# HIGH SEAS AND OVERSEAS RADIO
# LINCOMPEX MARK II
# TESTS
# RECEIVE UNIT

This section contains test and alignment procedures for the Lincompex Mark II receive unit. It is assumed that personnel have a general knowledge of the Lincompex system before performing these charts. A general description of the Lincompex transmitter and receiver units is covered in Section 403-310-101 and Section 403-310-102.

This maintenance section is divided into two categories. The first covers the step-by-step check of the overall alignment in which the signal levels of the control path and the speech path are tested for proper magnitude. The second group of charts test the individual modules and submodules.

**CHART** **PAGE**



## CHART 1

## STEP-BY-STEP CHECK OF OVERALL ALIGNMENT

**APPARATUS:**

1—Electronic Frequency Counter with an input impedance high compared with 600 ohms to measure frequencies between 200 and 6000 Hz to an accuracy of 0.1 Hz

2—Tone Sources, each with a minimum frequency range from 1 kHz to 3 kHz and each with a 600-ohm attenuator to vary the output level over the range +5 to −60 dBm

1—DC Millivoltmeter capable of measuring between 10 mV and 1.0 volt

**CHART 1 (Cont)**

**APPARATUS (Cont):**

2—High-impedance Audio Level Meters to measure up to +7 dBm

***Note:*** The signal level diagrams (Fig. 1 and 2) are useful in performing these tests.

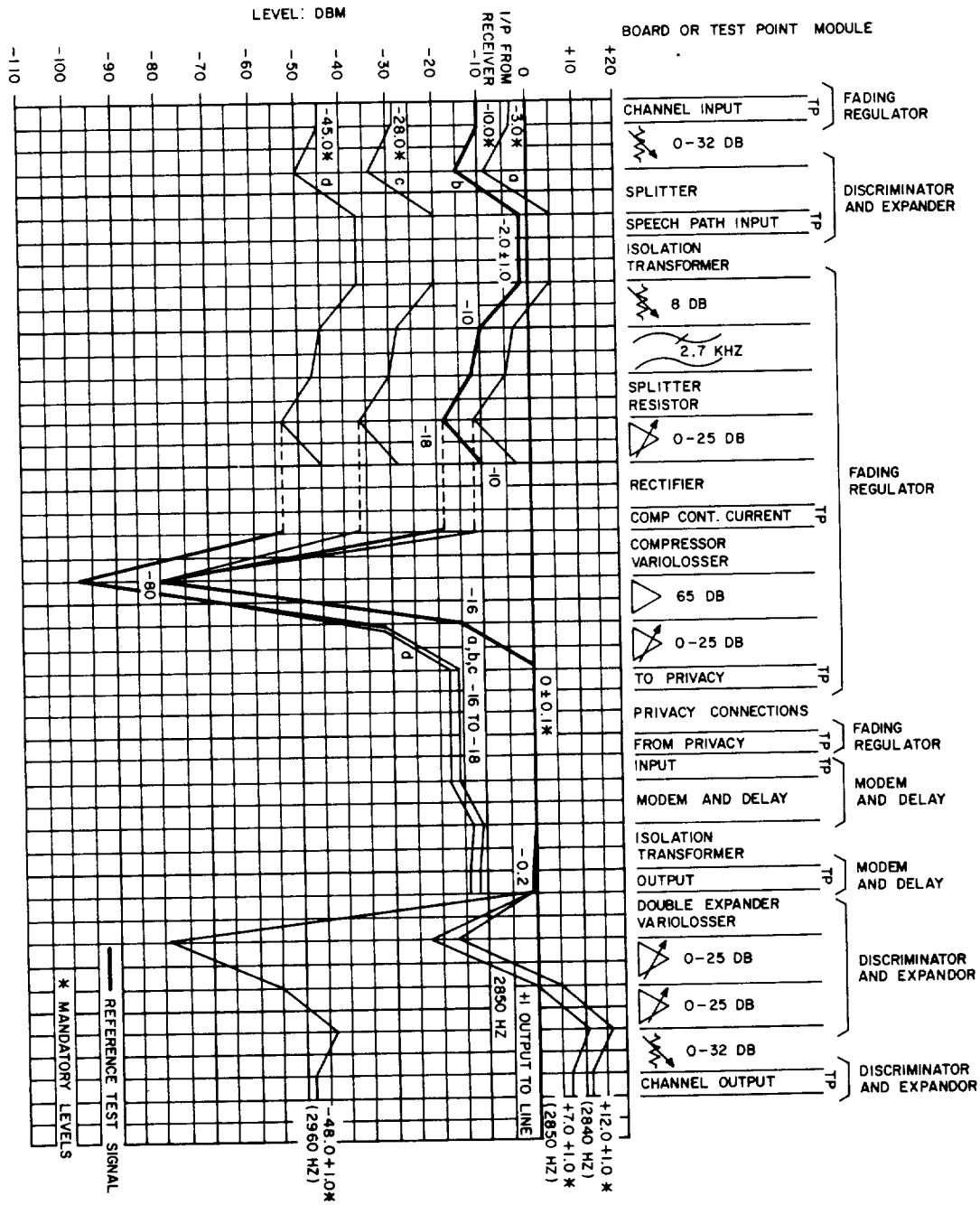


**Fig. 1—Speech Path Level Diagram**

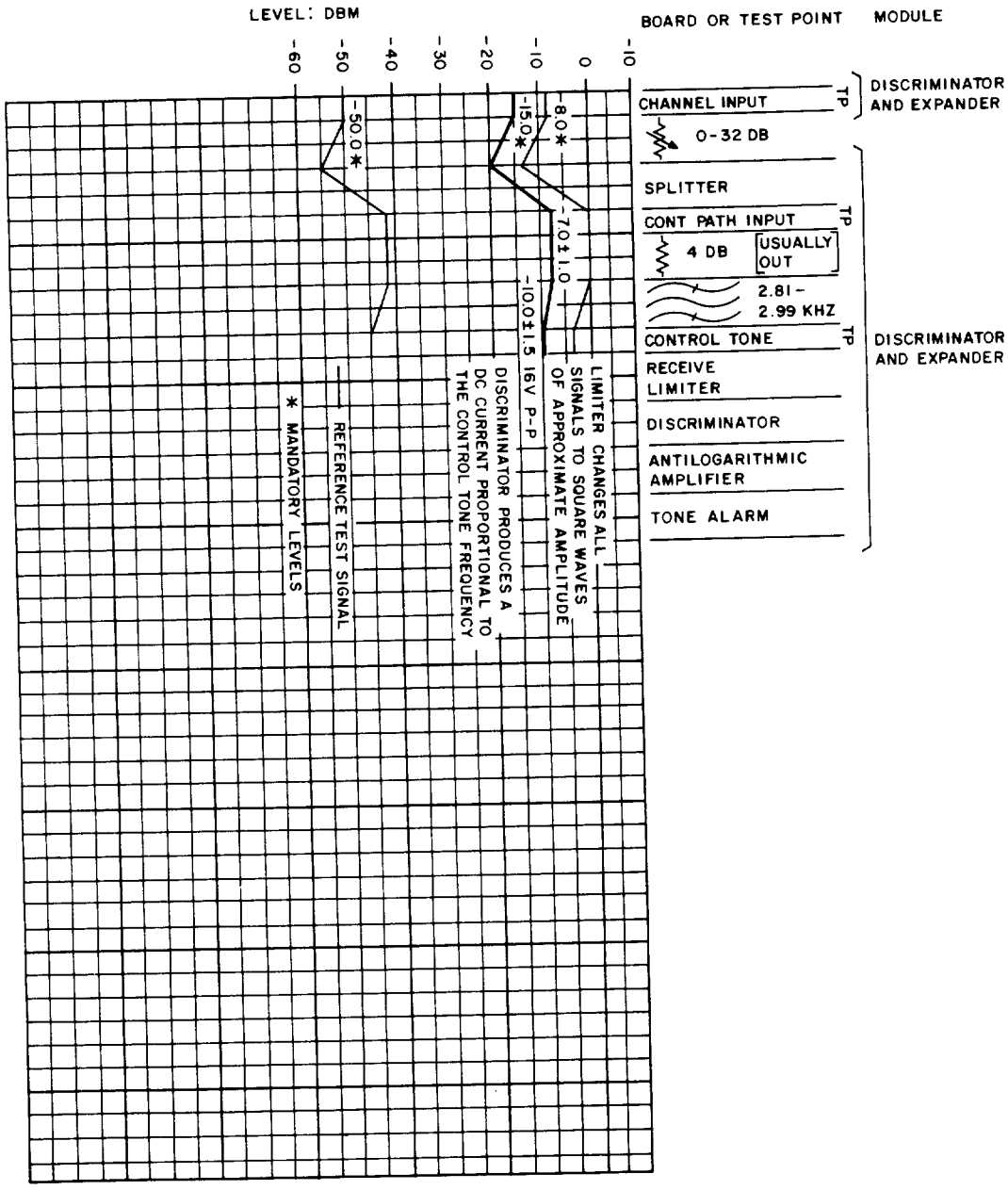


**Fig. 2—Control Path Level Diagram**

**CHART 1 (Cont)**

| STEP | PROCEDURE |
|---|---|
| | **Speech Path Check** |
| 1 | Ensure that privacy equipment, if used, is switched out by applying 24 Vdc between TSB10(+) and TSB9(−) from either an external source or by strapping TSB7 to TSB10 and TSB8 to TSB9. The same may be accomplished by strapping TSB1 to TSB4 and TSB2 to TSB5, or by operation of the privacy cutoff key. |
| 2 | Remove the CHAN I/P bridging plug on the fading regulator module and apply a 1000-Hz tone at a level of −10 dBm across the pair of jacks ***not*** marked LINE. |
| 3 | Remove the SP'CH PATH I/P bridging plug on the discriminator and expander module and measure the tone level across the unbalanced pair of jacks.<br><br>***Requirement:*** −2 dBm ±1 dB (terminated). |
| 4 | Replace the SP'CH PATH I/P plug. |
| 5 | Check the fading regulator compressor control current by measuring the voltage across the CON C'R'NT jack.<br><br>***Requirement:*** 270 mV ±10 mV. |
| 6 | If the requirement in Step 5 is not met, use the test frame and extend the module out of the case. Adjust the gain control of the 25-dB amplifier PCB1 until the requirement is met. Replace the module. |
