TWO-POINT PRIVATE LINE TELEPHONE SERVICE
FAA, AIRLINES, AND OTHER AGENCIES
OVERALL MEASUREMENTS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the overall tests, requirements, and intervals for testing of 4-wire facilities provided for air traffic communications systems, Vortac, and Federal Aviation Agency (FAA) services covered by FAA specification 1142A. These circuits may combine voice transmission, remote operation, and control of unattended radio broadcast transmitters for the relay of air control instructions to fast-moving aircraft.

1.02 This section is reissued to:

- Update transmission and noise requirements
- Update test equipment
- Add loopback arrangements.

Since this reissue constitutes a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Unless specifically covered in this section, testing and maintenance procedures should follow the standard procedures for similar 4-wire voice circuits as covered in Section 310-300-500.

1.04 The circuits must be reliable so that they will be available for emergencies. They may not be readily available for routine tests; therefore, they must be properly placed in service from the start. Routine tests must be coordinated with the customer and performed so that out-of-service time may be kept to a minimum. ***Prompt restoral of service to the customer cannot be overemphasized.***

1.05 Special service protection (SSP) should be applied to each circuit, and appropriate measures should be observed to prevent loss of protection when working on the circuits (see Section 660-200-301).

1.06 Figure 1 illustrates FAA Form 6000-2; this form is typical of performance records that may be maintained by the customer on telephone company facilities. Each serving test center (STC) or control office should avail itself of customer procedures to standardize communication with the customer reference initial and operating tolerances.

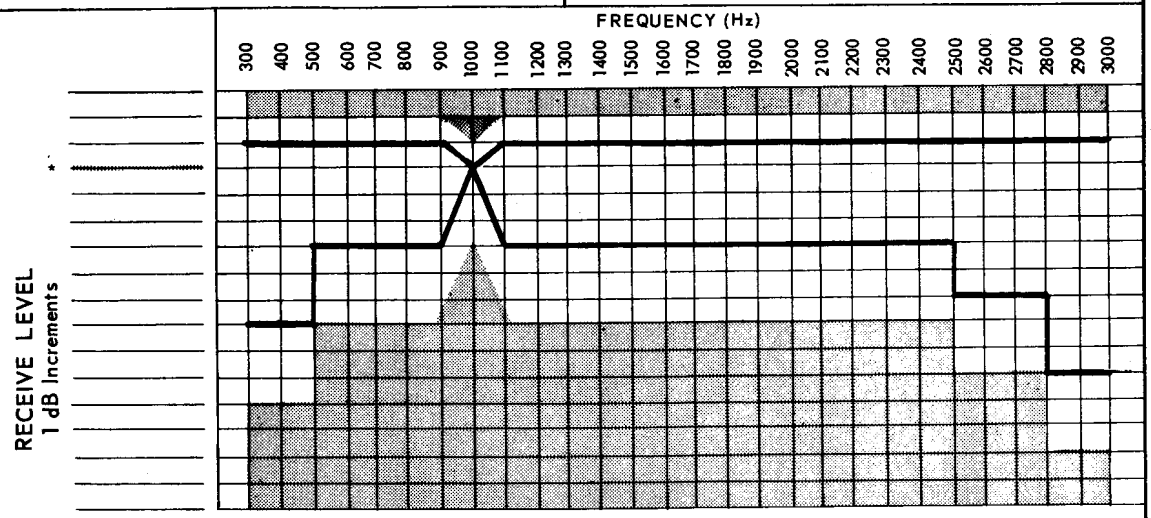
1.07 Figures 2A and 2B are a suggested form that may be locally reproduced on 5- by 8-inch card stock for recording the results of initial, routine, and "as required" measurements. The form should always be attached to the circuit layout record (CLR) by the control office and the STC.

1.08 Measurements recorded on circuit order acceptance should be entered as initial entries on Form E-6266 for future reference as an aid to circuit maintenance. The STC station routines may normally be performed on a loopback when loopback equipment is provided.

1.09 Customer-provided equipment (CPE) not conforming to transmission standards should be administered as outlined in Section 660-101-312. Continuous tone power at 0 TLP should not exceed −8 dBm, and momentary peaks should not exceed 0 dBm.

CONTROL LINE PERFORMANCE RECORD

CIRCUIT IDENTIFIER	ACCEPTANCE DATE
SENDING FACILITY	RECEIVING FACILITY



* Enter 1000 Hz receive level *(–16 to –17 dBm)* with –8 dBm send level as obtained at time of circuit acceptance.

