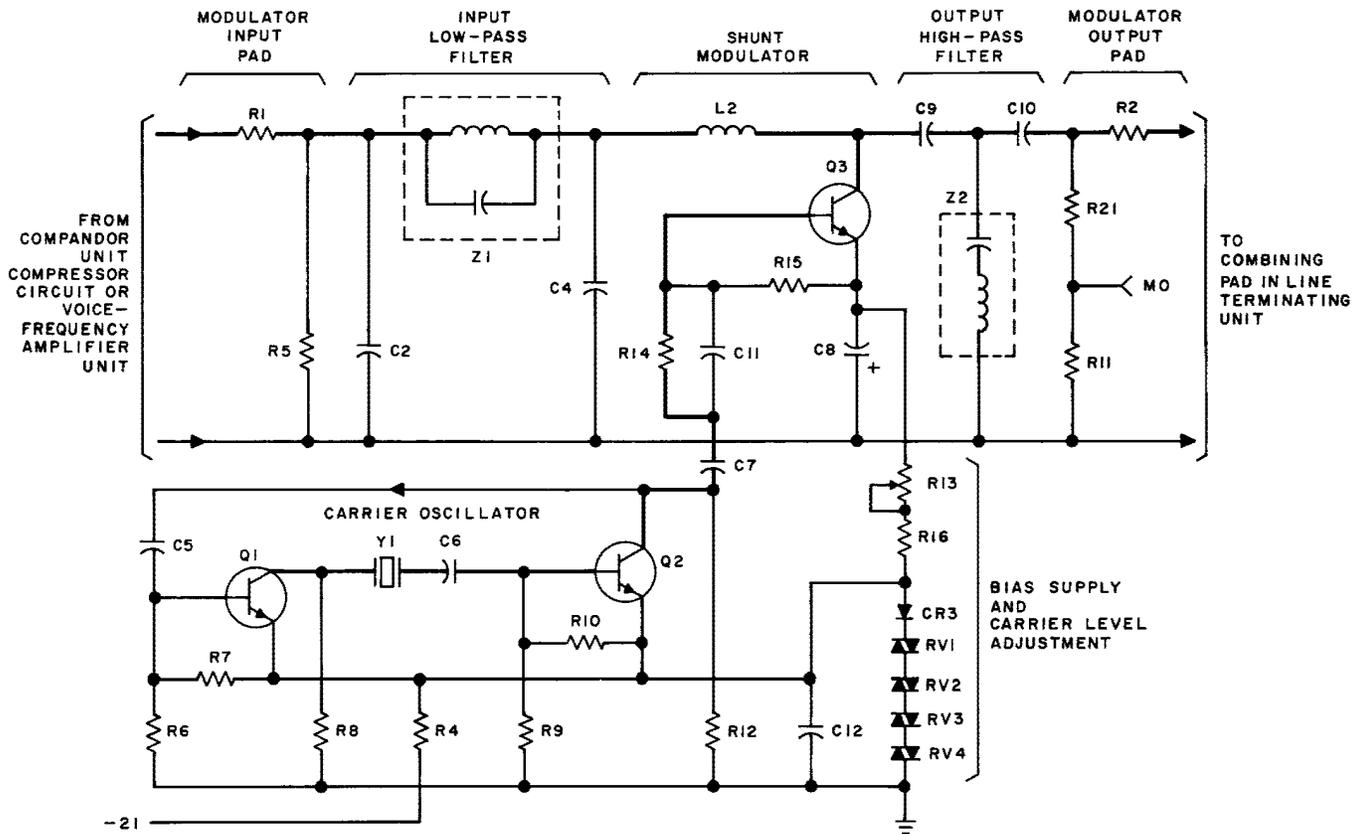


Fig. 3 — Modulator Circuit — J99272BF Message Channel Modem Unit (Crystal Filter)

D. Modulator

2.06 The modulator employed in the N2 channel modem unit is a simple shunt modulator consisting of transistor switch Q3 driven by a square-wave carrier generator (Fig. 3). The transistor switch serves to swing the voltage at its collector between the value of the voice frequency signal voltage, when the transistor is non-conducting (open switch), and the magnitude of the bias voltage, when the transistor is in saturation (switch closed). This collector voltage has the form:

$$V(t) = \left(\frac{i_s}{G} - E \right) f(t) + E$$

where:

- i_s = voice frequency signal current
- G = conductance of constant resistance filter pair
- E = dc bias voltage on transistor

and

$$f(t) = 1/2 + 2/\pi \cos ct - 2/3\pi \cos 3ct + \dots$$

representing the Fourier series of the square-wave carrier frequency generator. For a sinusoidal input current:

$$i = I \cos \omega t, V(t) \text{ becomes:}$$

$$V = 1/2 E - \frac{2E}{\pi} \cos ct + \frac{I}{2G} \cos \omega t + \\ I/\pi G \cos (c - \omega) t + \\ I/\pi G \cos (c + \omega) t + \dots$$

This voltage wave is seen to contain a dc term, a carrier frequency term (the amplitude of which is proportional to the dc bias voltage), a voice frequency term, and the upper- and lower-sideband terms which are proportional to the input signal. The carrier frequency and its sidebands pass through the output filter to the modulator output pad and the combining pad in the line terminating unit. Some harmonics of the carrier frequency and its sidebands are also produced by the modulator and are passed to the group equipment where

they are suppressed in the bandpass filter of the group transmitting unit.

E. Bias Supply and Carrier Level Adjustments

2.07 The amplitude of the carrier from the modulator is controlled by the dc bias voltage applied to the transistor switch. This bias voltage is established primarily by the voltage drop across the reference diode CR3 and the temperature compensating varistors RV1 through RV4. This voltage remains constant to ± 0.1 db over the operating temperature range and for supply voltage variations up to ± 10 percent of nominal. In the crystal filter channel modem unit, an additional voltage drop across the series combination of variable resistor R13 and fixed resistor R16 permits factory adjustment of the dc bias, and hence, the carrier level, by varying R13, as required. In the LC filter channel modem unit, a parallel combination of five resistors, R16 through R20, provides this voltage drop; factory adjustment of the dc bias is accomplished by clipping R17 through R20, as required.