| 7 | Remove the TO PRIV bridging plug on the fading regulator and check the tone level across the top pair of jacks.<br><br>***Requirement:*** 0 dBm ±0.1 dB (terminated). |
| 8 | If the requirement in Step 7 is not met, use the test frame and extend the module out of the case. Adjust the gain control of the 25-dB amplifier PCB5 until the requirement is met. Replace the module and the TO PRIV plug. |
| 9 | Remove the FROM PRIV bridging plug and measure across the top pair of jacks.<br><br>***Requirement:*** 0 dBm ±0.1 dB (terminated).<br><br>***Note:*** No tone at this point indicates faulty privacy switching relays (RLA, RLB, RLC, and RLD) or failure to follow instructions to switch out privacy explained in Step 1. |
| 10 | Replace the FROM PRIV plug. |
| 11 | Remove the modem I/P bridging plug and measure the tone level across the top pair of jacks. |

**CHART 1 (Cont)**

| STEP | PROCEDURE |
|---|---|
| | ***Requirement:*** 0 dBm ±0.1 dB (terminated) |
| 12 | Maintain the monitor as in Step 11 and decrease the input level of the 1000-Hz tone in 5-dB steps. Measure the level at the modem I/P.<br><br>***Requirement:*** The output remains within 1 dB of that obtained in Step 11 until the input reaches −15 dBm0 (which is −25 dBm for a reference test input level of −10 dBm). At −20 dBm0, the output should be within 4 dB of that measured in Step 11 and at lower levels an approximately linear input/output characteristic should be obtained. |
| 13 | If the requirement in Step 12 is not met, use the test frame and extend the fading regulator module out of the case. With an input level of −45 dBm (−35 dBm0), adjust RV2 on the compressor variolosser PCB3 until the measured signal level at the modem I/P is −17 dBm. |
| 14 | Reset the input level to the reference test input level. |
| 15 | Replace the modem I/P plug. |
| 16 | Remove the modem O/P plug and measure the tone across the top pair of jacks.<br><br>***Requirement:*** 0 dBm ±1.0 dB. |
| 17 | Replace the O/P plug. |
| | **Control Path Check** |
| 18 | Change the frequency and output level of the test signal applied in Step 2 to 2900 Hz at a level of −5 dBm0 (ie, −15 dBm for a reference test input of −10 dBm). |
| 19 | Remove the CON PATH I/P bridging plug on the discriminator and expander module. Measure the tone level across the top pair of jacks (unbalanced).<br><br>***Requirement:*** −7 dBm ±1 dB (terminated). |
| 20 | Transfer the test oscillator from the CHAN I/P to the CON PATH I/P lower pair of jacks. Set the frequency to 2850 Hz and the level to −7 dBm. |
