

DESCRIPTION OF TRANSMISSION TEST REQUIREMENT TABLES

1. GENERAL

1.01 This section describes the transmission test requirement tables and transmission notes as shown on the circuit drawings and replaces Section A804.003, Issue 3. It is reissued to add a description of the "Transmission Notes" and also to cover "Return Loss" requirements and the methods of including them in the Transmission Test Requirements Tables.

1.02 The transmission test requirement tables and transmission notes form a part of the circuit drawings.

1.03 Two general types of transmission test requirement tables are shown on circuit drawings. One type covers 1000 cycle loss requirements and is described in part 2. The other type covers gain requirements at single and multi-frequencies, and loss requirements at multi-frequencies, and is described in part 3.

1.04 In some cases return loss or singing point and composite set impedance unbalance requirements are shown on the transmission test requirement tables. They are described in part 4.

1.05 In cases where the testing information cannot readily be specified in transmission test requirement tables, notes covering this information are shown on the circuit drawings. These notes are described in part 5.

1.06 Information given in the transmission test requirement tables and transmission notes does not include losses of switchboard wiring or the conductor losses of the outside plant.

1.07 Information in the transmission test requirement tables and transmission notes is revised when necessary in connection with circuit changes and is accordingly kept up to date by this means.

2. DESCRIPTION OF TABLE USED FOR 1000 CYCLE LOSS REQUIREMENTS

2.01 Title of Table Each transmission test requirement table has the title "TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 600 OHM LINES)".

2.02 Form of Table The 1000 cycle loss transmission test requirement table shown on circuit drawings is usually of the type illustrated either in Fig. 1, Fig. 2 or Fig. 3. It is divided into two main divisions which are fixed, except that the

part of the table giving the maximum allowable circuit loss is subdivided when necessary to fit the circuit conditions. One of the main divisions is arranged for the transmission losses for the circuit in its talking condition and the other for the transmission losses of the individual pieces of apparatus involved. The specified losses apply to the condition of test only and, while they serve to check the condition of the equipment, they do not always correspond to the loss under actual talking conditions.

Transmission Losses for Circuit

2.03 The transmission losses shown in the table are the losses at 1000 cycles between 600-ohm impedances and do not necessarily bear any close relation to the loss assignable to the apparatus in computing the overall equivalent of a complete circuit between subscribers.

2.04 Referring to Fig. 1 it is to be noted that the top part of the table is divided into two parts. The part at the left consists of a diagram of the transmission circuit and the part at the right gives the maximum allowable circuit loss in decibels (db). In some cases, as shown in Fig. 2, the maximum allowable circuit loss is shown directly under the sketch of the transmission circuit. When losses for more than one transmission condition are required for a circuit, provision is made for the additional space required for the associated maximum allowable circuit losses.

2.05 Each piece of apparatus is designated on the diagram with the same designation given it on the circuit drawing. The number in the upper left-hand corner of the space given over to the diagram (see Fig. 1) is the file number of the transmission condition and should be disregarded.

TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 600 <sup>OHM</sup> LINES)					
211.041 L4		MAX. ALLOWABLE CIRCUIT LOSS			
		WITH 94E REP COIL - 12 db			
		WITH 94F REP COIL - 17 db			
INDIVIDUAL APPARATUS LOSSES					
APPARATUS	DESIG.	CODE	MAX. LOSS	MIN. LOSS	REMARKS
CONDENSER	(A)&(B)	4MF	20.9	17.3	
REPEATING COIL	(C)	94E	0.9		
REPEATING COIL	(C)	94F	1.3		
* INDICATES APPARATUS FOR WHICH IND LOSSES ARE NOT REQUIRED.					