Initial tolerance/limit

Exceeds operating tolerance/limit

FREQUENCY (Hz)	RECEIVE LEVEL @ – 8DBM INPUT	RECEIVE LEVEL @ – 15DBM INPUT	FREQUENCY (Hz)	RECEIVE LEVEL @ – 8DBM INPUT	RECEIVE LEVEL @ – 15DBM INPUT
300			1700		
400			1800		
500			1900		
600			2000		
700			2100		
800			2200		
900			2300		
1000			2400		
1100			2500		
1200			2600		
1300			2700		
1400			2800		
1500			2900		
1600			3000		

PERFORMANCE WORKSHEET		
INITIAL CHARACTERISTICS		
1. 1000 – HZ RECEIVE LEVEL WITH – 8 DBM SEND LEVEL AT TIME OF CIRCUIT ACCEPTANCE *(–16 to – 17 dBm)*		DBM
2. NET LOSS @ 1000 HZ AT TIME OF ACCEPTANCE *(8 to 9 dB)*		DB
PRESENT CHARACTERISTICS		
3. 1000 Hz RECEIVE LEVEL		DBM
4. 1000 Hz SEND LEVEL	–8.0	DBM
5. NET TRANSMISSION LOSS		DB
6. NOISE LEVEL *(Conversion factor – 85; add algebraically)*		DBA
7. WEIGHTED NOISE		DBM
8. WEIGHTED NOISE		DBM
9. LOWEST RECEIVED LEVEL 300–2500 Hz		DBM
10. SIGNAL TO NOISE RATIO		DB
11. WEIGHTED NOISE		DBM
12. LOWEST RECEIVED LEVEL 2600–3000 Hz		DBM
13. SIGNAL TO NOISE RATIO		DB

TIME	DATE OF REPORT	SIGNATURE OF TECHNICIAN

FAA Form 6000-2 (8-69) SUPERSEDES FAA FORM 2088-19 C FAA AC 70-4033

Fig. 1—FAA Form 6000-2 (Not Authorized for Telephone Company Use)

(A) = CONTROL
(Z) = NON CONTROL

REMOTE CONTROL AIR GROUND CIRCUIT
TRANSMISSION HISTORY

E-6266
310-305-500

CIRCUIT NUMBER _____ CONTROL OFFICE _____ CO NUMBER _____

TEST DATE INITIALS	1000-HZ LOSS AML RCV(A)	1000-HZ LOSS AML RCV(Z)	1000-HZ LOSS DEVIATION (A)	1000-HZ LOSS DEVIATION (Z)	NOISE dBrnCO RCV(A)	NOISE dBrnCO RCV(Z)	DC LOOP RESISTANCE OHMS TRMT(A)	DC LOOP RESISTANCE OHMS RCV(A)	DC LOOP RESISTANCE OHMS TRMT(Z)	DC LOOP RESISTANCE OHMS RCV(Z)	CUSTOMER OUTPUT POWER (DBMO) (A)	CUSTOMER OUTPUT POWER (DBMO) (Z)

	1000-HZ LOOPBACK LEVEL EXPECTED	1000-HZ LOOPBACK LEVEL ACTUAL	ALTERNATE SWITCHING (A)	ALTERNATE SWITCHING (Z)

LOOPBACK INSTRUCTIONS:

Fig. 2A—Form E-6266 (Front)

(A) = CONTROL
(Z) = NONCONTROL

REMOTE CONTROL AIR GROUND CIRCUIT
TRANSMISSION HISTORY

310-305-500

CIRCUIT NUMBER _____

DATE											LIMITS (dB)	
FREQ (HZ)	RCV(A)	RCV(Z)	RCV(A)	RCV(Z)	RCV(A)	RCV(Z)	RCV(A)	RCV(Z)	RCV(A)	RCV(Z)	CO	ROUTINE
300											+6 TO -1	+9 TO -2
500											+3 TO -1	+6 TO -2
600											+3 TO -1	+6 TO -2
800											+3 TO -1	+6 TO -2
1000	0	0	0	0	0	0	0	0	0	0		
1200											+3 TO -1	+6 TO -2
1400											+3 TO -1	+6 TO -2
1600											+3 TO -1	+6 TO -2
1800											+3 TO -1	+6 TO -2
2000											+3 TO -1	+6 TO -2
2200											+3 TO -1	+6 TO -2
* 2400											+3 TO -1	+6 TO -2
2500											+5 TO -1	+8 TO -2
2600											+5 TO -1	+8 TO -2
2700											+5 TO -1	+8 TO -2
2800											+8 TO -1	+11 TO -2
3000											+8 TO -1	+11 TO -2

RECORD DEVIATIONS FROM 1000 HZ; PLUS SIGN INDICATES MORE LOSS AND MINUS SIGN INDICATES LESS LOSS.