| 21 | Monitor the level across the CON TONE jacks on the discriminator and expander module.<br><br>***Requirement:*** −10 dBm ±1.5 dB (unterminated). |
| 22 | With the conditions as in Step 20 monitor the EXP CON C'R'NT on the discriminator and expander module. Use a dc millivoltmeter.<br><br>***Requirement:*** 350 mV ±10 mV. |

**CHART 1 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 23 | Remove the CHAN I/P bridging plug on the fading regulator module and apply a 1000-Hz tone at a level of −10 dBm across the pair of jacks ***not*** marked LINE (the control tone simulating signal of 2850 still connected as in Step 20). |
| 24 | Remove the CHAN O/P plug and measure the tone level across the top pair of jacks.<br><br>***Requirement:*** +7 dBm ±1 dB (terminated).<br><br>***Note:*** If a reference test output level lower than +7 dBm is required for the system, attenuator AT2 on the rear panel of the unit is strapped accordingly. |
| 25 | If the requirement in Step 24 is met, proceed to Back-to-Back Test. If this requirement is not met, it may be that:<br><br>(a) the gain settings of the 25-dB amplifiers PCB7 and PCB8 in the discriminator and expander module require adjustment, or<br><br>(b) the discriminator and antilogarithmic amplifier require setting. |
| 26 | To ascertain which of the two faults is present, vary the frequency of the control tone signal in steps of 10 Hz between 2840 Hz and 2960 Hz and plot frequency against output level. |
| 27 | If a constant error is present over the whole range, a correction may be made by adjusting the gain control of PCB7 or PCB8. If the error is not constant over the whole range, a complete realignment must be made as outlined in the following steps. |
| 28 | Set the gain of the 25-dB amplifier PCB8 in the discriminator and expander module to maximum by turning RV1 fully counterclockwise. |
| 29 | Set the gain of the 25-dB amplifier PCB7 to minimum by turning RV1 fully clockwise. |
| 30 | Connect a dc millivoltmeter across EXP CON C'R'NT jacks on the module front panel. |
| 31 | Set the frequency simulating the control tone to 2850 Hz (accuracy ±0.1 Hz) and adjust RV1 on the discriminator PCB4 to obtain a voltage of 350 mV across the EXP CON C'R'NT jacks. |
| 32 | Note the level (in dBm) across the CHAN O/P jacks terminated in 600 ohms. |
| 33 | Set the frequency simulating the control tone to 2940 Hz (accuracy ±0.1 Hz) and adjust RV1 on the antilogarithmic amplifier PCB5 to obtain a level across the CHAN O/P jacks 44.5 dB below the level noted in Step 32. |
| 34 | Repeat the operations described in Steps 31 through 33 several times to ensure that both points are accurately set. |