Fig. 1

TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 600 <sup>Ω</sup> LINES)					
211.022-L1	222.006-L1				
MAX. ALLOWABLE CIRCUIT LOSS 1.1	MAX. ALLOWABLE CIRCUIT LOSS 1.1				
INDIVIDUAL APPARATUS LOSSES					
APPARATUS	DESIG.	CODE	MAX. LOSS	MIN. LOSS	REMARKS
CONDENSERS A & C		2M.F.	14.5	11.5	
REP. COIL		225-A, 28-A, 125-A, 1125-A, OR FRONT COIL OF 23-AC	0.9		
* INDICATES APPARATUS FOR WHICH IND. LOSSES ARE NOT REQUIRED					

Fig. 2

2.06 In the space below the sketch or at the right side of it, the transmission loss in decibels (db) is given under the heading "MAX. ALLOWABLE CIRCUIT LOSS." In certain cases, as shown in Fig. 3, such

TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 600 <sup>Ω</sup> LINES)					
730.002-141-75 (C)	MAX. ALLOWABLE CIRCUIT LOSS				
	BRIDGE TRANS.				
	"X" WIRING 2.3 11.2				
	"Y" WIRING 2.3 11.5				
INDIVIDUAL APPARATUS LOSSES					
APPARATUS	DESIG.	CODE	MAX. LOSS	MIN. LOSS	REMARKS
CONDENSER	B	1 M.F.	9.3	6.3	
CONDENSER	C	3 M.F.	17.3	14.3	
IND. COIL	C	63	11.6	10.6	
* INDICATES APPARATUS FOR WHICH IND. LOSSES ARE NOT REQUIRED					

Fig. 3

as in specifying the loss for an operator's telephone circuit, the space under the heading "MAX. ALLOWABLE CIRCUIT LOSS" is divided into two parts to provide for bridged and transmitting losses. These divisions are headed "BRIDG." and "TRANS." respectively. When the loss is specified for a monitoring transformer, the divisions are headed "BRIDG." and "REC.", to provide for bridged and receiving losses, respectively. In other cases a receiving circuit loss only is specified and the "BRIDG." column is left vacant.

Individual Apparatus Losses

2.07 The lower portion of the table, referring again to Fig. 1, is headed "INDIVIDUAL APPARATUS LOSSES", and is sub-

divided into six columns, namely, - "APPARATUS", "DESIG.", "CODE", "MAX. LOSS", "MIN. LOSS" and "REMARKS". Information pertaining to these headings is given in the following paragraphs.

2.08 The individual apparatus losses are for use only in those cases in which the circuit fails to meet the overall requirement, and it becomes necessary, therefore, to measure the individual pieces of apparatus to determine the cause.

2.09 Apparatus In this column is listed the name of each piece of apparatus, such as relay, repeating coil, etc., for which individual losses are given. This includes each piece of apparatus in the transmission circuit which is not marked with an asterisk (\*) on the transmission sketch. However, in toll offices where a Wheatstone Bridge is available, individual losses are not specified for resistances. If the resistances effect transmission they are not marked with an asterisk (\*) on the transmission sketch. When one or more pieces of apparatus are marked with an asterisk (\*) the following note appears at the bottom of the transmission table:

" \* Indicates apparatus for which individual losses are not required."

2.10 The conditions under which individual losses are not given are usually where the equipment is shunted by means of a condenser, or other apparatus of lower impedance, such as shown in Fig. 2 and Fig. 3, and also in some cases where two pieces of equipment of considerably different impedance are connected in series and the combination bridged across the circuit. An example of this latter condition is a toll cord circuit in which a relay of relatively low impedance is connected in series with a retardation coil.

2.11 Desig. (Designation) The circuit designation of each piece of apparatus shown in the sketch for which individual losses are given is shown in this column.

2.12 Code In this column are given the code numbers of the various pieces of apparatus with the exception of condensers and resistances. In the case of condensers the capacity is given, and in the case of resistances the value of the resistance is given in this column.

2.13 Max. (Maximum) Loss This column is provided for the transmission losses of the individual pieces of apparatus as measured between impedances of 600 ohms of a transmission measuring set with a measuring current of a frequency of 1000 cycles. Unless otherwise specified the connections of the apparatus to the transmission measuring set shall be the same (with the exception of condensers) as is used in the respective transmission circuits. For example,

2.13 (Continued)

series connected apparatus is tested in series and shunt connected apparatus is tested in shunt. Condensers having a capacity of 0.25 mf or more regardless of their connection in the respective transmission circuits, are tested in shunt. Condensers having a smaller capacity are tested in series.

