

LINE-UP OF COMBINATIONS OF  
J, K AND L GROUPS IN TANDEM

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1. GENERAL

1.01 This section covers the over-all system net loss tests to be made when various combinations of J, K and L carrier telephone systems are interconnected at group frequencies. The connection of L sections at supergroup frequencies, and the connection of K1 and K2 sections at line frequencies, is covered in other sections and will not be considered here.

1.02 At the junction between channel groups, group connector circuits are employed to reduce the -5 db output level to the -42 db input level, to eliminate the frequencies outside of the wanted band, to reduce the pilot and carrier leak frequencies so that new pilots can be added as required, and to provide "Regular" and "Alternate" outputs for patching. The group connectors are described in E44.170. Type L supergroups employ supergroup connectors described in E34.180 and K1-K2 junctions employ connectors covered in E34.073.

1.03 The line-up procedures for the individual systems and connecting circuits are given in the associated section as follows:

E34.043 Type J Carrier Telephone Over-all System - J2 Terminals with J2 Repeaters or Modified J1 Repeaters

E34.060 Type K1 Carrier Telephone - Over-all System

E34.070 Type K2 Carrier Telephone - Over-all System

E34.080 Type L Carrier Telephone - Over-all System

E34.170 Group Connecting Circuits - Type J, K and L Carrier Systems.

1.04 Where the circuit load warrants it, long circuits are built up in large enough groups so that it is advantageous to omit channel banks at individual group terminals and to connect the circuits together on a group basis; i.e., in the 60-108 kc frequency range. Where these interconnections occur they are accomplished by use of group connecting circuits as described in E44.170 and E34.170.

1.05 When a number of groups are connected in tandem it is necessary to make over-all tests of net loss, noise, crosstalk and modulation to determine that the group is satisfactory for use in the toll plant. This section deals solely with the tests of over-all equalization and net loss. While each group should be tested individually the tests of the over-all channel group will determine whether the interconnections are free from trouble, whether the accumulation of individual permissible variation has exceeded the over-all limitations and whether the groups have developed trouble since the last test.

1.06 Before any adjustments are made in the initial line-up or in subsequent realignment of any part of the tandem group it is very important that all pilots are checked and adjusted to their specified values.

2. TRANSMISSION TESTS AND ADJUSTMENTS

(A) Line-up of Carrier Sections

2.01 In order to ensure that the groups will be satisfactory when connected in tandem the individual carrier groups should be first checked for satisfactory line-up of equalization and net loss as provided in Paragraph 1.03.

2.02 In connecting groups in tandem the group connector specified in E34.170 should be used at each junction. Each connector circuit should be adjusted to have a loss as near 37 db as possible.

2.03 The channel banks at each end should be tested and adjusted in accordance with E34.054.

(B) Over-all System Net Loss Tests

2.04 The over-all transmission check is made from the voice frequency side of the channel banks at the 4-wire voice frequency