**CHART 1 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 35 | Set the frequency simulating the control tone to 2850 Hz (accuracy $\pm$0.1 Hz) and adjust RV1 on the 25-dB amplifier PCB7 to obtain a level of +7 dBm across the CHAN O/P jacks. |
| 36 | With a control tone simulating signal (2850 Hz) applied to the CON PATH I/P lower pair of jacks on the discriminator and expander module (Step 20), set the level of the tone to −58 dBm. |
| 37 | Check that the speech simulating signal (1000 Hz) is applied to the fading regulator module CHAN I/P jacks ***not*** marked LINE, Step 23.<br><br>***Requirement:*** The signal at the CHAN O/P jack is −13 dBm (terminated). |
| 38 | If the requirement in Step 37 is not met, ensure that the tone alarm relay has operated. A short circuit exists between TSA-7 and TSA-6 if the relay is operated. |
| 39 | ***If the relay has operated,*** set the output level by adjusting RV1 on the tone alarm board PCB3 of the discriminator and expander module.<br><br>***If the relay has not operated*** and the tone level is increased above −58 dBm, set RV2 on the tone alarm board so that the relay operates at the control tone level of −58 dBm and releases.<br><br>***Note:*** A 5-second delay exists before the relay operates on a sudden reduction of control tone level. |
| 40 | When restoring the control tone level above −58 dBm, check that the speech signal output level returns to normal and that the short circuit between TSA-6 and TSA-7 is removed. |
| 41 | Replace all bridging plugs removed in the preceding tests. |
| | **Back-to-Back Test** |
| 42 | Remove the CHAN O/P plug from the low-pass filter module in the transmit unit and connect the top pair of jacks to the bottom pair of jacks of the CHAN I/P plug on the fading regulator module in the receive unit. |
| 43 | Apply the reference test level input at 1000 Hz in the pair ***not*** marked LINE of the CHAN I/P jacks on the transmit unit. |
| 44 | Measure the tone level at the receive unit across the CHAN O/P upper pair of jacks.<br><br>***Requirement:*** +7 dBm $\pm$1 dB (terminated). |
| 45 | Vary the tone input level in 5-dB steps from +5 dBm0 to −55 dBm0. |

**CHART 1 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 46 | Measure the tone level as in Step 44.<br><br>***Requirement:*** The output follows the input level changes within ±1.5 dB. |

**CHART 2**

**DISCRIMINATOR AND EXPANDER MODULE**

**APPARATUS:**

2—Audio Oscillators with an output impedance of 600 ohms, capable of producing signals from 1000 to 3500 Hz at a level up to +3 dBm

2—High-impedance Audio Level Meters to measure levels over the range +20 dBm to −65 dBm

1—600-ohm Variable Attenuator to provide a maximum attenuation of 60 dB

1—DC Millivoltmeter to measure voltages between 5 mV and 1.0 volt

1—Regulated Power Supply to provide a 24-volt and two 12-volt dc outputs at up to 0.5 A each. The voltages must be accurately set to within 20 mV of the nominal, and must not have a ripple voltage greater than 1 mV. The Lincompex II power supply module is recommended for this.

1—Frequency Meter to measure frequencies between 2800 and 3000 Hz to an accuracy of ±0.1 Hz

2—600-ohm Resistors

1—24-way Socket, McMurdo Red Range RS24

| STEP | PROCEDURE |
|---|---|
| | **Preparation** |
| 1 | Fit the 24-way socket to the 24-way plug on the rear of the module. |
| 2 | Connect the output of an oscillator through the 600-ohm attenuator to PLA-10 and -11. |
| 3 | Connect a 600-ohm resistor between PLA-7 and PLA-8. |