2.14 Min. (Minimum) Loss In some cases it is necessary to work to a minimum transmission loss which is given in this column. For example, the induction coil of operators' telephone circuits, as covered in Fig. 3, requires such a loss limit. The conditions of measurement shall be the same as covered under "Max. Loss".

2.15 Remarks Any remarks which are necessary in connection with the transmission losses are placed in this column.

3. TABLE USED FOR GAIN REQUIREMENTS AT SINGLE AND MULTI-FREQUENCIES AND LOSS REQUIREMENTS AT MULTI-FREQUENCIES

3.01 Title of Table Each transmission test requirement table has the general title "TRANSMISSION TEST REQUIREMENTS" with one of the following sub-titles in parenthesis under the general title. (LOSS BETWEEN 600 $\omega$  LINES), (1000-CYCLE GAIN BETWEEN 600 $\omega$  LINES) or (GAIN BETWEEN 600 $\omega$  LINES).

3.02 Form of Table The gain or loss transmission test requirement table shown on circuit drawings is usually of the type illustrated either in Fig. 4, Fig. 5 or Fig. 6. It shows the circuit gain or loss at all necessary testing frequencies and some of these tables also show the individual apparatus losses. The specified gains or losses for the circuit apply to the condition of test only and while they serve to check the condition of the equipment they do not always correspond to the gain or loss under actual talking conditions.

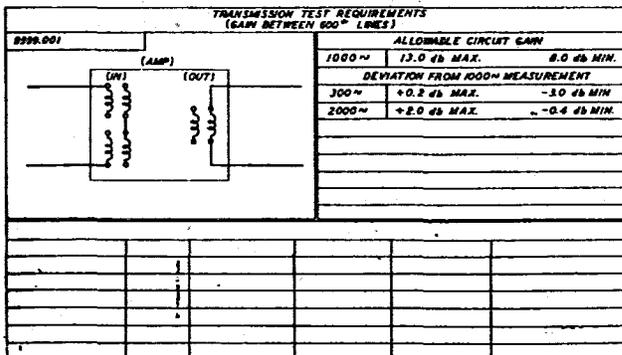
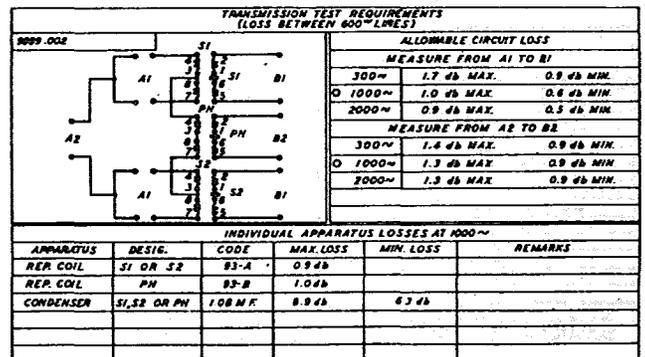


Fig. 4

Transmission Gain or Loss for Circuit

3.03 The transmission test requirements shown in the table are the gains or the losses at the frequencies shown in the table as measured between 600-ohm impedances and do not necessarily bear any close relation to the gain or loss assignable to the apparatus in computing the overall equivalent of a complete circuit between subscribers.

3.04 Referring to the top part of Fig. 5 it is to be noted that the table is divided into two parts. The part at the left consists of a diagram of the transmission circuit and the part at the right gives the allowable circuit loss in decibels (db). In the case shown in Fig. 4 maximum and minimum gain requirements are given for a typical amplifier at 1000 cycles and maximum and minimum gain requirements are given at 300 and 2000 cycles in terms of deviation from the 1000 cycle measurement. Since in this case the amplifier is tested as a unit, a detailed sketch of the transmission circuit is not shown in the table. In these cases individual apparatus losses are generally not shown. In the case shown in Fig. 5 maximum and minimum loss requirements are given for the side circuit phantom repeating coil at 300, 1000 and 2000 cycles. Also maximum and minimum loss requirements are given for the phantom circuit phantom repeating coil, as measured thru 1/2 the side circuit coils, at 300, 1000 and 2000 cycles. Referring to Fig. 6 which covers transmission requirements for four wire terminating equipment it is to be noted that the table is divided into two parts. The upper part consists of a diagram of the transmission circuit and the lower part directly under the sketch gives the allowable circuit loss or gain in decibels (db). The lower part is further divided into two parts, one for the overall circuit loss or gain and the other for trouble location measurements. Where trouble location measurements are specified, individual apparatus loss limits are not shown. As covered in the note at the bottom of the table it is not necessary for



