PRIVATE LINE DATA SYSTEMS
SPECIAL DATA NETWORKS
STRATEGIC AIR COMMAND CONTROL SYSTEM (SACCS)
DESCRIPTION AND SERVICE MAINTENANCE

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to state frequency shift requirements. This issue also recommends the use of the 25A Voiceband Gain and Delay Set for both LOSS-FREQUENCY and RELATIVE ENVELOPE DELAY measurements. Changes are indicated by marginal arrows.

1.02 This section covers description, administrative procedures and maintenance requirements for the Strategic Air Command Control System (SACCS). This system was initially known as the 465L Project.

1.03 The Telephone Company provides only the line facilities, terminating in demarcation strips, to interconnect customer equipment at various locations in the system. These facilities are arranged for 4-wire, Schedule 4, Type 4B alternate voice-data operation, unless otherwise specified. At the request of the customer and where feasible, the following special service arrangements are provided:

(a) Where the existing Primary Alert System and SAC Control System circuits originate and terminate at common locations, diversified circuit routes are provided.

(b) The SAC Control System circuits terminating at the same Remote Communications Central (RCC) are assigned diversified routing. Circuits originating and terminating at common locations are routed via diverse paths.

(c) Target area avoidance routing is used.

(d) Detailed restoration plans are to be established and maintained for each circuit.

(e) The Telephone Company will be responsible for "end-to-end" circuit control and restoration.

1.04 Circuits which interconnect headquarters locations with operational bases and missile complexes or other headquarters locations make up the SAC Control System. Over-all administration of these circuits is handled by the SAC Network Control Office. Local circuits may be provided to interconnect remote points on an operational base or missile complex with the SAC Control System. These circuits are not administered by the Network Control Office as part of the network. See simplified layout in Fig. 1.

2. DESCRIPTION OF TERMS

2.01 Several new terms have been introduced by SAC. These terms may be used by the customer during contacts regarding this service.