**CHART 2 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 4 | Connect a 600-ohm resistor between PLA-23 and PLA-24. |
| 5 | Connect a level meter to PLA-23 and PLA-24 to monitor the output signal. |
| 6 | Connect the output of an oscillator to PLA-16 and PLA-15 (ground). This provides the input signal. |
| 7 | Connect the dc millivoltmeter across the EXP CON C'R'NT jack. |
| 8 | Connect the digital frequency meter across the output of the oscillator connected across PLA-10 and PLA-11. |
| 9 | Apply 24 volts to PLA-1 (+) and PLA-2 (−)<br>12 volts to PLA-2 (+) and PLA-3 (−)<br>12 volts to PLA-4 (+) and PLA-2 (−) |
| 10 | Strap: PLA-18 to PLA-20<br>PLA-19 to PLA-21 |
| | **Alignment of Discriminator and Antilogarithmic Amplifier** |
| 11 | Apply a signal of 1000 Hz at 0 dBm across PLA-15 and -16. |
| 12 | Set the gain of 25-dB amplifier PCB8 to maximum by setting RV1 fully counterclockwise. |
| 13 | Set the gain of 25-dB amplifier PCB7 to minimum by setting RV1 on this board fully clockwise. |
| 14 | Set the frequency of the signal applied to PLA-10 and -11 to 2851 Hz $\pm$0.1 Hz at a level of −20 dBm. Adjust RV1 on the discriminator printed board PCB4 to produce a voltage of 350 mV on the dc millivoltmeter connected to the EXP CON C'R'NT jack. Note the level of the signal across PLA-23 and -24. |
| 15 | Set the frequency of the PLA-10 and -11 signal to 2940 Hz $\pm$0.1 Hz and adjust RV1 on the antilogarithmic amplifier printed board PCB5 to give a level across PLA-23 and -24 of 44.5 dB below the level set in Step 14. |

| CHART 2 (Cont) | |
|---|---|
| **STEP** | **PROCEDURE** |
| 16 | Repeat the operations described in Steps 14 and 15 several times until both points are accurately set and there is no change in reading at either end. |
| 17 | Set the frequency of the signal applied to PLA-10 and -11 to 2851 Hz $\pm$0.1 Hz and adjust RV1 on PCB7 amplifier to produce a level of +7 dBm at PLA-23 and -24. |
| | **Limiter Characteristic** |
| 18 | Set the frequency of the PLA-10 and -11 signal to 2000 Hz. Note the output level of the 1000-Hz tone across PLA-23 and -24. Vary the level of the control tone signal between $-15$ dBm and $-55$ dBm. The 1000-Hz output level should not change more than $\pm$0.5 dB. |
| 19 | Reduce the control tone level to $-65$ dBm. |
| | ***Requirement:*** The output signal should not change by more than $\pm$1 dB. |
| | **Tone Alarm Setting** |
| 20 | Set the frequency of the PLA-10 and -11 signal to 2850 Hz and reduce its level to $-71$ dBm. Adjust RV2 on the tone alarm circuit PCB3 until relay RLA operates and short circuits PLA-13 and -14. This circuit has a 5-second relay so RV2 should be adjusted a little at a time with a 5-second interval between adjustments. |
| 21 | Connect an ohmmeter between PLA-13 and -14, and set the control signal input level to $-70.5$ dBm. Check that an open circuit exists between PLA-13 and -14. |
| 22 | Set the control signal input level to $-7$ dBm and adjust RV1 on the tone alarm board so that the output signal level across the PLA-23 and -24 is $-13$ dBm ($-20$ dBm0). |
| 23 | Confirm that as the control signal level is increased above $-71$ dBm, the relay RLA releases, and the output signal level reverts to the value corresponding to the frequency of the control signal. |
| | **Control Frequency—Output Level Check** |
| 24 | With the unit correctly set up, the circuit output level measured at PLA-23 and -24 for variation of control signal frequency across PLA-10 and -11 should lie within the following limits: |

**CHART 2 (Cont)**

| STEP | PROCEDURE |
|---|---|
| | **CONTROL TONE FREQUENCY (Hz)** / **RECEIVE UNIT O/P (dBm)**<br>2840 — +12 ±1 dB<br>2850 — +7 ±1 dB<br>2860 — +2 ±1 dB<br>2870 — −3 ±1 dB<br>2880 — −8 ±1 dB<br>2890 — −13 ±1 dB<br>2900 — −18 ±1 dB<br>2910 — −23 ±1 dB<br>2920 — −28 ±1 dB<br>2930 — −33 ±1 dB<br>2940 — −38 ±1 dB<br>2950 — −43 ±1 dB<br>2960 — −48 ±1 dB<br>Greater than 2990 — Less than −62 |
| 25 | **Splitter Amplifier Check**<br>With a signal level of −15 dBm at a frequency of 1000 Hz across PLA-10 and -11, check that the signal across PLA-7 and -8 measures −2 dBm ±1 dB. |

**CHART 3**

**FADING REGULATOR MODULE**

**APPARATUS:**

The test equipment listed in Chart 1 is required to test and align this module. In addition, a regulated power supply of 24 volts and 12 volts dc at 0.5 A and a 24-way McMurdo Red Range socket RS24 is needed.

| STEP | PROCEDURE |
|---|---|
| 1 | **Preparation**<br>Strap: PLA-9 to PLA-16<br>PLA-8 to PLA-15<br>PLA-18 to PLA-21<br>PLA-19 to PLA-20 |