NOTE:  
1. MEASUREMENTS DESIGNATED WITH A CIRCLE (O) SHALL BE MADE BY THE INSTALLER ON SHOP TESTED EQUIPMENT REGARDLESS OF WHETHER THEY HAVE BEEN REQUESTED BY THE CUSTOMER. ALL OTHER MEASUREMENTS ON SHOP TESTED EQUIPMENT MAY BE OMITTED BY THE INSTALLER.

Fig. 5

3.04 (Continued)

the installer to make all of the loss measurements if the equipment has been assembled in the shop. Additional trouble location circuit loss requirements are also shown in Fig. 6.

3.05 Each piece of apparatus is designated on the diagram with the same designation given it on the circuit drawing. The number shown in the upper left-hand corner

of the space given over to the diagram is the file number of the transmission condition and should be disregarded.

Individual Apparatus Losses

3.06 The lower portion of the table, referring to Fig. 5, is headed "INDIVIDUAL APPARATUS LOSSES AT 1000 CYCLES" and is subdivided into six columns, namely - "APPARATUS", "DESIG.", "CODE", "MAX. LOSS", "MIN. LOSS" and "REMARKS". Information pertaining to these headings is given in the following paragraphs.

3.07 The individual apparatus losses are for use only in those cases in which the circuit fails to meet the overall requirement, and it is necessary therefore to measure the individual pieces of apparatus to determine the cause. On circuits where the individual apparatus losses are not useful in determining the cause of a failure to meet the overall requirements the individual apparatus losses are not shown in the table (See Figs. 4 and 6). In toll offices where a Wheatstone Bridge is available, individual losses are not specified for resistances. If the resistances affect transmission they are not marked with an asterisk (\*) on the transmission sketch.

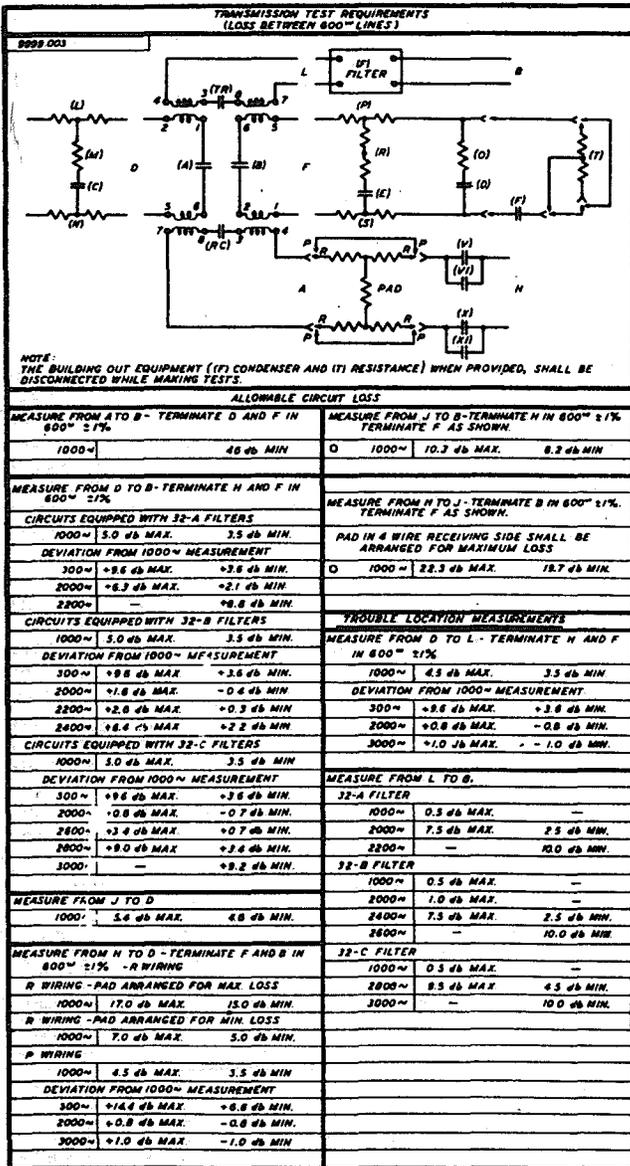
3.08 Apparatus In this column is given the name of each piece of apparatus, such as relay, repeating coil, etc., for which individual losses are given.