F. Modulator Output Pad

2.08 The output pad, when connected to the combining pad in the line terminating unit, provides a 3000-ohm termination for the output high-pass filter and acts as an isolating pad for the paralleling of all modulator outputs at the line terminating unit. A low impedance tap on the shunt resistor is brought to a test point on the front panel for monitoring the modulator output.

G. Carrier Oscillator

2.09 The carrier frequency for the modulator circuit is generated by the transistor oscillator shown in Fig. 3. This oscillator circuit is a 2-transistor multivibrator cross-coupled from collector to base through capacitor C5 and quartz crystal unit Y1 (with C6 in series with the crystal). The oscillator circuit produces a square-wave output voltage, the frequency of which is controlled by the quartz crystal unit. This frequency is one of 13 carrier frequencies spaced at 8-kc intervals from 168 kc to 264 kc. The variation of transmitted carrier frequency in any channel is expected to be less than 70 parts per million.

3. MODULATOR CIRCUIT — SCHEDULE C AND D PROGRAM CHANNEL MODEM UNIT

3.01 The modulator and carrier frequency oscillator circuits are identical to those described in Part 2 of this section for the message channel modem units equipped with LC filters. The input pad and the input low-pass filter are different and are covered in the following paragraphs.

3.02 The input pad of the modulator, shown in Fig. 5, consists of R1, R3, and R5 along with a special shaping network consisting of L1 and C1. This pad and equalizing network present the same input impedance as a message modulator circuit and provide voice frequency predistortion to the input filters.

3.03 The input low-pass filter has two sections compared to one in the message channel modem units and has the shaping required for C and D program material. No changes were made in the configuration of the output high-pass filter shown in Fig. 3; however, values of some components were changed in order to meet C and D program requirements. These filter characteristics are shown in Fig. 4.

4. DEMODULATOR CIRCUIT — MESSAGE CHANNEL MODEM UNIT

A. Circuit Description

4.01 The demodulator circuit is the receiving portion of the N2 channel modem unit assembly. As shown in the block diagram in Fig. 2, this circuit includes the channel bandpass filter, the regulating amplifier, the demodulator or detector, the receiving low-pass filter, and output transformer, plus the control circuit for the regulating amplifier.

B. Channel Bandpass Filter

4.02 The channel bandpass filter selects 1 of 12 carriers and its sidebands (the sidebands occupy approximately 4 kc on either side of the carrier) from the group receiving circuit output and transmits them to the input pad of the regulating amplifier. All 12 channel bandpass filters in a complete system are paralleled at their inputs

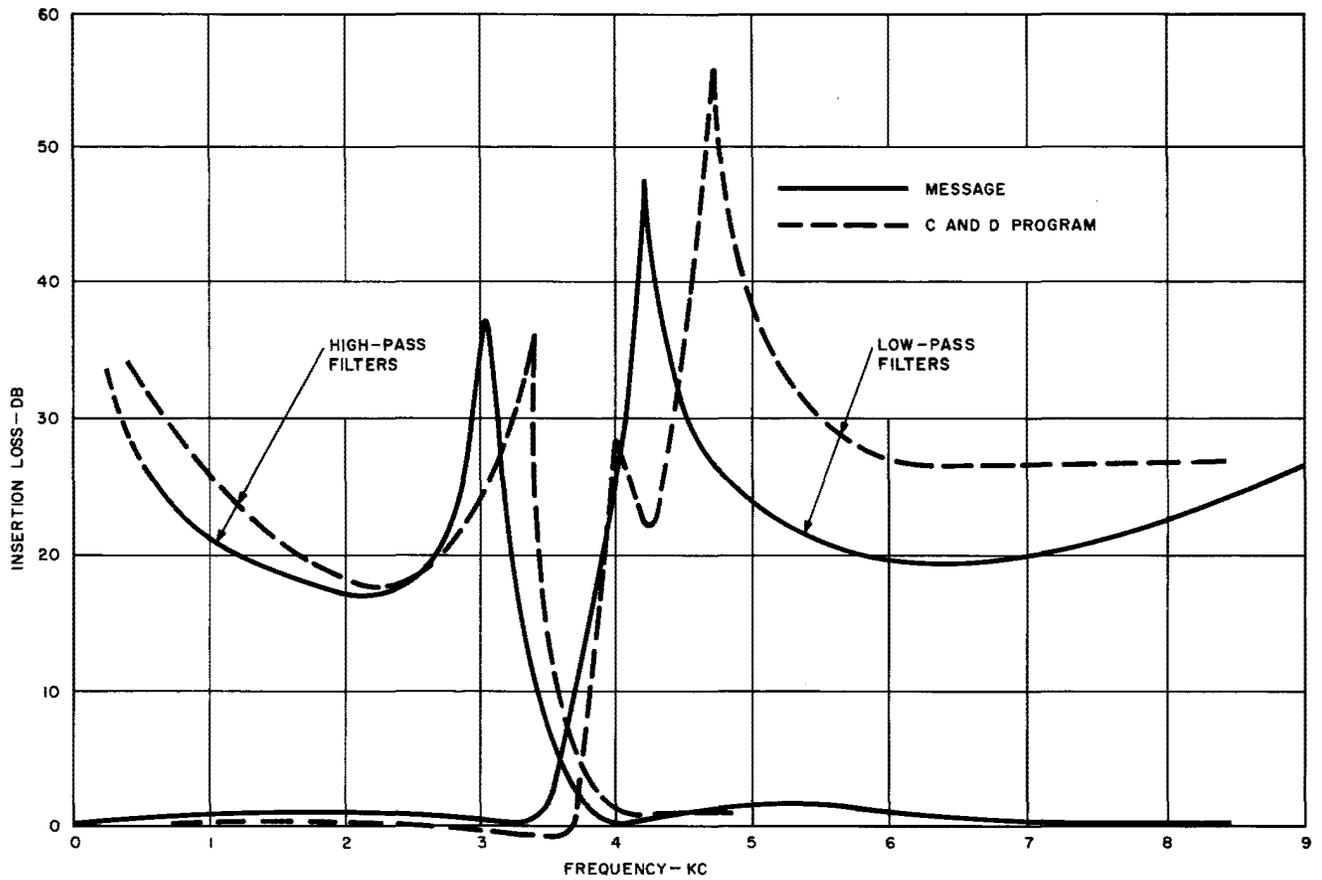


Fig. 4 — Loss Versus Frequency Characteristics of Message and Schedule C and D Program Modulator Low-Pass and High-Pass Filter Pairs