**CHART 3 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 2 | Connect an audio oscillator through a 600-ohm attenuator to PLA-5 and PLA-6 (ground). Connect an audio level meter across PLA-5 and PLA-6 to monitor the input signal. |
| 3 | Connect a 600-ohm resistor between PLA-23 and PLA-24 and a second audio level meter across this load to monitor the output signal. |
| 4 | Connect a dc millivoltmeter across the COMP CON C'R'NT jack on the front panel of the module. |
| 5 | Apply 24 volts to PLA-1 (+) and PLA-2 (−). |
| 6 | Apply 12 volts to PLA-2 (+) and PLA-3 (−). |
| | **Compressor Alignment**<br>**A. Rectifier Bias Current** |
| 7 | With no input signal and with pins 5, 6, and 7 of the transformer T1 short-circuited, adjust RV1 on the rectifier board PCB2 to give an indication of 8 mV on the dc millivoltmeter across COMP CON C'R'NT jack. |
| 8 | Remove the short circuits from T1. |
| | **B. Rectifier Drive Level** |
| 9 | Apply an input signal of −2 dBm at 1000 Hz and adjust RV1 on the 25-dB amplifier PCB1 to give a control indication on the millivoltmeter of 270 mV. |
| | **C. Output Setting** |
| 10 | With the input signal as in Step 9, adjust RV1 on the 25-dB amplifier PCB5 to produce an output level of 0 dBm across PLA-23 and -24. |
| | **D. Clamping Level** |
| 11 | With an input signal of −37 dBm at 1000 Hz, adjust RV2 on the variolosser compressor board PCB3 to produce an output level of −17 dBm across PLA-23 and PLA-24. |
| | **Frequency Response and Filtering** |
| 12 | With an input level constant at −2 dBm, vary the frequency and observe the output level.<br>***Requirement:*** The output at 2800 Hz and above is at least 40 dB below the level at 1000 Hz. |
| 13 | If the requirement in Step 12 is met, proceed to Step 22. If the requirement in Step 12 is not met, either or both of the low-pass filter sections are faulty or out of alignment. Realign the filter according to Steps 14 through 21. |

**CHART 3 (Cont)**

| STEP | PROCEDURE |
|---|---|
| | ***Note:*** Realign only if there is conclusive evidence that the fault lies in the filter. To realign, the section must be removed from the module and the detailed procedures followed closely. |
| 14 | Remove the rubber discs from the adjustment holes of the four inductors. |
| 15 | Connect an audio oscillator (output level set at −10 dBm) to the input of the filter, pins 1 and 2 (ground) in the printed board. |
| 16 | Connect an audio level measuring set to the output of the filter, pins 3 and 4 (ground) on the printed board. Load with 600 ohms. |
| 17 | Set the input frequency to 2813 Hz ±1 Hz and turn the adjuster in inductor L3 to produce minimum output from the filter. |
| 18 | Set the input frequency to 2925 Hz ±1 Hz and turn the adjuster in inductor L2 to produce minimum output from the filter. |
| 19 | Set the input frequency to 3349 Hz ±1 Hz and turn the adjuster in inductor L4 to produce minimum output from the filter. |
| 20 | Set the input frequency to 5271 Hz ±1 Hz and turn the adjuster in inductor L1 to produce minimum output from the filter. |
| 21 | Replace the rubber discs in the four inductors. |
| | **Input/Output Characteristic** |
| 22 | Apply a 1000-Hz signal to PLA-5 and PLA-6. Check the outputs for the inputs listed:<br>***Input Level*** — ***Output Level***<br>+3 dBm — 0 dBm ±1 dB<br>−2 dBm — 0 dBm ±1 dB<br>−17 dBm — 0 dBm ±1 dB<br>−22 dBm — −3 dBm ±1 dB<br>−27 dBm — −7 dBm ±1 dB<br>At levels below those listed, the input/output relationship is linear to within ±1 dB. |
| 23 | Disconnect all loads and straps. |

## CHART 4

## MODEM MODULE

**APPARATUS:**

1—Audio Oscillator with an output impedance of 600 ohms to give a signal level of up to +5 dBm over a frequency range of 250 Hz to 10 kHz

1—Regulated Power Supply to provide a +12 volt and a −12 volt dc output at approximately 60 mA each

1—Oscilloscope to monitor a 6-volt peak-to-peak square wave of 80-kHz repetition frequency

1—High-Impedance Audio Level Meter to measure up to 0 dBm

1—600-ohm Resistor

1—24-way Socket, McMurdo Red Range RS24

1—Harmonic Distortion Factor Meter

| STEP | PROCEDURE |
|---|---|
| | **Preparation** |
| 1 | Fit the 24-way socket to the 24-way plug on the rear of the module. |
| 2 | Connect the 600-ohm resistor and the audio level meter across PLA-19 and PLA-18 (ground). |
| 3 | Apply 12 volts to PLA-3 (−) and PLA-2 (+) an a second 12-volt supply to PLA-4 (+) and PLA-2 (−). |
| 4 | Strap PLA-10 to PLA-11. |
| | **Gain Setting** |
| 5 | With a 1000-Hz signal applied across PLA-16 and PLA-17 at a level of 0 dBm, monitor the level across PLA-18 and -19 and set the gain potentiometer RV3 to produce an output of 0 dBm. |
| 6 | Check that the output signal is removed when the I/P bridging plug on the front panel of the module is withdrawn. |
| 7 | Strap: PLA-19 to PLA-20<br>PLA-18 to PLA-21 |
| 8 | With the input signal applied as in Step 5, monitor the output across PLA-23 and -24. This should be similar to that across the PLA-18 and -19. |