3.09 Desig. (Designation) The circuit designation of each piece of apparatus shown in the sketch for which individual losses are given is shown in this column.

3.10 Code In this column are given the code numbers of the various pieces of apparatus with the exception of condensers and resistances. In the case of condensers the capacity is given, and in the case of resistances the value of the resistance is given in this column.

3.11 Max. (Maximum) Loss This column is provided for the transmission losses of the individual pieces of apparatus as measured between impedances of 600 ohms. Unless otherwise specified the connections of the apparatus to the transmission measuring set shall be the same (with the exception of condensers) as is used in the respective transmission circuits. For example, series connected apparatus is tested in series and shunt connected apparatus is tested in shunt. Condensers having a capacity of 0.25 MF or more, regardless of their connection in the respective transmission circuits are tested in shunt. Condensers having a smaller capacity are tested in series.

3.12 Min. (Minimum) Loss In some cases it is necessary to work to a minimum transmission loss which is given in this



NOTE: MEASUREMENTS DESIGNATED WITH A CIRCLE (O) SHALL BE MADE BY THE INSTALLER ON SHOP TESTED EQUIPMENT, REGARDLESS OF WHETHER THEY HAVE BEEN REQUESTED BY THE CUSTOMER. ALL OTHER MEASUREMENTS ON SHOP TESTED EQUIPMENT MAY BE OMITTED BY THE INSTALLER.

2. IF THE MEASUREMENT FROM J TO B DOES NOT MEET ITS REQUIREMENT, THE CRT. WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM J TO D, AND D TO B MEET THEIR REQUIREMENTS. IF THE MEASUREMENTS FROM D TO B DO NOT MEET THEIR REQUIREMENTS, THE CRT. WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM D TO L, AND L TO B MEET THEIR REQUIREMENTS. IF THE MEASUREMENT FROM M TO J DOES NOT MEET ITS REQUIREMENT, THE CRT. WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM J TO D AND H TO D MEET THEIR REQUIREMENTS.

Fig. 6

3.12 (Continued)

column. For example, the condenser in circuits, such as covered in Fig. 5, requires such a loss limit. The conditions of measurement shall be the same as covered under "Max. Loss".

3.13 Remarks Any remarks which are necessary in connection with the transmission losses are placed in this column.

4. TABLE USED FOR RETURN LOSS OR SINGING POINT AND COMPOSITE SET IMPEDANCE UNBALANCE REQUIREMENTS

4.01 Title of Table Each transmission test requirement table has the general title "TRANSMISSION TEST REQUIREMENTS" with any combination of the following sub-titles under the general title. (LOSS BETWEEN 600 OHM LINES), (RETURN LOSS OR SINGING POINT), (COMPOSITE SET IMPEDANCE UNBALANCE).

4.02 Form of Table The loss or gain transmission test requirement table shown on circuit drawings is usually of the type illustrated in Fig. 7. It shows the circuit loss or gain at all necessary testing frequencies and also the individual apparatus losses. The specified losses or gains for the circuit apply to the condition of test only and while they serve to check the condition of the equipment they do not always correspond to the loss or gain under actual talking conditions.