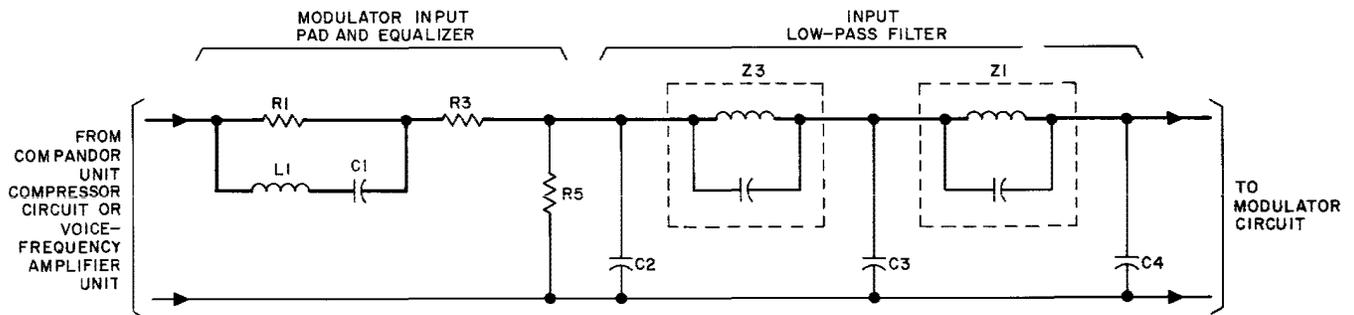


Fig. 5 — Schedule C and D Program Modulator Input Circuit

and work from the low output impedance of the group receiving circuit. Each filter presents a nominal 75-ohm load impedance to the group receiving circuit at its carrier frequency. The input impedance of the filter increases rapidly for signals outside the band of interest. The LC filter is terminated in 1200 ohms and the crystal filter is terminated in 700 ohms at the amplifier input.

Since each filter is designed on a constant voltage input basis, the effect of paralleling is negligible.

4.03 The unmodified J99272F message channel modem unit and the J99272AG schedule C and D program channel modem unit are equipped with the same LC structure receiving bandpass

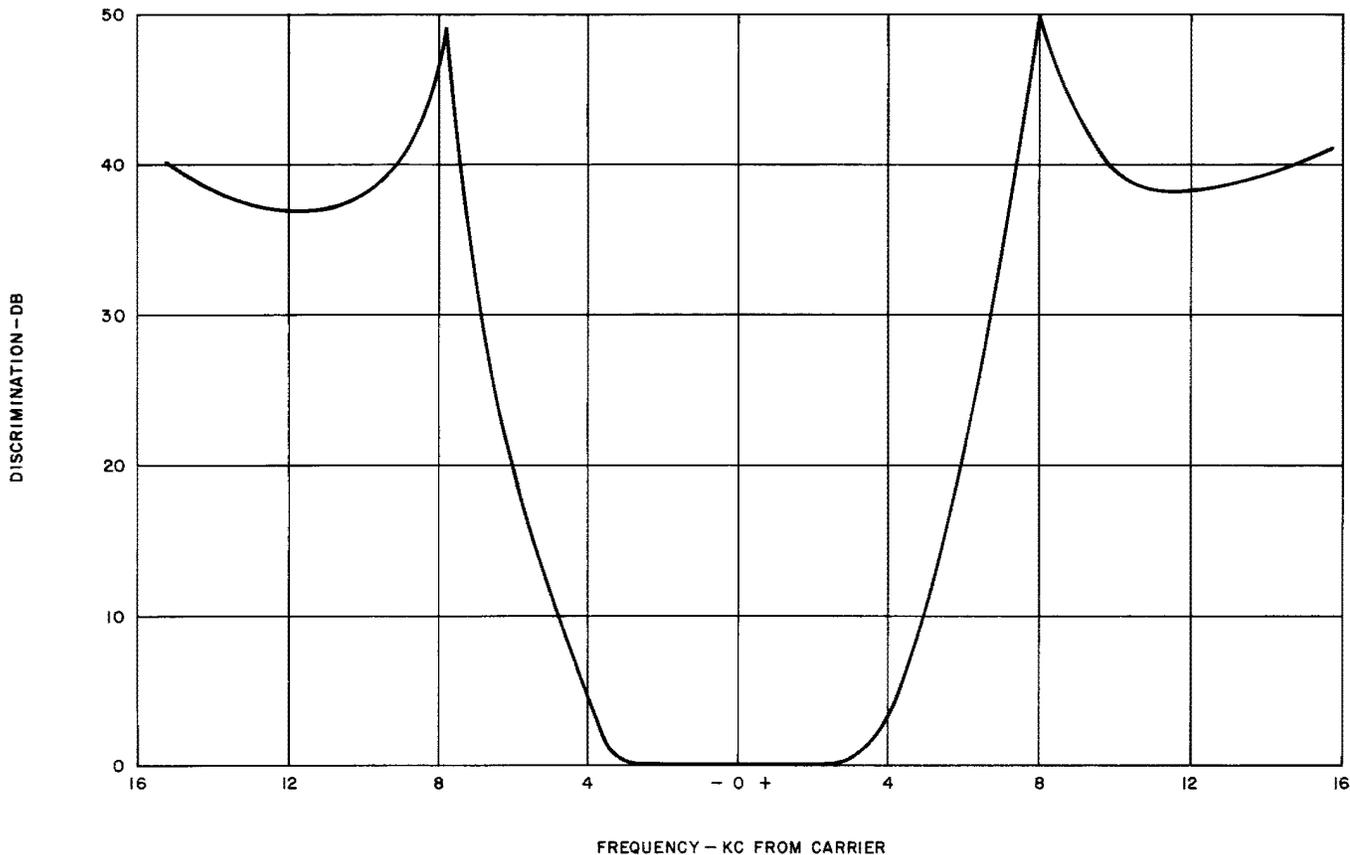
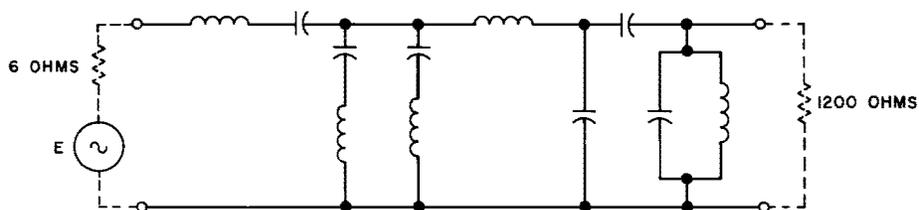