**CHART 4 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 9 | Check that the output signal is removed when the O/P bridging plug on the front panel is withdrawn. |
| | **Distortion** |
| 10 | With the input signal applied as in Step 5, check that the overall harmonic distortion at the output is less than 1 percent. |
| | *Note:* Further checks on the modem module will be made in the delay module checks that follow. |

**CHART 5**

**DELAY MODULE**

**APPARATUS:**

In addition to the test equipment in Chart 4, the following is required:

1—Modem Module

1—24-way Socket, McMurdo Red Range RS24

1—Double-beam Oscilloscope

1—Audio Oscillator with 600-ohms output impedance to supply a low frequency (approximately 15 Hz) at a maximum level of 0 dBm

| STEP | PROCEDURE |
|---|---|
| | **Preparation** |
| 1 | Between the delay and modem modules, connect: |

| Modem PLA- | to | Delay PLA- |
|---|---|---|
| 2 | | 2 |
| 4 | | 4 |
| 10 | | 11 |
| 11 | | 23 |
| 12 | | 12 |
| 24 | | 24 |

| CHART 5 (Cont) | |
|---|---|
| **STEP** | **PROCEDURE** |
| 2 | On the modem module, connect PLA-18 to -21 and PLA-19 to -20. |
| 3 | Connect a 600-ohm resistor between PLA-23 and PLA-24 on the modem module. |
| 4 | Connect a signal generator between PLA-16 and PLA-17 on the modem module. |
| 5 | Apply 12 volts to PLA-3 (−) and PLA-2 (+) and a second 12-volt supply to PLA-4 (+) and PLA-2 (−) of the modem module. |
| 6 | Insert the delay module bridging plug into the IN position. |
| | **Gain and Frequency Response** |
| 7 | Apply an input signal of 0 dBm across PLA-16 and -17 at 1000 Hz. Measure the output level across PLA-23 and -24 and set the modem gain control to produce an output level of 0 dBm. |
| 8 | Vary the frequency of the signal generator from 250 Hz to 3000 Hz and note the frequency at which maximum output occurs (with the input level kept constant at all frequencies).<br><br>***Requirement 1:*** Between 250 and 350 Hz the output shall not fall by more than 1 dB below the maximum level.<br><br>***Requirement 2:*** Between 350 and 3000 Hz the output shall not fall by more than 0.5 dB below the maximum level.<br><br>***Requirement 3:*** At 10 kHz the output shall not fall by less than 20 dB. |
| | **Linearity** |
| 9 | At an input frequency of 1000 Hz, measure the output level with input levels of +5, −10, −30, and −40 dBm.<br><br>***Requirement:*** The overall gain at each input level must be 0 dB ±0.5 dB. |
| | **Distortion** |
| 10 | At an input frequency of 300 Hz, 1000 Hz, and 3000 Hz and input levels of +4 and −40 dBm, measure the distortion.<br><br>***Requirement:*** The total distortion of the system should not exceed 1.5 percent. |
| | **Noise Level** |
| 11 | Terminate PLA-16 and -17 with a 600-ohm resistor. Measure the noise output across PLA-23 and -24.<br><br>***Requirement:*** The noise should be less than −70 dBm. |

**CHART 5 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 12 | With the modem and delay modules connected, connect a double beam oscilloscope such that one trace displays the input and the other the output of the modem. |
| 13 | Feed into the input of the modem via a double balanced bridge ring modulator (Fig. 3) a 2000-Hz signal at 0 dBm modulated by a signal of as low a frequency as possible (15 Hz). |

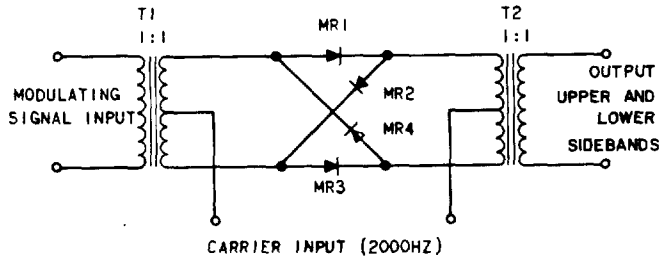


**Fig. 3—Bridge Ring Modulator**

***Requirement:*** The time difference between the input and output waveforms should be 3.6 ms with the U-link in the DELAY IN position, and zero when the U-link is in the DELAY OUT position.

***Note:*** The oscilloscope should be used with the external sync fed from the modulating frequency. The peaks of the 2000-Hz signal are 0.5 ms apart.