4.03 The return loss or singing point requirements shown in the table are a measure of the difference in impedance between line and network equipment when terminated as covered in the table. The composite set impedance unbalance requirements shown in the table are a measure of the balance to ground of the various parts of a composite set. These requirements also include comparative measurements, from the standpoint of balance to ground, of composite sets used on the side circuits of phantom groups. These tests indicate the amount of phantom circuit to side circuit crosstalk and longitudinal circuit unbalance.

4.04 Referring to Fig. 7 which covers transmission requirements for phantom composited equipment it is to be noted that the table is divided into two parts. The upper part consists of a diagram of the transmission circuit and the lower part directly under the diagram gives the circuit loss in decibels (db), the return loss or singing point in decibels (db) and the composite set impedance unbalance in "Maximum Allowable Per Cent Unbalance". The return loss or singing point requirements are further divided into two groups, one for overall circuit return loss or singing point and the other for trouble location measurements. The lower part of the table covers individual apparatus loss. As covered by Note 1 in

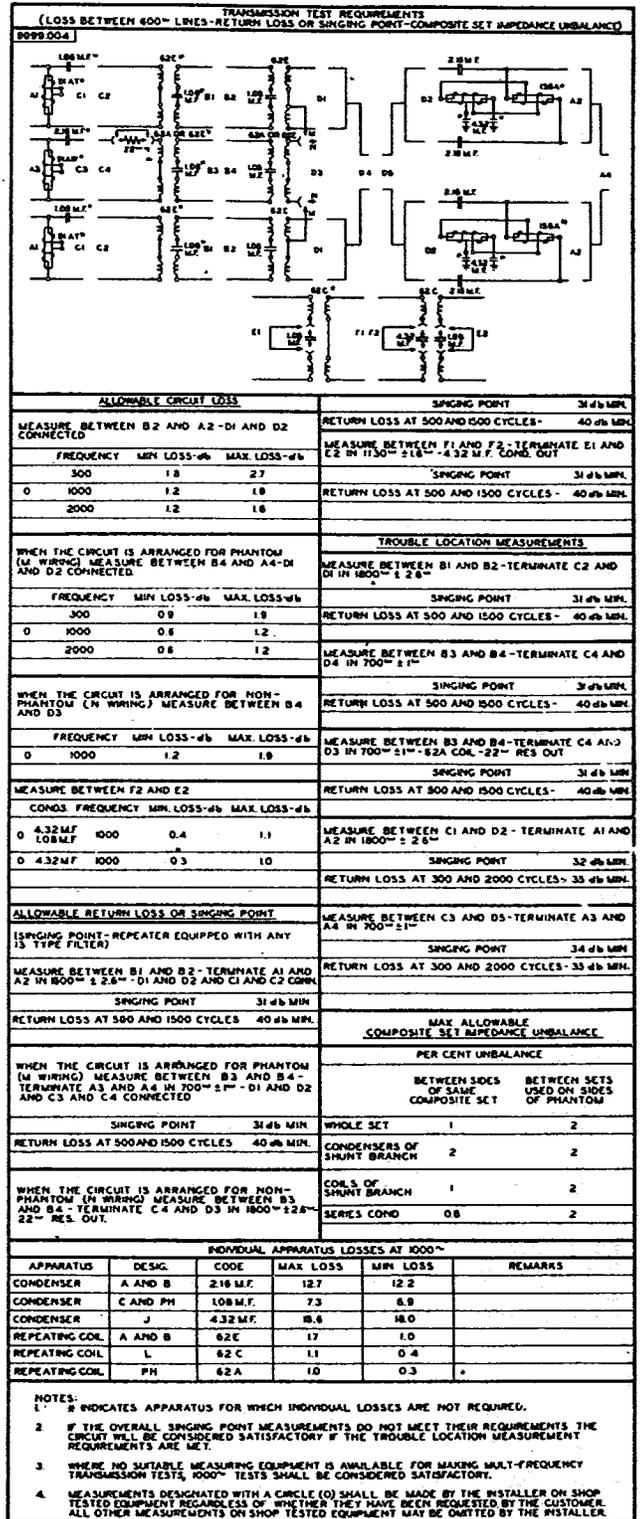


Fig. 7

## 4.04 (Continued)

Fig. 7 apparatus marked with an asterisk (\*) does not require individual loss limits. It is to be noted that no transmission loss limits are given for network equipment. This equipment is checked by a singing point check.