Fig. 6 — Message and Schedule C and D Program Channel LC Bandpass Filter — Schematic and Typical Loss Versus Frequency Characteristic

filter. The filter schematic and a loss-frequency characteristic are shown in Fig. 6. Attenuation to adjacent carriers is expected to remain greater than 35 db during the life of the unit. The J99272BF and the modified J99272F channel modem units are equipped with the same crystal receiving bandpass filters. The schematic and loss-frequency characteristic are shown in Fig. 7 and the attenuation to adjacent carriers is expected to remain greater than 45 db. Both LC and crystal

filters transmit a band of frequencies ± 3250 cps from the carrier with less than 1-db distortion.

C. Regulating Amplifier

4.04 The regulating amplifier for the J99272BF unit is shown in detail in Fig. 8. The output from the channel bandpass filter is transmitted through the filter terminating pad to the input of the regulating amplifier. This amplifier

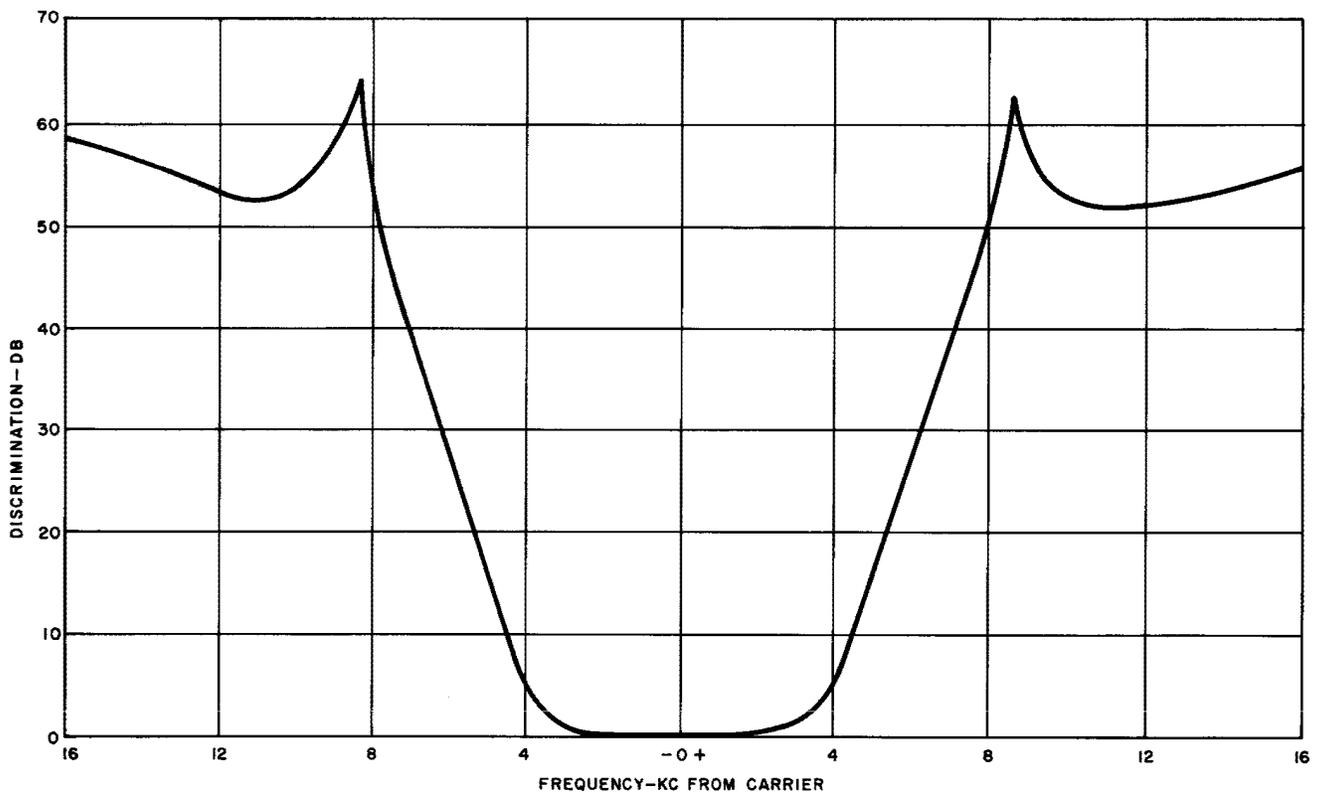
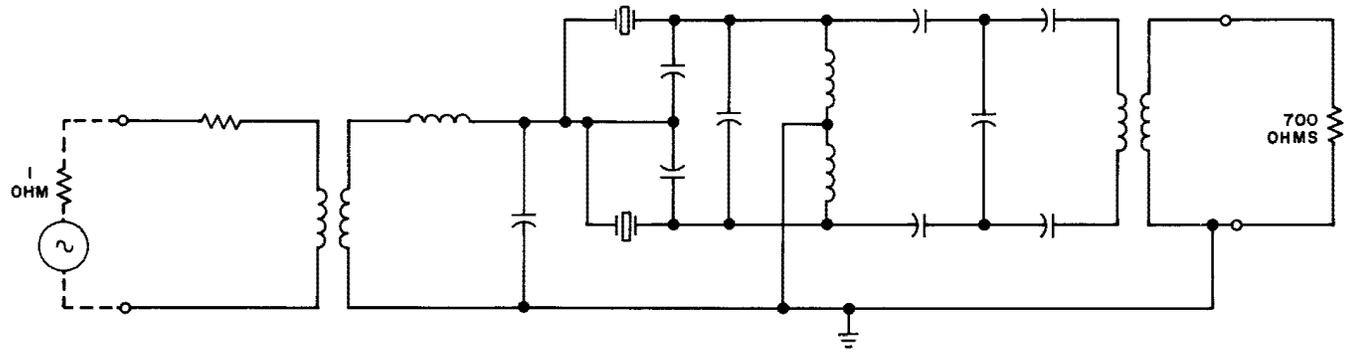