2.02 The following is a list of terms, their abbreviations and a brief description of their use:

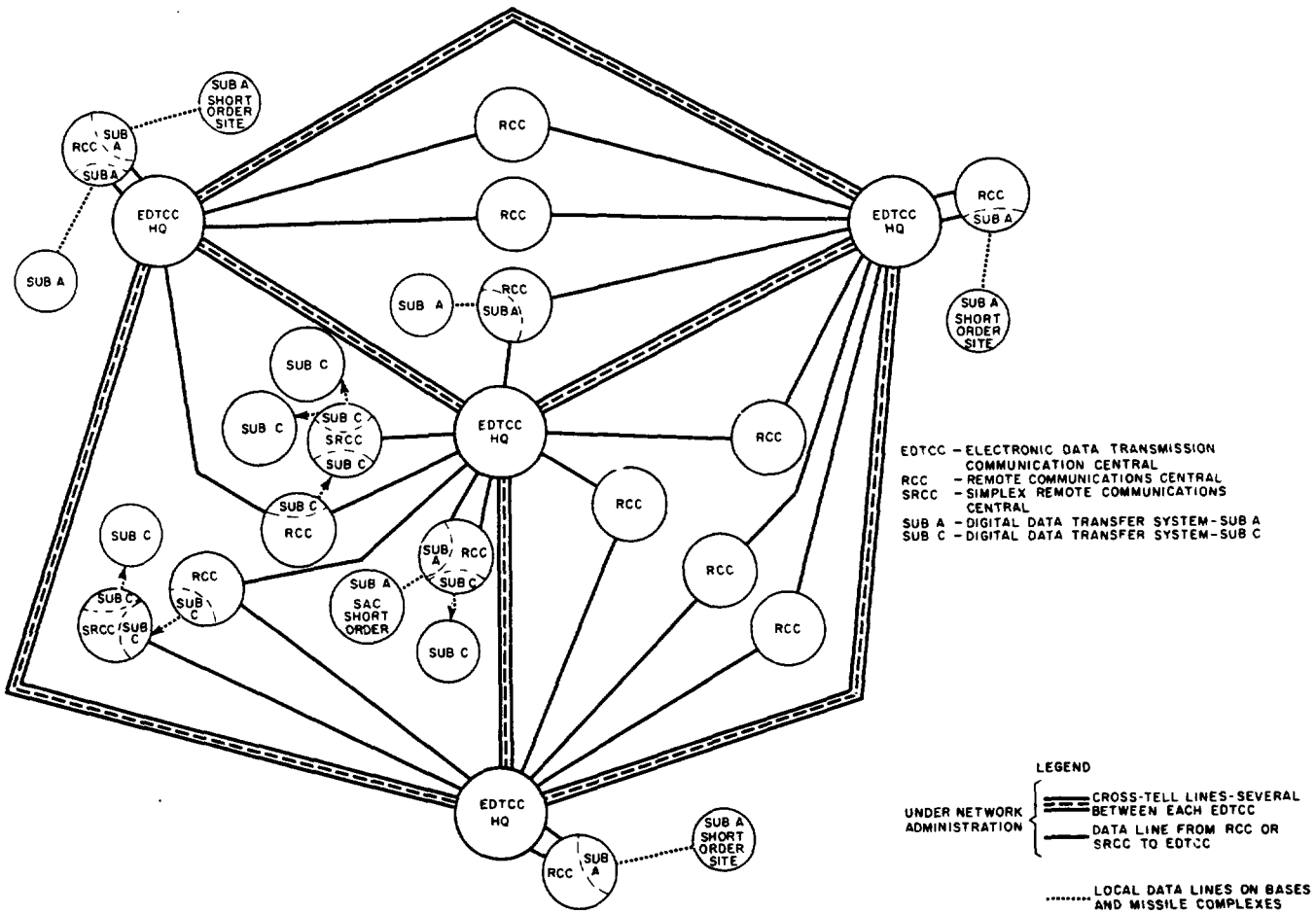

Fig. 1 – SAC Control System Simplified Layout

(a) ***EDTCC or TCC—Electronic Data Transmission Communication Central*** — An EDTCC is the location at a headquarters where the circuits to operational bases, missile complexes and other headquarters terminate. EDTCCs control the flow of information throughout the complete system. Customer equipment is composed of the following:

(1) Stored program elements

(2) Secure voice units

(3) Data sets

(4) Line units —used to store or retransmit information

(5) Technical Control Consoles — used for patching, testing and voice communications over the transmission facilities.

(b) ***RCC — Remote Communications Central*** — An RCC is the customer's data equipment location at an operational base command post. RCCs are normally connected by data circuits to two different EDTCCs. Other locally provided data circuits may also terminate at these Centrals. Customer equipment is composed of the following:

(1) Input printer

(2) High speed output printer

(3) Stored program units

(4) Data sets

(5) Secure voice units

(6) Line units

(7) Fault and Facility Control Panel — Customer testing, patching and voice communication position.

(c) ***SRCC — Simplex Remote Communication Central*** — An SRCC is the customer's data equipment location at a missile site alter-

nate command post. Only one Control System circuit from an EDTCC terminates at an SRCC. Locally provided data circuits also terminate in these Centrals. The customer's SRCC equipment is similar to that at an RCC.

(d) ***TSA or SUB-A — Digital Data Transfer System — SUB-A*** — A SUB-A is defined as a two-way data system used to interconnect a remote site on an operational base with the SAC Control System at the base RCC. The customer equipment is similar to that at the RCC except secure voice units are not used. Circuits for this system may be used for voice communications, but have no signaling capability.

(e) ***TSC or SUB-C — Digital Data Transfer System — SUB-C*** — A SUB-C is defined as a one-way data system used to transmit SAC Control System information from an RCC to its associated SRCCs and from SRCCs to other receive-only points within the missile complex.

(f) ***CROSS TELL LINKS*** — These are data lines which interconnect EDTCCs. Several lines are provided between any two EDTCCs. The customer may use these for voice communications; however, they are not equipped for signaling.

(g) ***MESSAGE ERROR*** — One or more data transmission errors within any two-second interval are recorded by a counter as a Message Error in the customer's test position at EDTCCs. The counter is not provided at RCCs and SRCCs.

(h) ***HIGH ERROR RATE ALARM*** — When three Message Errors are recorded within a six-second interval, the customer receives a visual and audible High Error Rate Alarm in the test position at the receiving EDTCC, RCC, or SRCC.

(i) ***END-TO-END CONTROL*** — Defined by the customer as over-all service control responsibility for a circuit from customer equipment location to customer equipment location, i.e., demarcation strip to demarcation strip. It includes testing of government and other Company facilities, and responsibility for referral and follow up of trouble to the proper agency for clearance and service restoration.

3. DESCRIPTION OF SYSTEM

3.01 The SAC Control System provides the commander of SAC and the numbered Air Force Headquarters locations with high speed, continuous communications and data on a world-wide basis, to permit complete and rapid control of the SAC force. This is accomplished by collection of information from operational bases and missile complexes and dissemination of the information to the SAC commanders. The system will provide information and data to aid in war planning, command post exercises and other tactical and logistic purposes. This system may also be used for alerting the SAC force.

3.02 The SAC Control System is composed of three major subsystems, i.e., Data Display, Data Processing and Data Transmission.

3.03 The Data Display Subsystem provides a means of extracting desired information from the computer and displaying the information, either by means of a high speed printer or projected on a wall screen. Certain types of priority messages are automatically displayed when they arrive at a headquarters location.

3.04 The Data Processing Subsystem provides a capability for processing and storing data and the preparation of information for display when requested. Three computers are used in the subsystem.

3.05 The Data Transmission Subsystem (DTS) is comprised of the necessary equipment and facilities to interconnect the operational sites and the headquarters locations. Interconnection of the Data Display and Data Processing Subsystems is also provided by the Data Transmission Subsystem at the EDTCCs.

3.06 The DTS equipment normally consists of data sets, telephone sets and signaling equipment, secure voice sets and data line units.