**CHART 6**

**POWER SUPPLY MODULE**

**APPARATUS:**

1—Variable Transformer with a continuously variable output voltage from 100 to 250 volts for an input voltage of 250 volts at 47 to 63 Hz

1—AC Voltmeter to measure voltages between 90 and 260 volts at 50 Hz

1—Digital (or similar) DC Voltmeter to measure up to 24 volts, accurate to $\pm 5$ mV; and 100 mV, accurate to $\pm 0.05$ mV

1—Stable 12-volt DC Supply for use as a bucking voltage

1—Stable 24-volt DC Supply for use as a bucking voltage

3—50-ohm 15-watt Rheostats

**CHART 6 (Cont)**

**APPARATUS (Cont):**

1—1-ampere DC Meter

1—Ohmmeter

1—8-way socket, McMurdo Red Range RS8

| STEP | PROCEDURE |
|---|---|
| | **Preparation** |
| 1 | Fit the 8-way socket to the plug at the rear of the module. |
| 2 | Connect the output terminals of the variable transformer to PLA-6 (HOT) and PLA-7 (NEUTRAL). Set the output to minimum. |
| 3 | Connect PLA-8 to office ground (earth). |
| 4 | Set the taps on the panel at the rear of the module to 250 volts. |
| 5 | Connect the ac voltmeter across the output of the variable transformer to measure the input voltage to the module. |
| 6 | Connect the input of the variable transformer to the power line and adjust the input voltage to the module at 250 volts. |
| | **Voltage Checks** |
| 7 | Check that the lamp on the front panel is lighted. |
| 8 | Connect the digital voltmeter between PLA-8 (+) and PLA-3 (−).<br>***Requirement:*** 12 volts ±20 mV. |
| 9 | Check the voltage between PLA-8 (−) and PLA-2 (+).<br>***Requirement:*** 12 volts ±12 mV. |
| 10 | Check the voltage between PLA-8 (−) and PLA-1 (+).<br>***Requirement:*** 24 volts ±20 mV. |
| 11 | If any of the voltages in Steps 8, 9, and 10 are incorrect, it is necessary to adjust the respective potentiometer in the appropriate regulator block. Each regulator block has two potentiometers, one to set the overload trip current and the other to set the output voltage. The voltage setting control is the one mounted on the board ***without*** the finned transistor. |

**CHART 6 (Cont)**

| STEP | PROCEDURE |
|---|---|
| 12 | Check that the correct voltages appear at the front panel voltage monitoring jacks. |
| | **Regulation** |
| 13 | Connect the three rheostats set to maximum resistance across PLA-8 and -1, PLA-8 and -2, and PLA-8 and -3. |
| 14 | Connect the digital voltmeter and bucking power supply as shown in Fig. 4. This permits the reading of a voltage on the 0.1-volt scale. |

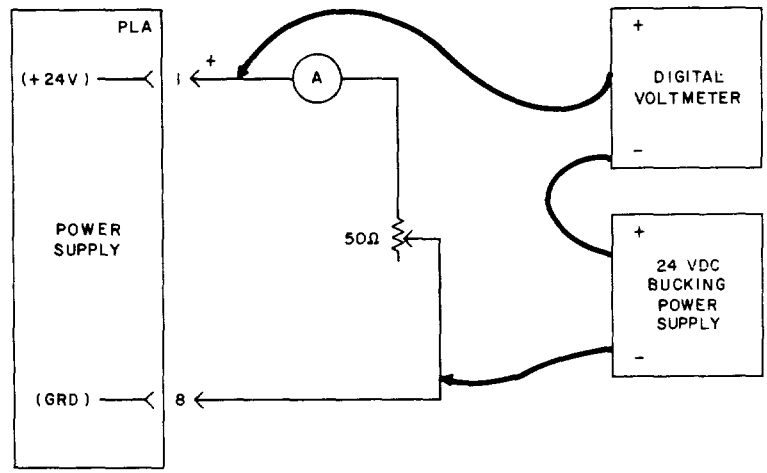


**Fig. 4—Power Supply Test Setup**

| | |
|---|---|
| 15 | Reduce the resistance of each rheostat until the output current in each is 500 mA. |
| 16 | Monitor the output of each supply.<br><br>***Requirement:*** The change in output voltage from the no-load to 500-mA load condition is no greater than 0.5 mV. |
| 17 | With the connections as in Steps 13 through 15, vary the input supply voltage from 225 to 275 volts.<br><br>***Requirement:*** The output voltage does not change by more than $\pm 2.5$ mV in any of the three supplies. |
| 18 | Adjust the main input voltage in steps corresponding to the voltages marked on the tapping panel, and set the taps in each case to correspond to the voltage. Check that there is no change in the output voltages. |

| CHART 6 (Cont) | |
|---|---|
| **STEP** | **PROCEDURE** |
| | **Alarms** |
| 19 | Check that a short circuit appears between PLA-4 and -5 if any one of the four fuses on the front panel is removed. |
| 20 | With the ohmmeter across PLA-4 and PLA-5, reduce the load resistance across each output in turn until a short circuit appears between PLA-4 and -5.<br><br>***Requirement:*** The load current at which the short circuit appears should be 0.55 A $\pm$0.01 A.<br><br>***Note:*** This is the alarm condition. To reset the circuit after an alarm, increase the load resistance, so as not to overload the circuit, and temporarily remove the input supply voltage. If the alarm condition does not appear at the correct current, adjust the appropriate potentiometer on the respective regulator block. This is the potentiometer on the board with the finned transistor. |