Fig. 7 — Message Channel Crystal Bandpass Filter — Schematic and Typical Loss Versus Frequency Characteristic

incorporates automatic gain control to maintain a relatively constant output power with large changes in the input power. Gain control is obtained by using part of the dc output of the demodulator to control the resistance of a directly heated thermistor in the emitter circuit of the first stage of the 2-transistor amplifier. The gain of the first stage is approximately proportional to the ratio of its equivalent generator impedance to

the thermistor resistance (which determines the amount of negative feedback). Hence, the gain will vary inversely with the value of the thermistor resistance.

D. Demodulator

4.05 The channel demodulator shown in Fig. 8 consists of two germanium diodes and two mica capacitors connected as a full-wave volt-

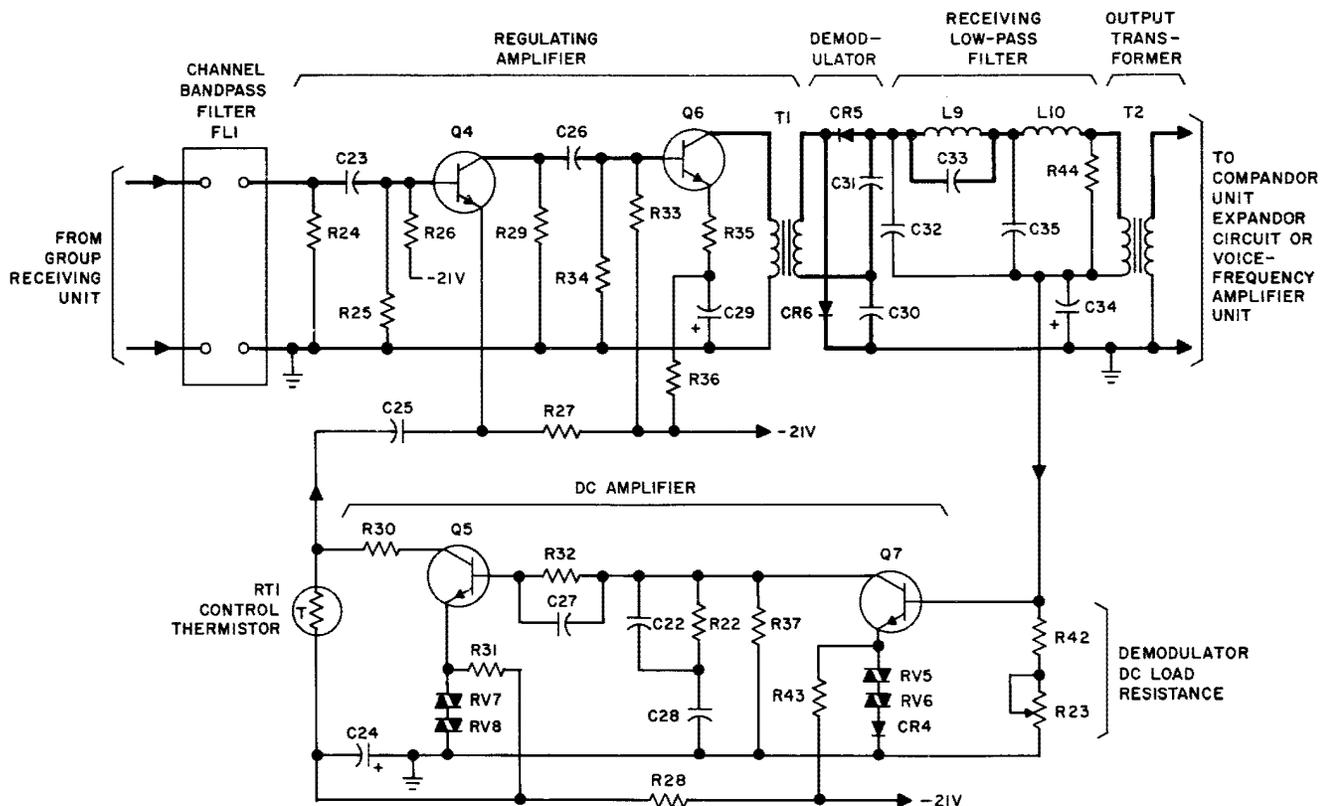


Fig. 8 — Demodulator Circuit — Message Channel Modem Unit (J99272BF) (Crystal Filter)

age-doubler rectifier. The input impedance of the demodulator is 1500 ohms. Its output impedance is approximately 25,000 ohms. The carrier power at its input is +11.5 dbm.

4.06 The demodulator receives the carrier frequency and sidebands from the regulating amplifier and demodulates the sidebands against the carrier by rectifier action to produce direct current (corresponding to the steady value of carrier at its input), voice frequency currents corresponding to the sidebands, and a carrier leak which is filtered out by the receiving low-pass filter. The dc output, which is a measure of the carrier power, is used to control the operation of the regulating amplifier. The dc output is approximately -7.0 volts, the exact voltage being dependent upon the manufacturing variations in the reference diode in the dc amplifier circuit.

4.07 The voice frequency output of the demodulator is transmitted to the receiving low-pass filter and output transformer and then to the

expandor circuit of the compandor unit or to the receiving voice frequency amplifier input. The voice frequency output level is a function of the demodulator dc load resistance and is factory adjusted by clipping resistors R38 through R41 which parallel the main dc load resistor R42 in the modified or unmodified J99272F channel modem unit or by varying R23 which is in series with R42 in the J99272BF unit (shown in Fig. 8). The voice frequency power at the transformer output is factory adjusted to -5.0 dbm with a nominal amplitude carrier input signal modulated by a standard line-up tone (1000 cycles at zero system level).