3.07 The data sets are customer supplied and designed for 2400 bps transmission, using four carrier frequencies. The carrier frequencies are 935, 1375, 1815 and 2255 cps. The data sets may be used at two lower transmission speeds if desired. A 1200 bps transmission rate uses the 1375 and 1815 cps carriers. A 600

bps transmission rate uses the 1375 cps carrier. Transmission rate is controlled by the customer. The transmission rate in use affects the total power output of the customer's signal on the circuits. Note that since the data sets are customer supplied the information in this paragraph may become invalid at any time without notice. As of this time the data sets cannot be used on compandored channels.

3.08 The customer may use the circuits for voice transmission when desired by patching 4-wire telephone terminating equipment on the circuit at each end. Signaling equipment is added with the telephone set at EDTCCs. Circuits from EDTCCs terminating at RCCs and SRCCs are provided with signal receiving equipment. A 1600 cps tone is used for signaling from an EDTCC. No means of signaling is provided from an RCC or SRCC to an EDTCC.

3.09 Over-all testing of circuits and equipment is performed by the customer at Technical Control Consoles, located at EDTCCs. Included in these consoles are:

(a) Jack appearances of the circuits and customer equipment.

(b) Telephone terminating and signaling equipment for connection to the circuits.

(c) Message error counters and high error rate alarm indicators. Circuit and equipment jack appearances for customer testing and patching are also provided at RCCs and SRCCs in a Fault and Facility Control Panel.

4. OFFICE RESPONSIBILITIES

4.01 The definitions and responsibilities of STCs (Serving Test Centers), Control and other offices are covered in "Toll Telephone Facility Maintenance—Office Responsibilities" Section E12.101. Some of these responsibilities for the SAC Control System are emphasized in the following paragraphs.

4.02 Office responsibilities for circuits in this system which are assigned to underseas cable facilities shall be handled in accordance with the following:

(a) The circuit control offices are responsible for the over-all service.

(b) The U.S. subcontrol offices (U.S. underseas facility terminal offices) serve as contact offices for overseas service problems and are responsible for service in the section between those offices and the overseas subcontrol offices.

(c) The overseas subcontrol offices are responsible for service in the section between those offices and the overseas circuit terminals. In addition, the customer has established a subcontrol contact at each overseas customer location. This contact is to assist in service maintenance in this section and in over-all circuit tests.

4.03 The network control office shall:

(a) Maintain the status of circuits from EDTCCs to RCCs and SRCCs, and from EDTCCs to other EDTCCs.

(b) Maintain restoration plans for these circuits as prepared and furnished by the circuit control offices or the circuit layout engineers.

(c) Maintain close liaison with the customer in matters concerning network operation and continuity of service.

4.04 The circuit control offices shall:

(a) Be responsible for over-all control of its SAC Control System circuits, i.e., from demarcation strip to demarcation strip.

(b) Maintain up-to-date restoration plans for each controlled circuit. This will include periodic testing of the plans. Current plans should be furnished the network control office.

(c) Maintain records of all initial or circuit order test results for maintenance reference.

4.05 The STC office shall:

(a) Assist the control offices in maintaining up-to-date restoration plans.

(b) Maintain records of initial or circuit order test results from the STC to station for maintenance reference.

5. RESTORATION OF SERVICE

5.01 Providing service continuity on the circuits of the SAC Control System is of the utmost importance. Restoration efforts by the control and other offices should be so directed that out-of-service periods are reduced to the absolute minimum.

5.02 Traffic Release Emergency (TRE) circuits are provided for SACCS circuits where feasible. The TREs may consist of working message and spare line facilities and are equalized to meet Schedule 4, Type 4B data requirements.

5.03 In any case where an engineered restoration circuit is not provided, the circuit control office should prepare a restoration plan. When this is required patching facilities having similar attenuation and delay characteristics between STCs should be selected. This will prevent adding excessive delay distortion impairment to the circuit. If difficulty is experienced in selecting an adequate reroute, the problem should be referred to the appropriate engineering group for assistance.

6. TEST EQUIPMENT AND SPECIAL TEST ARRANGEMENTS

6.01 The following test equipment should be available for use at all STCs and customer stations:

J94025A(25A) Voiceband Gain and Delay Set or:
21A TMS or equivalent
KS-15877 and KS-15878 Envelope Delay Test Sets (both rated MD)
VU Meter or 400D VTVM, or equivalent
3A Noise Measuring Set
6A Impulse Counter
General Purpose Oscilloscope

6.02 In addition to the above, the control STC may have a Bell System data set such as the 201A or 201B and the associated 901, 902 and 903 data test sets. Such a data set, test set combination could be used to give a quick rough idea of where trouble may be located. Since no Bell System data set operates in the same manner as the customer-provided data set, the value of such testing will be isolating a portion of a circuit which causes extremely high error rate. An attempt to correlate error rate between a Bell System data set and customer-provided data set would be extremely difficult.

