

L3 CARRIER SYSTEM

ADJUSTMENT OF TV EQ A, TV DROP EQ A, (336A) GAIN AND DELAY MOP-UP EQUALIZER

The 336A equalizer is inserted into TV lines on the L3 carrier coaxial system at receiving terminals, and at nominal 400-mile intervals, to mop up gain and delay distortion in the TV band of the L3 carrier system. When installed at the "through circuit" locations it is designated TV EQ A. When installed in the dropping leg at intermediate dropping points where the through line TV EQ A is not required, it is designated as TV DROP EQ A. This section describes a method for adjusting TV EQ A and TV DROP EQ A. Message service remains normal during this procedure but the TV portion is taken out of service.

Pilot links equipped with more than one TV MOP-UP EQ A in the through portion of the line **MUST** be equalized progressively, starting with the equalizer nearest to the transmitting terminal and proceeding to the receiving terminal (signals are always transmitted from the transmitting terminal of the pilot link). Adjustments in the dropping legs (TV DROP EQ A) should not be done until preceding equalizers in through circuits (TV EQ A) are adjusted. While adjusting the equalizer in the dropping leg (TV DROP EQ A) succeeding equalizer adjustments can be made at the same time. Whenever an equalizer in a through circuit (TV EQ A) is changed, all succeeding equalizers should be readjusted.

A final over-all touch-up line-up should then be made between pilot links if a high-frequency line connection is normally used between the links. To save time, only the equalizers at dropping points and receiving terminals need be readjusted in the second or succeeding pilot links. This adjustment is made on signals from the transmitting terminal of the first pilot link.

Fig. 2 shows in diagram form the order of equalization for a typical system.

The 336A equalizer is equipped with:

- 23 gain terms (continuously adjustable with numbered dials)
- 15 gain echo switches, designated LEAD-LAG
- 15 delay terms (continuously adjustable with numbered dials)
- 2 delay range-extending switches designated -1, -2, 0, +1, +2
(used with delay terms 1 and 2)

All steps in this adjustment will be required whenever any of the following operations have been performed.

- (1) L-unit gain line-up
- (2) L-unit delay line-up
- (3) Power and pilot survey
- (4) Replacement of an amplifier

APPARATUS:

- J68837C — Cosine Equalizer Adjustment Set
- J68827A — Sending Console
- J68827B — Receiving Console
- KS-14665 Pad — 30.8 db
- P2BJ Cords — Use shortest length possible

STEP	PROCEDURE
	Test Set Preparation
1	At Transmitting End: Calibrate and adjust the cosine set transmitter for transmission of DELAY signals in the TV band as described in Section E40.266.3. Caution: To avoid interference to telephone service, do not change the transmitter of the cosine set from delay to gain, nor operate the TRS switch to the TP position while the set is connected to the line. At Receiving End (Equalizing Point): Calibrate and adjust the cosine set receiver for gain and delay measurements in the TV band in accordance with Section E40.266.3.
2	Remove TV service from the line to be equalized. The adjustment of the 336A should only be made when the line consists of the sections that will be used for the succeeding period of TV service.
	Test Set Connection
3	At Transmitting End: Patch from cosine set TR to BEF IN and BEF OUT to TV LINE IN. At Receiving Location: Patch from TV TST to cosine set REC jack at points where TV EQ A is in through circuit. Patch from TV DROP TST to cosine set REC at points where TV DROP EQ A is in the dropping circuit. At points equipped with only a single TV DROP HY, the following patch connections must also be made: (a) Remove patch plug from TV DROP B to TV DROP B TRK. (b) Patch TV DROP B to TV EQ TST. (c) Connect cosine set to TV DROP TST. Set the cosine receiver ATT to 0 db to help center the trace of the signal received from the line. With the GAIN-DELAY key on GAIN, use CR CENTER to position the gain characteristic on the scope. Operating the same key to DELAY, center the trace on the scope with LINE ZERO. Recheck the receiver's gain and delay calibration with the signal received from the line (oscilloscope gain).
4	Observe the 7266 kc (and 8320 kc if 6-pilot regulation is used) pilot indicators. Requirement: Should not fluctuate more than ± 0.05 db, that is, a range of 0.1 db. Note: If this requirement is not met, a readjustment of PIL SKP or BAND EDGE SETTER at the cosine transmitter is necessary. Fluctuation of 7266 kc indicator calls for readjustment of the 7266 PIL SKP. If 6-pilot regulation is used, fluctuation of 8320 kc indicator calls for readjustment of the 8.5 mc control on the transmitter band edge setter. Pilot skips must be in the best possible adjustment. Poor pilot skip will result in incorrect line regulation and instability of the receiver meter, thereby making proper equalization extremely difficult, if not impossible.
5	Set all LEAD-LAG switches on LAG. Set all COARSE DELAY switches (designated -2, -1, 0, +1, +2) on "0." Set all gain and delay terms on "5." This step can usually be omitted in the daily touch-up of a line. Caution: When adjusting at a switching main repeater, the operation of the COARSE DELAY switches may cause a hit on the 7266 kc pilot in the succeeding section. Therefore, when operating the COARSE DELAY switches, operate the TRSG SW, associated with the transmitting switch control in the succeeding section, to DISC. After the COARSE DELAY switches have been operated, return the TRSG SW to normal. This will return the switching section to normal thus insuring maximum switching protection.