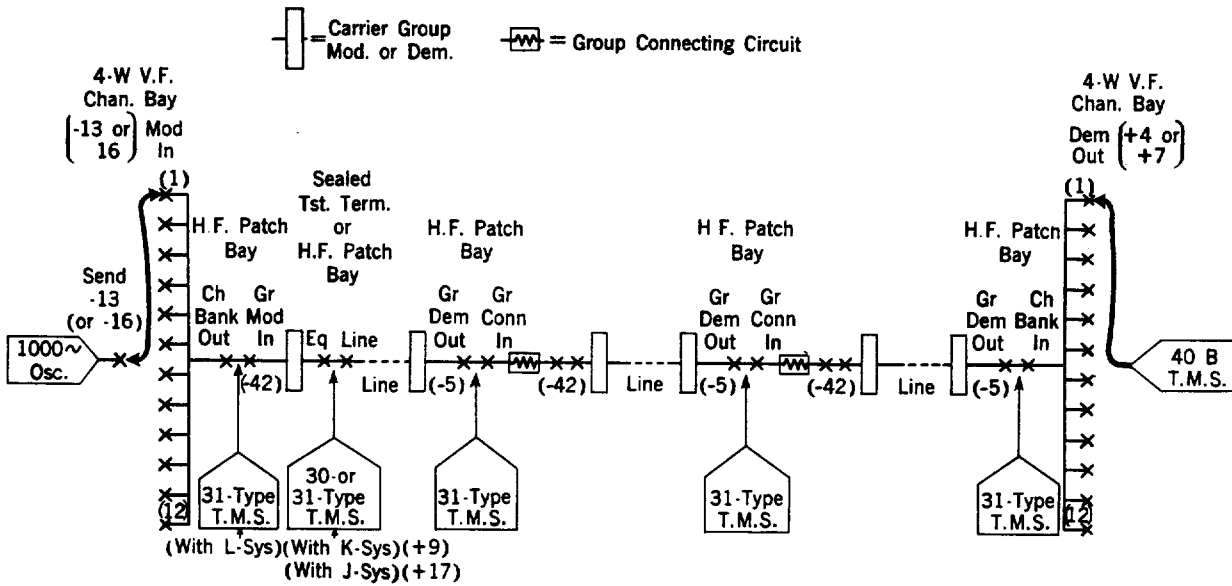


Fig. 1 - Over-all Net Loss Tests

channel bay. The levels are measured at each junction point at group frequency as well as at the receiving end. See Fig. 1.

2.05 Procedure - Transmitting End, 4-Wire Voice Frequency Channel Bay.

- (1) Patch the 1000-cycle testing power output to the MOD IN jacks of Channel 1 using the SEND -13 or SEND -16 output jacks to correspond to the specific level for the channel MOD IN jacks.
- (2) When measurements are completed on Channel 1 change the above patch to Channels 2 to 12 successively, to permit testing each channel.

2.06 Procedure - Transmitting End, High Frequency Measurements.

- (1) At terminals associated with an L-section - Using the 31-type or 42A transmission measuring set and a 312A plug make a bridged measurement of the transmission level at the GR MOD IN - CH BANK OUT jacks (nominally -42 dbm level point). The group frequency at which the 1000-cycle tone will appear for each channel is given in Table I.
- (2) At terminals associated with a K-section - Using the 31-type or 42A transmission measuring set and a 312A plug make

TABLE I  
CHANNEL FREQUENCIES AT DIFFERENT JACK LOCATIONS  
FREQUENCIES IN KC

CHAN. NO. JK. APPEARANCE	1000-Cycle Point of Channels											
	1	2	3	4	5	6	7	8	9	10	11	12
CH BANK OUT, GR DEM OUT, CH BANK IN, GR CONN IN	107	103	99	95	91	87	83	79	75	71	67	63
(Type K1 or K2 Terminal) EQ	13	17	21	25	29	33	37	41	45	49	53	57
(Type J Term.) EQ												
NA or NB W-E	37	41	45	49	53	57	61	65	69	73	77	81
SA or SB W-E	83	79	75	71	67	63	59	55	51	47	43	39
NA E-W	139	135	131	127	123	119	115	111	107	103	99	95
NB E-W	94	98	102	106	110	114	118	122	126	130	134	138
SA E-W	96	100	104	108	112	116	120	124	128	132	136	140
SB E-W	141	137	133	129	125	121	117	113	109	105	101	97

a bridged measurement of the transmission level at the EQ and LINE jacks (nominally +9 dbm level point). The frequency at which the 1000-cycle tone will appear for each channel is given in Table I.

(3) At terminals associated with a J-section - Using the 30-type transmission measuring set make a terminated measurement of the transmission level at the EQ and LINE jacks (nominally +17 dbm level point) for the initial line-up and when making subsequent adjustments after the entire channel group has been removed from service. Upon completion of the terminated measurement and when a 31-type or 42A transmission measuring set is available a bridge measurement should be made for reference in future adjustments when the entire channel group is not to be removed for service. The frequency at which the 1000-cycle tone will appear for each channel is given in Table I.