6.03 Any tests made on a loop-back basis are also subject to special interpretation. Fig. 5 indicates how a data set may be used on a loop-around basis to isolate trouble. Note that the data signal in portions of the illustrative circuit would be subjected to twice the distortion of the normal circuit and would be online at a level some 17 db lower than normal. Obviously, signals transmitted in such a manner will be much more subject to high error rate than those being transmitted straightaway through the system. As long as the tester recognizes these limitations it should be possible to get some idea of the section in trouble. Also, the test shown in Fig. 5 is the most severe possible. Dynamic tests from control office to customer and back can be used in the same manner and will not pose as severe a test.

6.04 To facilitate initial line-up, trouble clearance and routine testing, a patching jack arrangement per J70147C, or equivalent (similar in external appearance to a 63C1 Patching Jack Circuit Box), has been provided as near as possible to the demarcation strip at all RCCs and SRCCs excepting Minuteman SRCC locations. The line jacks can be considered as the demarcation point for testing after verification that continuity exists to the actual demarcation strip. The following patch cords are required for testing from the patch jack circuits:

2 — Cord, 2P1A

2 — Cord, 2P12A

1 — Cord, 2P30A

Fig. 2 shows a sketch of the jacks, a schematic of a jack circuit, and the suggested use of the designation strips.

6.05 At Minuteman SRCC locations, the customer has provided maintenance test equipment and normally will perform all testing, sectionalizing and other maintenance work within the capsule. The demarcation strip will be located within the capsule and suitable test access has been provided.

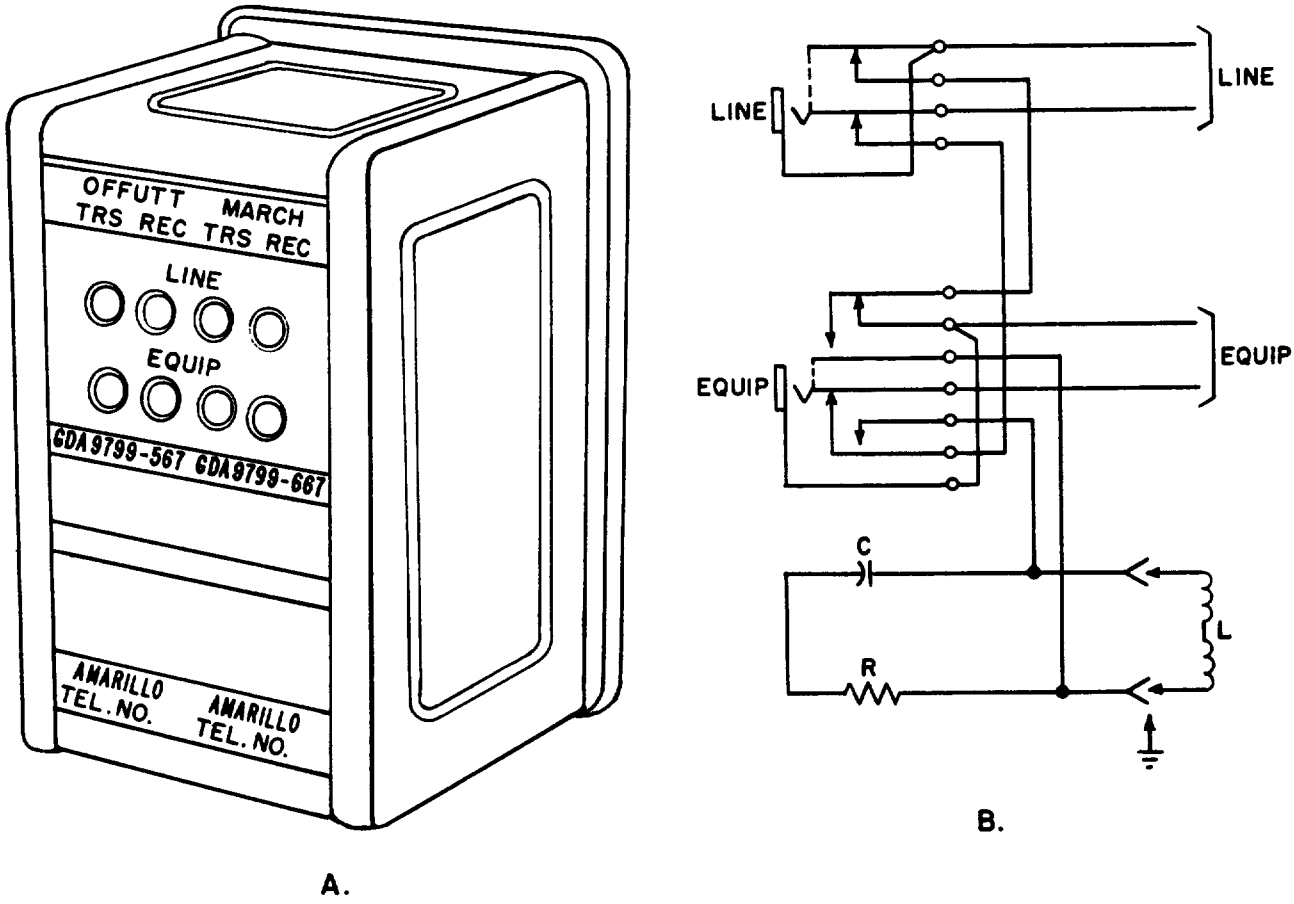

Fig. 2 – Patching Jack Circuit (Manual Patch Bay)

6.06 To facilitate testing at EDTCCs, jack strips are provided to accommodate the large number of circuits terminated. Adequate patch cords should be made available for connecting test equipment and performing loopback tests on circuits at these locations.