STEP	PROCEDURE
6	On the cosine receiver set, operate the GAIN-DELAY key to GAIN. Slide the cover of the equalizer to expose the GAIN terms.
7	Adjust GAIN term ONE for minimum slope between the high- and low-frequency markers on the oscilloscope trace.
8	Adjust GAIN term TWO for either minimum bow on scope trace or minimum meter indication.
9	Adjust GAIN term 3 to 23, in order, for minimum meter reading. For terms 1-10, the REC SW on the cosine set may be in the A position to suppress noise. For terms 10-23, the REC SW must be in the B position. <i>Note:</i> It will facilitate adjustment to return to terms one to three occasionally and then continue where left off. A typical order of adjustment might be: 1-5, 1, 6-10, 1, 2, 3, 11-15, 1, 16-20, 1, 2, 21-23, 1-5 (LAST).
10	Slide the cover to expose the DELAY terms. Operate the cosine receiver GAIN-DELAY key to DELAY.
11	On the initial pass at DELAY, operate the COARSE DELAY keys, (designated -1, -2, 0, +1, +2) to obtain a level, unbowed oscilloscope pattern. <i>Caution:</i> Same as Caution in Step 5. <i>Note:</i> If it appears that only a small correction is required on a daily touch-up basis, the first and second term knobs may be used to make this adjustment.
12	Adjust DELAY terms 3 to 15, in order, for minimum meter indication. <i>Note:</i> If the scope trace departs from a level, unbowed shape, COARSE DELAY keys or terms 1 and 2 may be touched up.
13	Operate the cosine receiver GAIN-DELAY key back to GAIN and repeat the gain adjustment as in Steps 7, 8, and 9. It should not be necessary to return to the lower numbered terms very often, the scope trace will indicate tilt or bow caused by a first or second term shape.
14	Operate the cosine receiver GAIN-DELAY key to DELAY and repeat the delay adjustment as in Steps 11 and 12. <i>Caution:</i> Before moving each control, note its position and if there is no improvement in the result, return the control to its original position. This will prevent unnecessary readjustment of gain terms due to interaction in the equalizer.
15	Make a scope check of the DELAY and GAIN characteristics to see if the adjustments are within limits as given in Fig. 1. The scope calibration must be checked for each characteristic. <i>Note:</i> If the proper adjustment has not been made, continue with Step 16. If the requirements have been made, proceed with Step 24.
16	Slide cover of equalizer and operate the cosine receiver key to GAIN. Adjust gain terms 1 through 7.

STEP	PROCEDURE
17	Slide cover and operate the cosine receiver key to DELAY. Adjust delay terms 10 through 15 as in Step 12. Note: Gain and delay terms of different orders have been adjusted to reduce the effects of interaction.
18	Check both the gain and delay characteristics to see if the requirements have now been met. If the requirements have been met, proceed with Step 24. Note: If the requirements still have not been met, and the equalization procedure was started as a touch-up of a previous adjustment where Step 5 was omitted, return to Step 5 and start anew with the equalizer in a neutral condition. If results are still unsatisfactory, continue with this procedure. In some cases it will be found that while one characteristic, gain for example, is being adjusted, the other characteristic, delay, has been made worse. A correction of delay may then make the gain characteristic unsatisfactory. This difficulty may persist until the proper LEAD-LAG switches are operated to LEAD, at which time it will be possible to obtain a <i>progressive</i> improvement in <i>both</i> gain and delay. There will be many switches which will have little effect. Other switches, usually those associated with the lower numbered terms, will be very important. A change in a LEAD-LAG switch calls for a different null position of the associated gain and delay term knob.
19	Operate the LEAD-LAG switches associated with gain terms ONE and TWO to LEAD. Make several gain and delay passes at adjustment as in Steps 5 through 17, and check results with the limits required. Note: If requirement is now met, proceed with Step 24, if not met proceed with Step 20.
20	Operate the LEAD-LAG switches associated with gain terms 3 through 7 to LEAD and repeat gain and delay adjustments as in Steps 5 through 17, and check results with the limits required. Note: If requirement is now met, proceed with Step 24, if not met proceed with Step 21.
21	Return LEAD-LAG switches associated with terms ONE and TWO to LAG, leaving those switches associated with 3 through 7 on LEAD. Again make several passes at gain and delay adjustment as in Steps 5 through 17, and check results with the limits required. Note: If requirement is now met, proceed with Step 24, if not met proceed with Step 22.
22	If adjustment difficulty persists, it may be an indication that one or more of the switching sections that make up the line probably have such a poor gain or delay characteristic that the 336A equalizer does not have sufficient range to correct it. If time permits, other combinations of LEAD-LAG switch settings should be tried in an orderly procedure. Terms 8 through 11, then 12 through 15, can be shifted until all switches are on LEAD. Important: Remember that the lower numbered switches are the more important. For this reason, switches ONE and TWO should be tried in both positions, for various combinations of the higher order switches.