E. Receiving Low-Pass Filter and Output Transformer

4.08 The receiving low-pass filter transmits voice frequencies below 3250 cycles from the demodulator through the output transformer to the expandor circuit or voice frequency amplifier input. The loss-frequency characteristic of the filter is shown in Fig. 9. The filter is driven

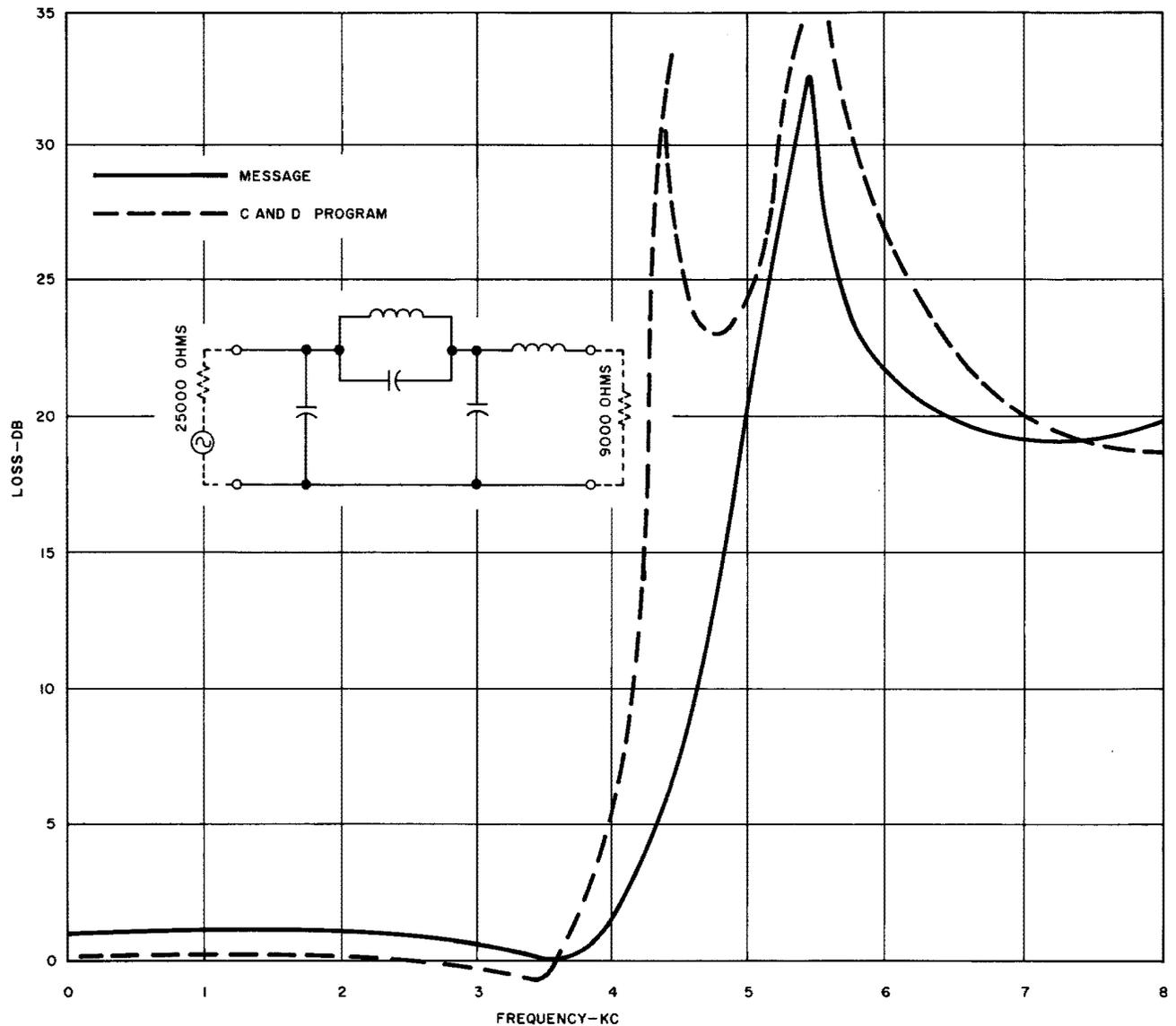


Fig. 9 — Message and Schedule C and D Program Receiving Low-Pass Filters — Loss Versus Frequency Characteristic

from the 25,000-ohm demodulator output impedance and is terminated by the output transformer which presents a 9000-ohm impedance to the filter when connected to the following circuit. The filter is designed to equalize the channel bandpass filter characteristic in the 2500- to 3250-cycle range. In the attenuating range, the loss peak at 5400 cycles is designed to suppress an unwanted product resulting from demodulation of adjacent channel 2600-cycle inband signaling tone.

F. DC Amplifier and Control Thermistor

4.09 Action of the regulator circuit can be described as follows (Fig. 8). The carrier frequency and its sidebands are transmitted through the regulating amplifier to the demodulator. The dc output of the demodulator is a voltage of negative polarity developed across a load resistance and is proportional to the carrier amplitude. In both the modified and unmodified

J99272F message and the J99272AG schedule C and D program channel modem units, the load consists of five paralleled resistors, R38 through R42. Factory adjustment is made by clipping the resistors R38 through R41, as required. These resistors are not shown in Fig. 8 since this figure shows the demodulator circuit for the J99272BF message channel modem unit. In this unit the load is a series combination of variable resistor R23 and fixed resistor R42. Factory adjustment is made by varying R23, as required. This negative voltage is applied to the base of transistor Q7 in the first stage of the dc amplifier. The emitter of this transistor is held at a constant negative potential by the voltage drop across the reference diode CR4 and its temperature compensating varistors RV5 and RV6. If we define:

R_L = dc load resistance of demodulator

$|V_C|$ = Magnitude of dc component of demodulated carrier developed across R_L ,

$|V_R|$ = Magnitude of reference voltage at emitter of Q7,

V_{BE} = Emitter junction voltage of Q7, approximately 0.7 volt

then, for nominal carrier level at the amplifier output, $|V_R| - |V_C|$ is slightly larger than V_{BE} , the emitter junction of Q7 is forward biased, and base current flows into Q7; thus:

$$I_b = \frac{|V_R| - |V_C| - V_{BE}}{R_L}$$

This current is amplified by Q7 and Q5 and passes through the thermistor. The resistance of the thermistor is controlled by the current flowing through it. A decrease in the carrier input level causes a decrease in $|V_C|$, thus increasing the forward bias on Q7 and, hence, the current through the thermistor. The thermistor resistance decreases causing the amplifier gain to increase. Conversely, increasing the carrier input level results in less current through the thermistor allowing it to cool and increase resistance value, thus reducing the amplifier gain.