#### 2.07 Procedure - At Junction Points.

(1) Using the 31-type or 42A transmission measuring set and a 312A plug, make a bridged measurement of the transmission level at the GR DEM OUT - GR CONN IN jacks at the proper frequency per Table I (nominally -5 dbm level point).

#### 2.08 Procedure - Receiving End, High Frequency Measurement.

(1) Measure the transmission levels at the GR DEM OUT - CH BANK IN jacks as in Paragraph 2.07.

Requirements: At each test point the level of each channel measured should be within the following limits from the nominal value for that test point:

- (a) Where no K-section exists between the transmitting end and the test point:  $\pm 2$  db.
- (b) Where a K-section is included between the transmitting end and the test point:  $\pm 4$  db.

2.09 When a measuring point is not equipped with facilities for making the measurements on a bridged basis they should be made on a terminated basis using the 30-type transmission measuring set but only after the entire channel group has been removed from service. Where such measurements are made at an intermediate point the test equipment must be removed from the circuit as soon as readings are obtained to permit other test points more

remote from the transmitting end to make their readings. The limits specified under the requirements of Paragraph 2.08 should also apply when using the 30-type transmission measuring set on a terminated basis.

2.10 If the transmission frequency characteristic of the over-all channel group measured by the 12 channels at the receiving end of each section is not within the limits required, the group control office should review the data taken at the junction points, together with the over-all data, to determine what changes should be made to meet the requirements. The over-all excessive deviations may be due to the accumulation of deviations of each successive section, though each is within its own required limits when measured between its own terminals. In reviewing the junction point data, attention should be directed to the additive effect of sections where the deviations are in the same direction; that is, all above, or all below the flat transmission frequency characteristic. The control office should, from the studies, determine which section should be readjusted to accomplish the requirements. Where adjustments are required, the pilots should first be checked at all junction points and adjusted as close as possible to their required level. Then by changing the loss of the group connector at those points indicated by the study of the test data, the proper correction may be applied to bring the levels within the requirements. The change in the loss of the group connector should not be greater than  $\pm 2$  db from the 37 db nominal value at any one point. As an example, assuming a four-section group, the third section of which is a K-section. The maximum deviation permitted by these requirements at the junction points and the receiving end would then be:  $\pm 2$ ,  $\pm 2$ ,  $\pm 4$ ,  $\pm 4$  db. If after adjusting all pilots the following deviations still existed: +1, +1.5, +4.5, +5.5 db it would indicate the excessive deviations were primarily due to the +3 db deviation in the third section and so by introducing 1 db additional loss in the connectors between the second and third sections as well as between the third and fourth sections, a new set of deviations may be obtained which do meet the requirements: +1, +1.5, +3.5, +3.5 db. It will be noted that for purpose of illustration here, all deviations were cumulative. Such a condition may not be expected to occur frequently in actual practice.

2.11 While the deviation in the transmission frequency characteristics of such tandem groups will vary more than for a single channel, it is expected that after proper alignment as indicated in this section the deviations will be no more than can be taken up in the adjustment of the demodulator potentiometer in each channel equipment.

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2.12 Having met the requirements of Paragraph 2.08 the output levels of the channel demodulators should be measured at the DEM OUT jacks using the 40B transmission measuring set. If trouble is indicated by one channel being considerably different from the others this trouble should first be cleared. With the channel demodulators free of trouble the demodulator potentiometer should be adjusted to meet the following requirement:

Requirement: Whenever measured, the level should be adjusted to as close as possible (+0.2 db) to the nominal channel level (+4, +7).

Attached:

Page 101 - Note: A duplicate of those figures and tables of this section which is felt may be of use to the toll testboardman is provided on Page 101 which may be removed for use elsewhere without impairing the section.