STEP	PROCEDURE
23	Observe both DELAY and GAIN characteristics on the scope. If the limits still cannot be met, the delay and gain characteristics of the line are probably outside of the range of the equalizer, and a sectional gain and delay line-up should be made between the point in trouble and the preceding mop-up point which can obtain satisfactory results. Due to interaction in the equalizer, a poor line DELAY characteristic may cause the equalizer to give a poor GAIN result. For this reason, both GAIN and DELAY sectional characteristics of the line should be checked when trouble is encountered. Caution: <i>When checking sectional line characteristics, any TV EQ A (336A) which is located in the through portion of the line connecting equipment associated with a section under test must be set on neutral as described in Step 5. This is necessary because sectional delay measurements are made at a point following the equalizer.</i>
24	At points where the cosine receiver has been connected to TV TST, ONLY: Transfer the connection to TV DROP TST and verify that the gain and delay characteristic at that point is also within limits. A difference in characteristic indicates an equipment difficulty. (Points with TV DROP EQ will not have the same characteristic at the two TST jacks.)
25	Since readjustment of the TV EQ A may change the flat loss of the line connecting circuit, the power of pilot (at through TV EQ A points) and TV carrier (at receiving terminals and all points with a TV DROP TST) must be measured and adjusted as follows: Caution: <i>The 7266 kc pilot power adjustment [(A) below] must be made before equalizers at succeeding points are adjusted. The 4150 kc measurement [(B) below] is conveniently made at all points simultaneously, after all equalizer adjustments are completed.</i> (A) Points with TV EQ A (through line) and Not a Receiving Terminal Repeater (1) Make a terminating measurement of 7266 kc at TRSG HY OUT B as described in Section E34.591.3 and adjust TV EQ A ATT (furnished with 6-pilot regulation) first, and then adjust TV ATT to give the optimum value as given in Section E34.591.3 ± 0.05 db. Notes 1. TV EQ A ATT is adjusted first so that changes in flat loss may be corrected for both the through and drop legs of line connecting circuits. 2. The TRSG HY OUT B of one regular line is used to feed pilots to the standby line at points equipped with standard line switching arrangements. To prevent removal of pilots from the standby line, switch the standby line to some other circuit before measuring pilots on the one regular hybrid which normally feeds the standby line. Where there is only one regular line and standby, spare pilots need be supplied to the standby line through a spare hybrid. Caution: <i>While supplying pilots to the standby line, there will be no switching protection, therefore line should be restored to normal as quickly as possible. Also when connecting the 37B TMS to the TRSG HY OUT B jack, make the connection before break.</i>