7. CIRCUIT TESTS AND TEST METHODS

7.01 The following items are listed as "Check Points" necessary to establish and provide dependable service on circuits of the SAC Control System:

(a) Perform tests covered in Section 314-850-500 and make impulse noise tests on assigned exchange cable pairs.

(b) Insure proper wiring options are applied.

(c) Disconnect VF repeater monitor windings.

(d) Complete circuit order tests STC to STC and STC to Station prior to plant test date.

(e) Record all circuit order test results for maintenance reference.

(f) Provide Special Service Protection (SSP).

(g) Plan over-all tests for availability of control office, STC and station maintenance personnel.

7.02 Paragraphs 7.03 through 7.07 cover general circuit order tests to be made where applicable. Unless otherwise stated, requirements to be met are specified in Part 8 of this section.

7.03 ***EXCHANGE CABLE PAIRS*** assigned to this system should be tested as outlined in Section 314-850-500. In addition, dc insula-

tion resistance and impulse noise tests should be made. Impulse noise tests may be made as outlined in Paragraph 7.13.

7.04 VF REPEATERS should be tested for grid voltage, filament (heater) current, cathode activity, and maximum gain as covered in standard instructions for the type repeater involved.

7.05 N CARRIER special service channel units should be adjusted using enhanced lineup levels (B1 Data) as outlined in Sections 362-315-501 and 362-315-502. O and ON carrier adjustments should follow the normal service requirements in the same sections.

7.06 VOICE-FREQUENCY SECTIONS involving cable or open wire pairs (other than serving links) should be tested for 1000-cycle net loss and net loss frequency characteristics.

7.07 CARRIER SECTIONS should be tested for 1000-cycle net loss.

7.08 Paragraphs 7.09 through 7.14 cover circuit order and routine tests to be made on the following sections of each circuit:

(a) STC to Station

(b) STC to STC

(c) Station to Station

Figs. 3 and 4 of this section show typical STC and Station equipment layouts indicating the proper test points. Final test results should be retained for maintenance reference. Test requirements are specified in Part 8 of this section.

7.09 NET LOSS measurements at 1000 cycles should be made using a 25A, 21A TMS or equivalent test set.

7.10 LOSS-FREQUENCY measurements should be made at 100-cycle intervals from 300 to 3000 cycles. When recording test results show deviation from 1000 cycles, using a plus sign to indicate more loss and a minus sign to indicate less loss. A 25A, 21A TMS, or equivalent, should be used for this test. In addition to normal tests, loss-frequency measurements should also be made on a loop-back basis as follows:

(a) STC to Station

(b) Control office to distant STC

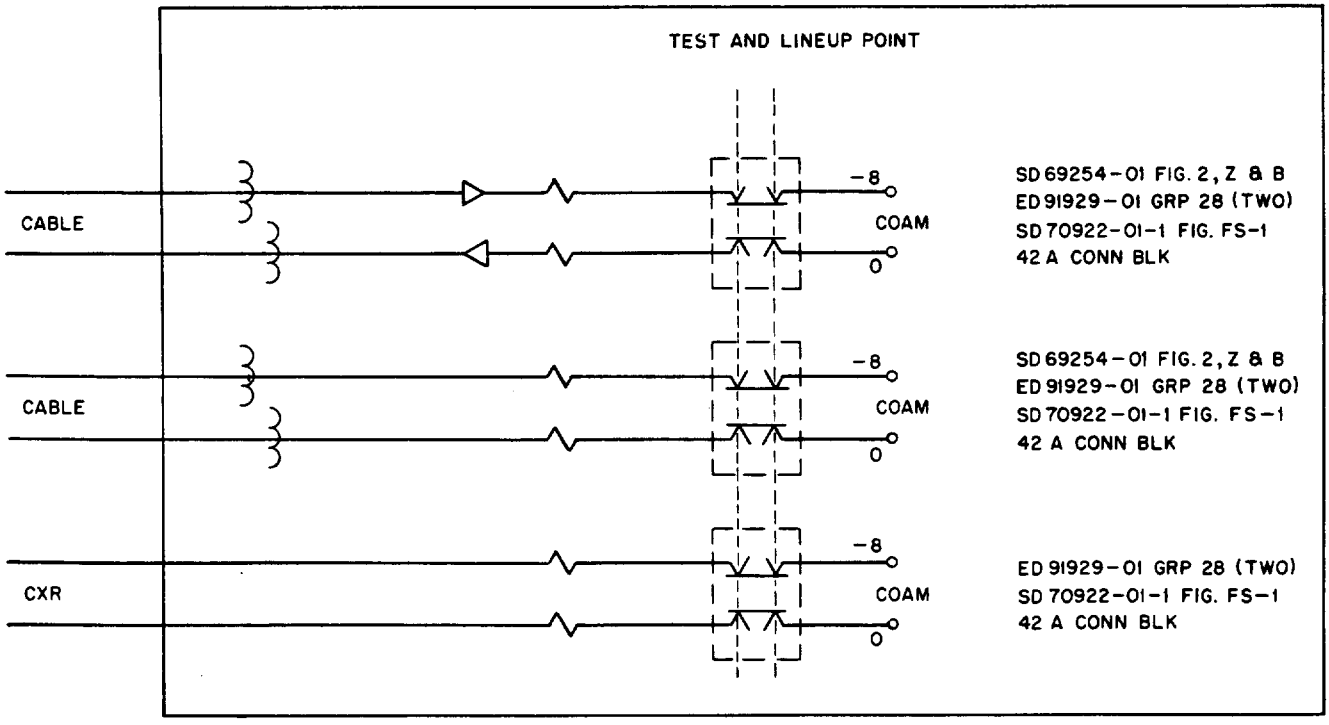

Fig. 3 – SAC Control System Typical Station

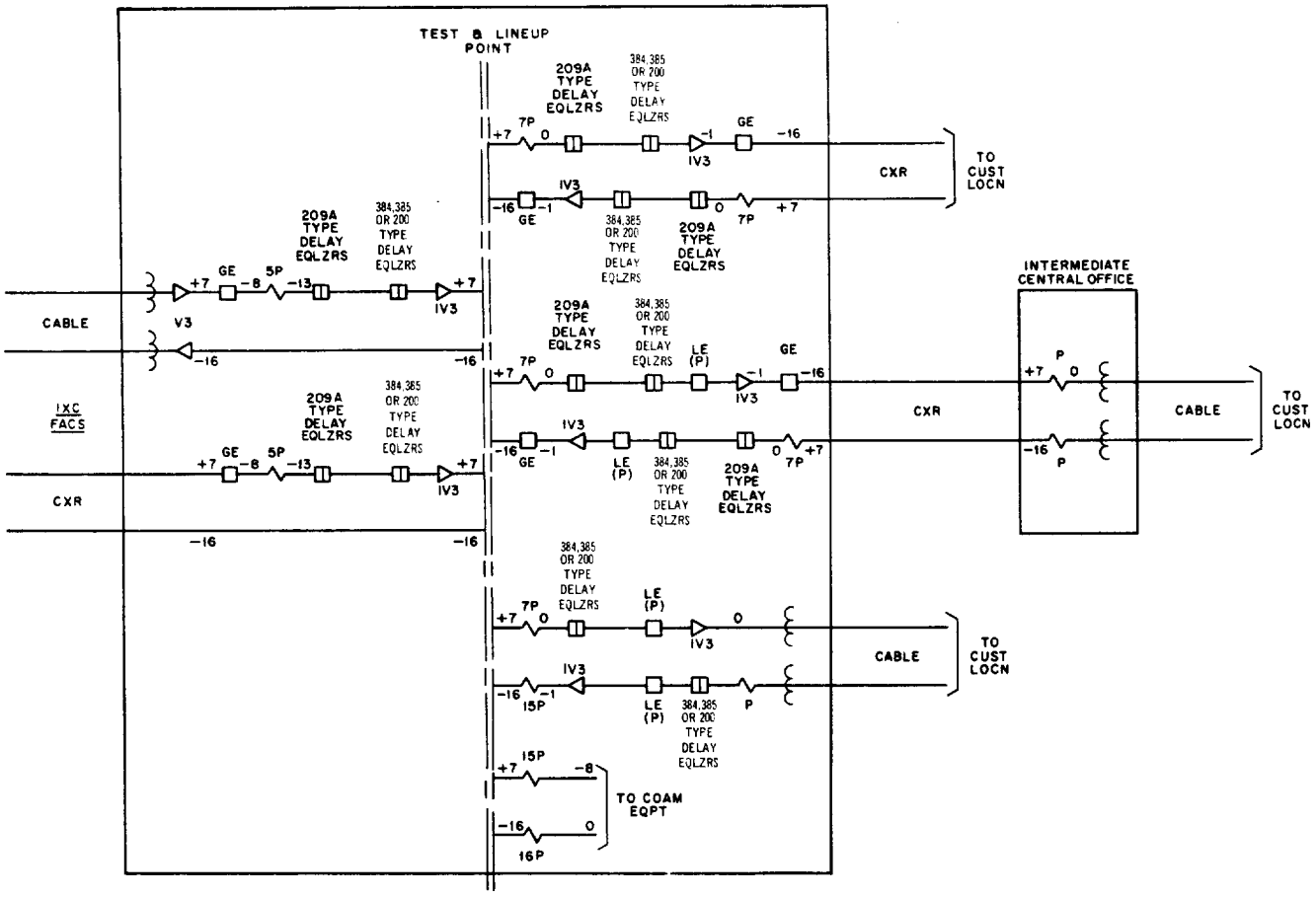

Fig. 4 – SAC Control System Typical STC Office Equipment Arrangements

7.11 ENVELOPE DELAY measurements should be made using the 25A Voiceband Gain and Delay Set. Use of this set is covered in BSP 103-115-100. Where this set is not available, the KS-15877 and KS-15878 sets may be used, however, the 25A is preferred because of its increased accuracy, lower cost and smaller size. Use of the KS sets is covered in Section 103-111-100. Delay measurements should be made from 500 to 2800 cycles. When recording test results, show deviation from reference, using a plus (+) sign to indicate more delay and a minus (−) sign to indicate less delay. In addition to normal tests, loop-back measurements should be made as follows:

(a) STC to Station

(b) Control office to distant Station

(c) Control office to each intermediate office which is a carrier or voice-frequency section terminal

7.12 STEADY NOISE measurements should be made using a 3A NMS. Readings are to be corrected to 0TLP to insure requirements are met. Examples of making this correction for each test set are shown below:

3A NMS "C" WEIGHTING	EX. NO. 1	EX. NO. 2
Measured noise (dbrn)	39	43
*Measured level (dbm)	−8	+7
Noise reading corrected to 0TLP (dbrn)	47	36

*Sending 0 dbm at the 0TLP

7.13 IMPULSE NOISE measurements are to be made using the 6A Impulse Counter as described in Section 103-620-100. Results are to be corrected to 0TLP to insure requirements are met. Correction to 0TLP when using the 6A Impulse Counter is done by changing switch setting. Examples of common level points and

the proper switch settings for these points are shown below:

LEVEL POINT (dbm)	SWITCH SETTING (dbm)
+7	75
−8	60
−16	51

7.14 Frequency shift or frequency error must be kept to ±5 cps end to end. Each carrier system should contribute no more than ±2 cps. Frequency error is caused by differences in modulating and demodulating carrier frequencies and can exist only in suppressed carrier systems such as K and L. Frequency error changes very slowly; if rapid "flutters" are observed, they are probably caused by other effects and should be reported to the Transmission Engineer or through line of organization for investigation. It is particularly troublesome in older systems such as C carrier and in some unsynchronized Lenkurt systems. Frequency error can be measured through use of a frequency counter, or a 72A Frequency Meter. Typically, a milliwatt 1000 cps supply is used as the standard source frequency. Where frequency error is suspected as a source of trouble, the standard source frequency should be first checked before actual measurements are made.

7.15 TOTAL POWER OUTPUT of customer equipment should be measured at the station using a 25A, 21A TMS or equivalent. After output is found to be proper, the STC should also measure the output for maintenance reference.

7.16 IN-SERVICE tests, which are limited to the measurement of the total power output of the customer equipment, may be made at the STCs on a high-impedance bridged basis. Measurements made at private line serviceboard monitor jacks with a VU meter are satisfactory. The calibration of the VU meter should be checked before measurements are made.

8. TEST INTERVALS AND REQUIREMENTS

8.01 Intervals and requirements for the tests outlined in this section are covered in TABLES I and II, unless specified in the BSP reference shown under Circuit Tests and Test Methods in Part 7 of this section.

8.02 Section 314-410-500 covers over-all tests and requirements on voice-bandwidth data circuits. Where requirements in that section differ from those shown in Table I, the values shown in Table I shall be used.

9. TROUBLE INVESTIGATION

9.01 When tests are necessary during trouble investigation, circuit order requirements shown in Table I should be met.

9.02 When trouble reports of high message error rates are received or marginal facilities are suspected, a loop-back DATA PERFORMANCE test may be made, as required, to sectionalize trouble. (See Part 6 of this section and Fig. 5.)

9.03 Other tests listed in this section should be made for trouble location as determined by the type of facility and nature of trouble reported.