### (C) Channel Net Loss-Frequency Characteristics

2.13 The channel net loss-frequency characteristics may be determined by the measurement of the channel bank with the transmitting and receiving circuits looped together at the terminal, as covered in Section E34.054. This will disclose transmission irregularities which may be due to channel band filters independent of any irregularities contributed by the high frequency line. The characteristics of the high frequency line are determined in connection with the equalization of the individual line sections. Where the loop method has been employed, it should not be necessary to make an over-all net loss-frequency measurement of the channels.

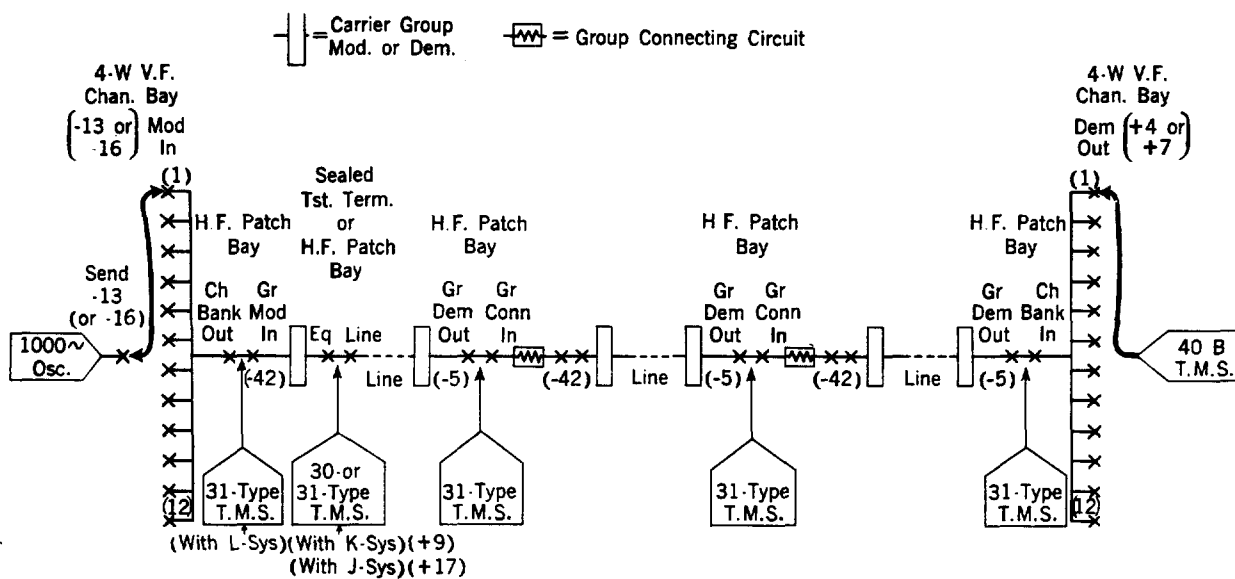


Fig. 1 - Over-all Net Loss Tests (E34.171)

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CHANNEL FREQUENCIES AT DIFFERENT JACK LOCATIONS  
FREQUENCIES IN KC

(E34.171)

CHAN. NO.		1000-Cycle Point of Channels											
		1	2	3	4	5	6	7	8	9	10	11	12
JK. APPEARANCE													
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(Type K1 or K2 Terminal) EQ		13	17	21	25	29	33	37	41	45	49	53	57
(Type J Term.) EQ													
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SA or SB	W-E	83	79	75	71	67	63	59	55	51	47	43	39
NA	E-W	139	135	131	127	123	119	115	111	107	103	99	95
NB	E-W	94	98	102	106	110	114	118	122	126	130	134	138
SA	E-W	96	100	104	108	112	116	120	124	128	132	136	140
SB	E-W	141	137	133	129	125	121	117	113	109	105	101	97