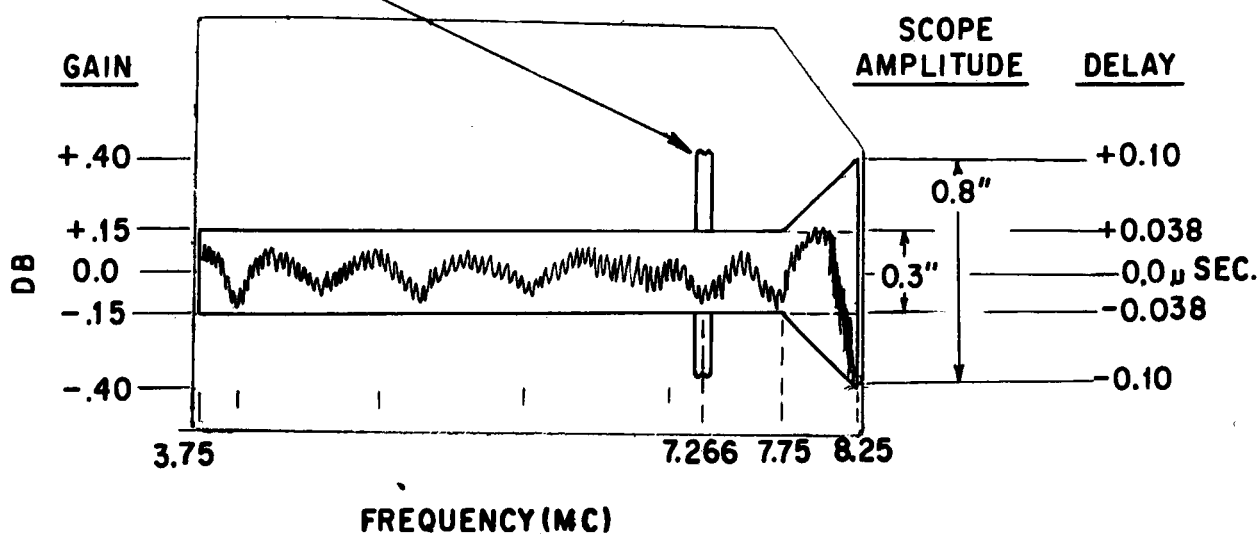
STEP	PROCEDURE
	(B) All points with TV DROP TST and Receiving Terminals where Pilots are Blocked (1) <i>Transmitting End</i> — Use the splitting pad (6 db) for sending test power from sending console per Section E40.264, substituting a 30.8 db KS-14655 pad for the adjustable attenuator. Tune oscillator to 4150 kc. Send this 4150 kc at -30.8 dbm into TV LINE IN. (2) <i>Receiving End</i> — (a) Calibrate the 37B TMS using the sending console and splitting pad method of sending as outlined in Section E40.264. Send a power of -30.8 dbm into the 37B TMS using a -30.8 db KS-14655 attenuator. Tune the TMS to 4150 kc, adjusting sensitivity controls to -31 db. Adjust the CAL control to obtain a 0.00 db reading on the expanded scale meter. Leave the SENS controls unchanged. (b) Connect the TMS to TV DROP TST, or TV TST at a receiving terminal, and tune the TMS to the received 4150 kc signal. Read the expanded scale meter. Requirement: The meter should read 0.00 ± 0.05 db. Note: If this requirement is not met, adjustments are made as follows: At Switching Main Repeaters: (1) Adjust TV DROP ATT to meet the requirement. Where there is no TV DROP ATT, adjustment is made with FLAT AMP F GAIN ADJ with a limit set as 0.0 ± 0.2 db. Caution: If FLAT AMP F is in the through circuit (TV EQ A used), Part (A) above must be repeated after any change in FLAT AMP F. (2) If TV DROP ATT runs out of range, adjust TV DROP EQ A ATT (furnished with TV DROP EQ A in 6-pilot regulated systems) and then TV DROP ATT to meet the requirement. (3) If TV DROP ATT runs out of range, and a TV EQ A ATT (through circuit) is furnished, adjust the TV EQ A ATT and then TV DROP ATT to meet the requirement. Caution: TV ATT must be readjusted immediately to meet the 7266 kc requirement of Part (A) above. At Receiving Terminal Main Repeater: (1) Adjust TV EQ A ATT for correct 4150 kc reading at TV TST ± 0.25 db (if TV TST is not furnished, measure at TV DROP TST). (2) Adjust TV ATT for correct 4150 kc at TV TST jack (± 0.05 db). (3) Adjust TV DROP ATT for correct 4150 kc at TV DROP TST jack (± 0.05 db). Caution: At receiving terminal repeaters TV ATT (through) must be adjusted before any points in a succeeding pilot link (through TV at line frequencies).
26	At all points: (a) Restore all patches, removing any patches made for testing purposes. (b) Restore line to TV service.

OSCILLOSCOPE OF COSINE SET CALIBRATED FOR

1.0 db/inch or 0.25 u sec/inch:

(Different scope gain settings are required for each characteristic)

THE SPIKE IS DUE TO TRANSIENT RESPONSE OF THE B.E.F. USED WITH THE COSINE TRANSMITTER. IT MAY BE EXCUSED FROM THE LIMIT



Note: Should either the gain or delay characteristic be out of limits in the 7.75 — 8.25 mc region, the result may be considered satisfactory if the complementary characteristic is well within limits. Their average deviation should be within limits.

Example:

$$\begin{array}{rcl} \text{GAIN} & 1.2'' & \\ \text{DELAY} & + .4'' & \\ \hline & 1.6'' & \end{array} \quad \frac{1.6}{2} = 0.8'' \text{ Average} = 0.8''$$

Result: OK

Fig. 1 — Limit for Gain and Delay Deviations in TV Lines Equipped with TV EQ A (336A Equalizer)