4.05 Each piece of apparatus is designated on the diagram with the same designation given it on the circuit drawing. The number in the upper left-hand corner of the space given over to the diagram (see Fig. 7) is the file number of the transmission condition and should be disregarded.

4.06 In the space below the sketch the transmission circuit loss or gain in decibels (db) is given as "MAX." and "MIN."

Individual Apparatus Losses

4.07 The lower portion of the table, referring again to Fig. 7, is headed "INDIVIDUAL APPARATUS LOSSES AT 1000 CYCLES" and is subdivided into six columns, namely "APPARATUS", "DESIG.", "CODE", "MAX. LOSS", "MIN. LOSS" and "REMARKS". Information pertaining to these headings is given in the following paragraphs.

4.08 The individual apparatus losses are for use only in those cases in which the circuit fails to meet the overall requirement, and it is necessary, therefore, to measure the individual pieces of apparatus to determine the cause.

4.09 Apparatus In this column is given the name of each piece of apparatus, such as relay, repeating coil, etc., for which individual losses are given. This includes each piece of apparatus in the transmission circuit which is not marked with an asterisk (\*) on the transmission sketch. However in toll offices where a Wheatstone Bridge is available, individual losses are not specified for resistances. If the resistances affect transmission they are not marked with an asterisk (\*) on the transmission sketch. When one or more pieces of apparatus are marked with an asterisk (\*), the following note appears at the bottom of the transmission table:

" \* Indicates apparatus for which individual losses are not required."

4.10 The conditions under which individual losses are not given are usually where the equipment is shunted by means of a condenser, or other apparatus of lower impedance, and also in some cases where two pieces of equipment of considerably different impedance are connected in series and the com-

ination bridged across the circuit as shown in Fig. 7.

4.11 Desig. (Designation) The circuit designation of each piece of apparatus shown in the sketch for which individual losses are given is shown in this column.

4.12 Code In this column are given the code numbers of the various pieces of apparatus with the exception of condensers and resistances. In the case of condensers the capacity is given, and in the case of resistances the value of the resistance is given in this column.

4.13 Max. (Maximum) Loss This column is provided for the transmission losses of the individual pieces of apparatus as measured between impedances of 600 ohms of a transmission measuring set with a measuring current of a frequency of 1000 cycles. Unless otherwise specified the connections of the apparatus to the transmission measuring set shall be the same (with the exception of condensers) as is used in the respective transmission circuits. For example, series connected apparatus is tested in series and shunt connected apparatus is tested in shunt. Condensers having a capacity of 0.25 MF or more regardless of their connection in the respective transmission circuits are tested in shunt. Condensers having a smaller capacity are tested in series.

4.14 Min. (Minimum) Loss In some cases it is necessary to work to a minimum transmission loss which is given in this column. For example, the repeating coil of the circuit, as covered in Fig. 7, requires such a loss limit. The conditions of measurement shall be the same as covered under "Max. Loss".

4.15 Remarks Any remarks which are necessary in connection with the transmission losses are placed in this column.

5. TRANSMISSION NOTES

5.01 When the transmission test requirements cannot be readily covered in tables similar to those already described, the information is given on the circuit drawings in the form of TRANSMISSION NOTES. These requirements appear on the drawings as the 300 series of notes.

5.02 The transmission notes give complete information regarding the allowable gain, loss or required output for the particular circuit on which they appear.

5.03 The following information which covers the requirements for an oscillator illustrates the use of Transmission Notes on the circuit drawings.

Transmission Notes

301. The oscillator shall have an output of between 16.5 and 21.5 milliamperes (22.1 to 24.4 db above 1 milliwatt).
302. The frequency of this oscillator shall be  $1000 \pm 24$  cycles. This requirement is based on beating the frequency
- against a 6010B oscillator or its equivalent.
303. The wave shape of this oscillator shall be tested by measuring its turnover and this turnover shall not exceed 0.1 db. When a 6A set is used, the sensitivity requirements of this transmission measuring set shall be met.

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