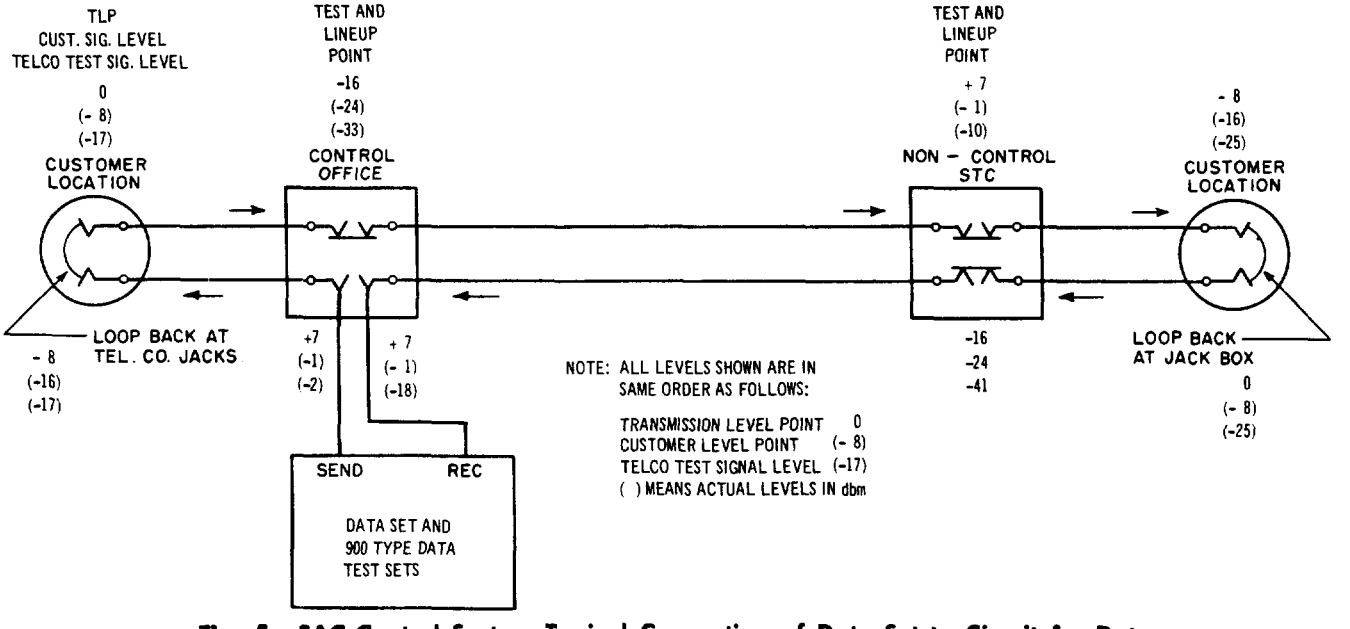

Fig. 5 – SAC Control System Typical Connection of Data Set to Circuit for Data Performance Test

TABLE I

STRATEGIC AIR COMMAND CONTROL SYSTEM CIRCUITS

Test Requirements and Intervals

TEST	REQUIREMENT	INTERVAL Circuit Order	Routine
1000-CYCLE NET LOSS			
STC to Station	Card value ±0.5 db	Yes	AR
STC to STC	Card value ±0.5 db	Yes	AR
STC to STC	Card value ±1.5 db	—	M
Station to Station	8 ± 1.0 db	Yes	AR
Station to Station	8 ± 3.0 db	—	Q
Voice or Carrier Section	Card value ±0.5 db	Yes	AR
LOSS-FREQUENCY			
STC to STC		Yes	AR
300 to 499 cycles	−1 to +2 db		
500 to 2800 cycles	−1 to +1 db		
2801 to 3000 cycles	−1 to +2 db		
STC to Station		Yes	AR
300 to 499 cycles	−1 to +2 db		
500 to 2800 cycles	−1 to +1.5 db		
2801 to 3000 cycles	−1 to +2 db		
Station to Station		Yes	A
300 to 499 cycles	−2 to +6 db		
500 to 2800 cycles	−1 to +3 db		
2801 to 3000 cycles	−2 to +6 db		
Voice-Frequency Sections	See Table II	Yes	AR
Loop-back Tests	Record Only	Yes	AR
ENVELOPE DELAY In Microseconds			
STC to STC		Yes	AR
1000 to 2600 cycles	150		
600 to 2600 cycles	450		
500 to 2800 cycles	900		
STC to Station		Yes	AR
1000 to 2600 cycles	200		
600 to 2600 cycles	600		
500 to 2800 cycles	1200		
Station to Station		Yes	A
1000 to 2600 cycles	500		
600 to 2600 cycles	1500		
500 to 2800 cycles	3000		
Loop-back Tests	Record Only	Yes	AR
→FREQUENCY ERROR	±5 cps	AR	AR

TABLE I (Cont)

TEST	REQUIREMENT		INTERVAL Circuit Order Routine	

CIRCUIT BACKGROUND NOISE

CIRCUIT LENGTH (Miles)	NOISE MEASUREMENTS BELOW (dbrn)* 3A-C Msg.
0- 50	31
51- 100	34
101- 400	37
401-1000	41
1001-1500	43
1501-2500	45
2501-4000	47

If a special service channel unit is used on a normally compandored facility the limit becomes 50 dbrnc0 for the over-all circuit. If this limit cannot be met, the data and voice service should be provided over separate channels. The duplication of channels should apply only to the normally compandored portion of the circuit.

IMPULSE NOISE			
Using 6A Impulse Counter with switch setting at level shown for 90 counts per half hour			
STC to STC	65 dbrn*	Yes	AR
STC to Station	65 dbrn*	Yes	AR
Station to Station	68 dbrn*	Yes	Q
TOTAL POWER OUTPUT of Customer Equipment	−8 dbm*	Yes	Q
EXCHANGE CABLE PAIR TESTS			
Per Section 314-850-500	See Section	Yes	AR
Loop Resistance	Within 10% of similar pairs	Yes	AR
Resistance Unbalance	Within 3 ohms	Yes	AR
Insulation Resistance		Yes	AR
Between Wires	500 megohm-miles		
Either Wire to Ground	250 megohm-miles		
IN-SERVICE TEST (Customer data level)			
At STC from local station	−8 ± 2.0 dbm*	—	D
At STC from distant station	−8 ± 5.0 dbm*	—	D

* Referred to 0TLP

D = Daily M = Monthly Q = Quarterly A = Annually AR = As Required