NOTES:

* DAS 806A3 OPERATE FREQUENCY

Fig. 2B—Form E-6266 (Reverse)

2. TESTING APPARATUS

2.01 Good measurements are contingent upon good test equipment and proper test procedure. All equipment should be checked prior to use to insure that it is working and calibrated properly. Circuit impedance at the test point should be considered in each measurement. When measurements are to be compared with those of the customer, ***we*** should assure that like measurements are being made.

2.02 The following test equipment may be used:

- WE 3C Noise Measuring Set (NMS)
- KS-19353 Oscillator
- Northeast Electronics Transmission Test Set (TTS) 4 ANH
- WE 21A Transmission Measuring Set (TMS)
- Wheatstone Bridge.

Other equivalent types of test sets may also be used if the above listed sets are unavailable.

2.03 The presence of direct current on the facility may affect the accuracy of measurement by any TMS not equipped with a dc blocking condensor. While direct current should not normally be present, tests for direct current should be made before making measurements.

Caution: Sealing current may be present on some local facilities.

2.04 The 3C NMS should not be used to measure the frequency response of the facility. The measurements should be made with one of the transmission measuring sets as listed in 2.02.

3. DC MEASUREMENTS

3.01 A lot of time can be wasted making transmission tests on a cable pair or open-wire pair that is in trouble. A quick way to check for trouble is to measure the dc loop resistance, including the coil at the customer's premises, from the STC to the station. The resistance should be measured with a wheatstone bridge and the value recorded on Form E-6266 for future reference.

3.02 The facility should also be checked for leakage to ground. If too much leakage to ground (low resistance) is present, the facility may be noisy.

3.03 The dc loop resistance, excluding the coil at the customer's premises, should be within ± 20 percent for aerial cable and ± 5 percent for predominately underground cable.

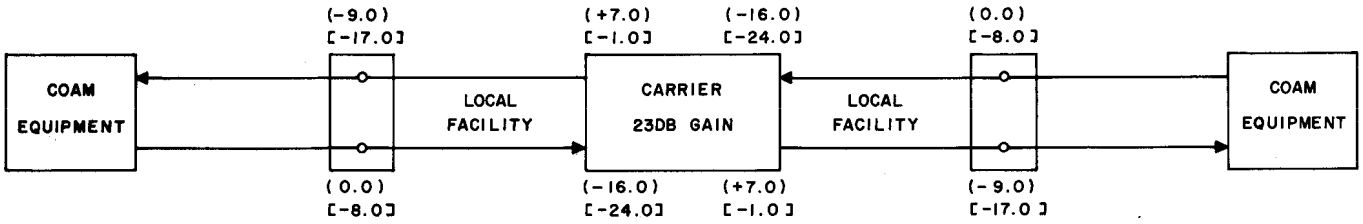
4. TRANSMISSION MEASUREMENTS

4.01 Accurate measurements of the transmission characteristics depend on the power of the test signal with respect to the transmission level point (TLP). The TLP is a point in a circuit at which the transmission level (in dB) is defined as the nominal or design gain (or loss) at 1000 Hz referenced to an arbitrary point in the system called the 0 TLP (not an indication of signal power level, ie, 0 dBm). The test level expressed in dBm0 is the level at which the circuit should be tested relative to the TLP. The simplified circuit diagram in Fig. 3 illustrates the relationship between the TLPs and test tone power in dBm. ***All loss measurements must be made at −8 dBm0 (−24 dBm at a −16 TLP). Circuit sections assigned to an N or ON carrier schedule C or D program channel unit (PCU) must be aligned at −11 dBm0 (−27 dBm at a −16 TLP).***

1000-Hz Loss Deviation

4.02 The actual 1000-Hz actual measured loss (AML) is measured from station to station between demarcation points with 600-ohm impedance test sets, and the results are compared with the expected measured loss (EML) as shown on the CLR. The difference between the two measurements is known as the loss deviation. For example, a 1000-Hz, −8.0 dBm tone is applied at the send demarcation point and the level received at the far end demarcation point is −17.4 dBm; therefore the 1000-Hz loss deviation would be (EML)−(AML) = (−17.0)−(−17.4) = +0.4 dBm (see Fig. 3).