4.10 Maximum current through the thermistor is limited to approximately 8 milliamperes by R30 in the collector circuit of Q5, correspond-

ing to a thermistor resistance value of approximately 150 ohms. The minimum current is determined by the I_{CO} of transistor Q5 which is held to less than 0.1 milliampere by reverse-biasing the emitter junction of Q5 in the nonconducting state. This minimum current corresponds to a thermistor resistance ranging from 30,000 ohms at 25° C to 10,000 ohms at 60° C. To minimize this ambient temperature effect, the thermistor is shunted by 5000 ohms in the emitter circuit of Q4. This effective resistance range of the thermistor produces a change in gain of approximately 26 db in the regulating amplifier.

4.11 The performance of the channel regulator is shown by the curve in Fig. 10, which shows the variation in output level of a 1000-cycle test tone for changes in carrier and sideband levels at the input to the channel bandpass filter. The stiffness of the control circuit is seen to be greater than 40 to 1; i.e., the change in output is less than 0.5 db for a 20-db change in carrier input level.

4.12 The reaction time of the channel regulator is primarily determined by the time constant of the control thermistor and is different in the two directions of change. For example, an increase of 10 db in the carrier level will require a period of approximately 2 minutes for the regulator to stabilize. Decreasing the carrier level by 10 db requires 30 seconds for stabilization.

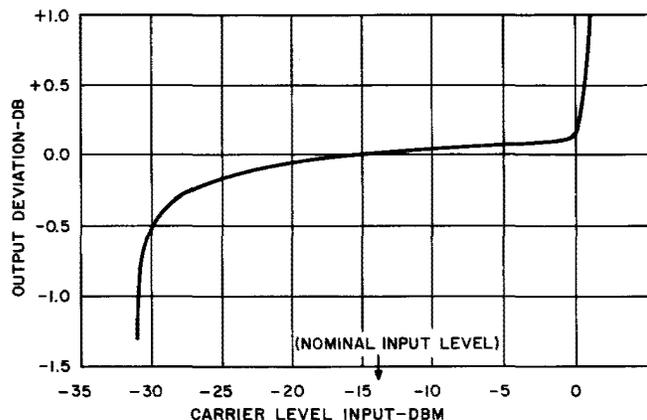


Fig. 10— Channel Regulator — Typical Input Versus Output Deviation

5. DEMODULATOR CIRCUIT — SCHEDULE C AND D PROGRAM CHANNEL MODEM UNIT

5.01 With the exception of the receiving low-pass filter and the output transformer, the schedule C and D program demodulator circuit is identical to the message demodulator circuit.

5.02 The receiving low-pass filter transmits voice frequencies below 3500 cycles received from the demodulator (Fig. 11). The driving impedance of the demodulator is identical in both message and schedule C and D program channel modem units. The loss-frequency characteristic of the schedule C and D program low-pass filter is shown in Fig. 9. The second loss peak, located at 5400 cycles, functions as in the message demodulator to reduce interference from adjacent channel 2600-cycle inband signaling tones.

5.03 The output transformer used in the message channel program unit was replaced with a new transformer having less low-frequency loss. This allows a voiceband of from 200 to 3500 cycles to be received.

6. TESTING AND MAINTENANCE FEATURES

A. Terminal Mounting

6.01 The terminal mounting consists of three aluminum castings. These aluminum castings are divided into three cells. Each cell has a width equivalent to four modules. The frames in which the equipment units are mounted slide between top and bottom guide rails cast in the mounting and are locked in place by a latch. The channel modem unit occupies one modular width.

6.02 A complete 12-channel N2 carrier terminal includes 12 channel modem units. Each channel modem unit, consisting of a modulator circuit and a demodulator circuit, is factory adjusted to one of 13 carrier frequencies shown in Table A. A complete terminal will generally include channels 2 through 13 with channel 1 being used as a spare unit.

**TABLE A
CHANNEL FREQUENCY ASSIGNMENTS**

CHANNEL NO.	CHANNEL FREQUENCY KC
1	168
2	176
3	184
4	192
5	200
6	208
7	216
8	224
9	232
10	240
11	248
12	256
13	264

6.03 The schedule C and D program channel modem unit is available only for channels 3 through 7 of Table A.

6.04 The channel modem units are plug-in units, all interconnecting wiring being made through a 20-contact receptacle. The terminal assignments are shown in Table B.