4.03 The maximum 1000-Hz loss deviation from the EML stated on the CLR should be +0 dB to −1 dB for circuit order and +3 dB to −2 dB for routine or trouble isolation.



( ) TLP

[ ] TEST TONE IN DBM

Fig. 3—Simplified Circuit Diagram Illustrating Test Levels From Demarcation Points

Frequency Response (Attenuation Distortion)

4.04 The facilities discussed in this section may be used to transmit tones to operate remote telemetering equipment as well as to transmit voice. Station to station frequency response must be checked to assure satisfactory transmission of the tones. Measurements should be recorded and made in both directions of transmission at the frequencies listed on Form E-6266 (Fig. 2B).

4.05 Table A lists the overall maximum allowable attenuation distortion deviation relative to 1000 Hz in dB. Measurements that do not meet requirements are out of limits; the loss deviation should be corrected to within circuit order limits.

Noise Measurements

4.06 Steady noise measurements should be made at the demarcation point (an NMS with C-message weighting should be used) by terminating the transmitting input to the circuit with 600-ohm impedance and by measuring the noise level at the receiving end. During each measurement the NMS should be used to monitor the circuit for intelligible crosstalk.

TABLE A

MAXIMUM DEVIATION FROM 1000-HZ

FREQUENCY HZ	CIRCUIT ORDER LIMITS (DB)	ROUTINE OR TROUBLE ISOLATION LIMITS (DB)
300—500	+6.0 to —1.0	+9.0 to —2.0
500—2500	+3.0 to —1.0	+6.0 to —2.0
2500—2800	+5.0 to —1.0	+8.0 to —2.0
2800—3000	+8.0 to —1.0	+11.0 to —2.0

4.07 The noise requirements listed in Table B are in dBrnc relative to 0 TLP (dBrnc0). The dBrnc may be read directly from the 3A NMS (or equivalent). To convert the reading in dBrnc to dBrnc0, subtract the TLP at the point of measurement from the reading in dBrnc. An example of making this conversion follows:

TABLE B

CIRCUIT LENGTH (MILES)	NOISE MEASUREMENT* AT OR BELOW (DBRNC0)
0— 50	31
51— 100	34
101— 400	37
401—1000	41
1001—1500	43
1501—2500	45
2501—4000	47
* Based on C-Message Weighting	

When a circuit contains a compandored facility, the above limits are lowered 5 dB for the compandored facility. A circuit made up of compandored and noncompandored facilities should use the limits above.

Actual noise reading (dBrnc)	+35	+33
Subtract the TLP at measuring point	—(— 9)	—(+ 7)
Noise relative to 0 TLP (dBrnc0)	+44	+26

Note: The rule for algebraic subtraction is applied.

5. TEST INTERVALS

5.01 Table C indicates, by means of the asterisk (*), the tests that should be performed on a circuit order basis. The routine transmission tests should be performed semiannually and are in addition to those specified for sections, equipment, etc. The "As Required" intervals should be determined by customer reports and test practices covering the respective types of equipment.

5.02 All tests are to be made on a release basis or by patching in spare equipment. At the completion of each test, verify that all equipment has been restored to service and that circuit operational tests are completed by the customer.

6. TROUBLE INVESTIGATION

6.01 Reports of service interruption should be investigated promptly, and circuit outage should be kept to a minimum.

6.02 Reports of service impairment where the customer does not release the circuit should be reported to supervision immediately and investigated promptly on an in-service basis. The sections requiring corrective maintenance should be either patched out or realigned during a customer release period.

TABLE C

TEST	CIRCUIT ORDER	ROUTINE
Net Loss (1000 Hz)	*	6M
Noise	*	6M
Frequency Response	*	AR
DC Measurements (STC to Station)	*	AR
Customer Equipment Output Power	*	AR
Loopback Operation	*	6M
AC Switching	*	AR

* Required test

6M — 6 months

AR — As required