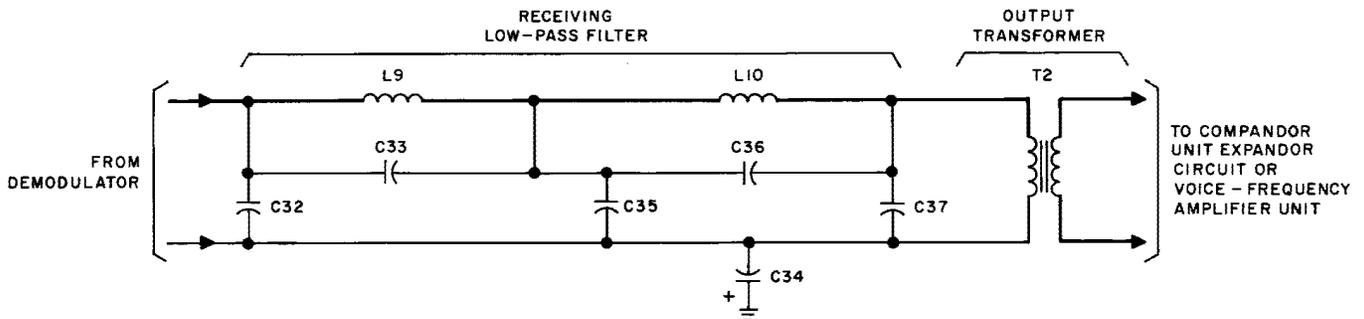


Fig. 11 — Schedule C and D Program Demodulator Output Circuit

TABLE B
CONNECTOR TERMINAL ASSIGNMENTS

PIN	TERMINAL ASSIGNMENTS
1	Shield ground
2	No connection
3	Modulator input
4	No connection
5	No connection
6	No connection
7	Modulator output
8	No connection
9	Modulator ground
10	No connection
11	-21 volt supply
12	No connection
13	Demodulator ground
14	No connection
15	Demodulator input
16	Channel filter output
17	Demodulator output
18	No connection
19	Demodulator output ground
20	No connection

B. Test Points

6.05 Test points are furnished in each channel modem unit for measuring both voice frequency levels and carrier frequency levels for line-up and trouble localizing purposes. Pin jacks mounted in the front panel permit bridging the circuits with an electronic voltmeter.

C. Trouble Locating

6.06 It is expected that a system trouble localized to a channel modem unit will be cleared by removing the faulty unit and replacing it with a spare.

7. TRANSMISSION PERFORMANCE

7.01 Since nearly all voice frequency and carrier channel filtering is located in the channel modem unit, this unit contributes the major part of the overall voice frequency transmission characteristic of a typical N2 channel. Figure 12 shows the voice frequency transmission characteristic of typical modulator circuits and demodulator circuits connected in tandem for both message and schedule C and D program channel modem units.

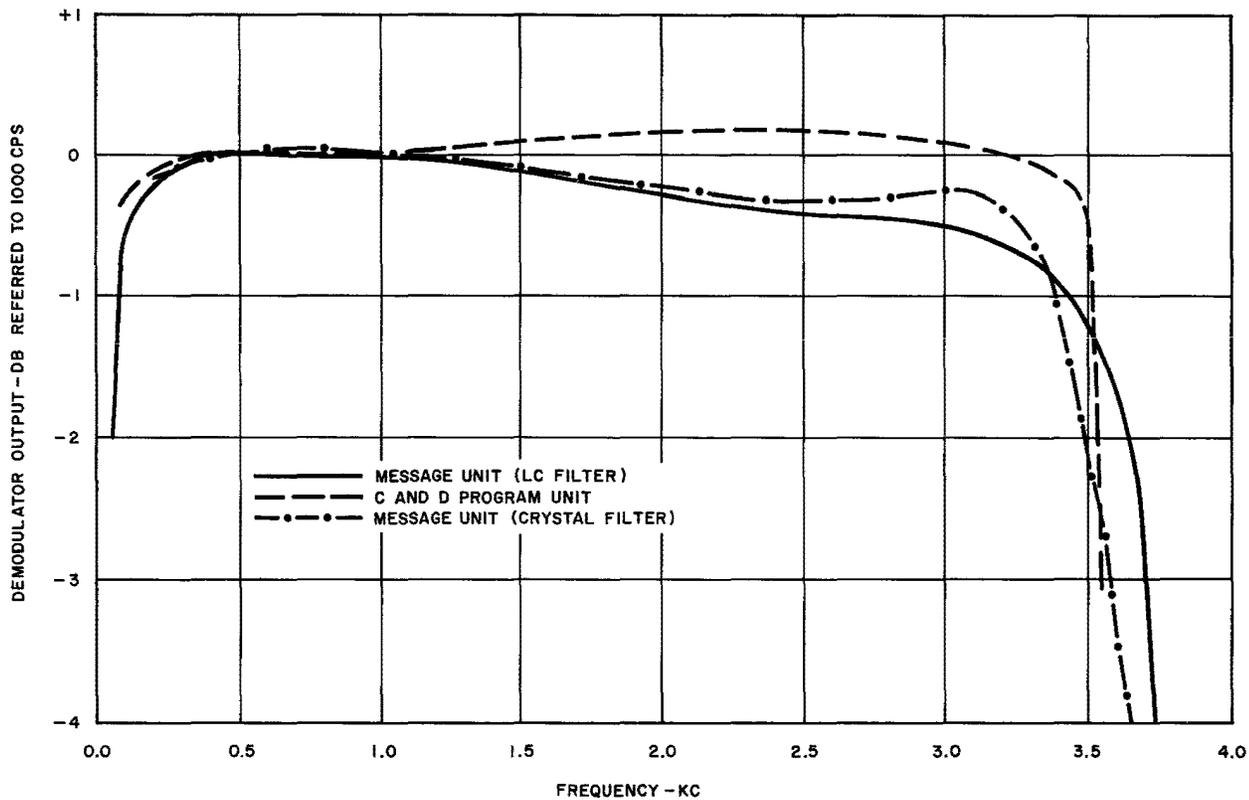


Fig. 12 — Typical Transmission Characteristics of Message and Schedule C and D Program Channel Modem Units (Modulator In To Demodulator Out)

8. DRAWINGS

8.01 The following schematic and equipment drawings (Table C) show detailed information.

TABLE C

SCHEMATIC DRAWING	EQUIPMENT DRAWING	LIST NOS.	TYPE OF UNIT
SD-95299-01 Issue 1 through 6	J99272F-1 J99272F-2	L1 to L13 { L1 to L13 L14 to L26	Message Channel Modem Unit — Unmodified (LC Filter)
SD-95299-01 Issue 7 or later	J99272F-1 J99272F-2	L1, 27 to L13, 39 { L1, 40 to L13, 52 L14, 53 to L26, 65	Message Channel Modem Unit — Modified (crystal filter)
SD-95299-02	J99272AG-()	L1 to L5	Schedule C and D Program Channel Modem Unit (LC Filter)
SD-95299-03	J99272BF-()	L1 to L13	Message Channel Modem Unit (crystal filter)