FIELD ASSISTANCE AND SUPPORT TEAM (FAST)

CUSTOMER SWITCHING TECHNICAL (CSTEC) SUPPORT

CONTENTS PAGE

1. GENERAL

1.01 This section describes the objectives and operation of Customer Switching Technical (CSTEC) Support. In addition, it outlines the background, coordination and escalation procedures, and types of test equipment CSTEC personnel need to perform effectively. CSTEC is a discipline of the Field Assistance And Support Team (FAST) concept. Other FAST disciplines are Data Technical (DATEC) Support, Voice and Nondata Special Services Technical (VOITEC) Support, and Software Technical (SOFTEC) Support.

1.02 Whenever this section is reissued, the reason for reissue will be contained in this paragraph.

1.03 The growth in number and complexity of Private Branch Exchange (PBX) and station systems has demonstrated the need to establish teams of technical experts to support them. These CSTEC Support personnel must have the knowledge and equipment to go beyond the capabilities of the installation and maintenance forces in solving complex

communications problems. The existence and effective functioning of CSTEC Support is essential to maintaining high-quality service and ensuring customer satisfaction.

1.04 For the purpose of this section, the term "field forces" refers to Business Services installation, maintenance and testing personnel, and their supervision who are involved with providing and maintaining PBX and station systems. These persons may be located at test centers, customer premises, or intermediate locations.

OBJECTIVES OF CSTEC SUPPORT

1.05 The primary objective of CSTEC Support is to improve our PBX and station system communications services by bringing service problems to the attention of technical experts through the use of mandatory escalation procedures. The use of these procedures in conjunction with existing Bell System Practices (BSPs) can be an effective aid in reducing long service delays which cause extreme customer dissatisfaction. An initial step toward the objective of improving these services is to ensure that the installation and maintenance forces are properly trained and equipped to carry out their basic assignments.

1.06 A second objective of CSTEC Support is to aid in the coordination of interarea and intercompany service problems by establishing definite procedures for obtaining technical assistance from distant locations. Following these procedures will help in promoting a teamwork approach to mutual problems and aid in providing a uniform grade of service.

1.07 A third objective of CSTEC Support is to provide interconnect vendor representatives with a contact for those technical questions regarding Bell System PBX and station system services that are not routinely referrable to other interconnection coordinators. Requests for these contacts may be originated by the Central Operations Group (COG). These types of contacts should be cultivated and could become invaluable when interfacing problems arise. Caution must be exercised when advising on questions of a proprietary nature in dealing with persons outside the Bell System.

1.08 The PBX and station system products and services of concern to CSTEC Support will include but not be limited to the following:

- Stored program control PBX (eg, DIMENSION® PBX system)
- Electronic PBX (eg, 800, 801, 812)
- Electromechanical PBX (eg, 701, 740, 756, 757)
- PBX peripherals
- Telephone answering systems
- Manual PBX
- Customer premise systems (50, 51 type)
- Automatic call distributors
- Selective signaling systems (eg, SS1, SS4)
- Government communications systems (eg, 300, 301)
- Power systems
- HORIZON® communications system
- Key and communications systems
- DIALOG* intercom system

2. CSTEC SUPPORT PERSONNEL

2.01 This section describes the typical qualifications, organization, responsibilities, and activities of CSTEC Support personnel.

A. Qualifications

2.02 CSTEC Support Personnel must have an in-depth knowledge of the theory, parameters, operation, circuitry, and testing of the products and services in their area of concern (as listed in paragraph 1.08 or subsequently defined).

2.03 To perform effectively in a wide variety of situations, CSTEC Support personnel must also be experienced or trained in the following subjects:

- Maintenance engineering methods and procedures
- Direct Distance Dialing (DDD) and Private Line Network structures
- Signaling methods and protocol
- Circuit design

*Trademark

- Transmission parameters and measurement
- Customer premise distribution methods
- Product quality measurement plans and techniques
- Applicable test equipment
- Registration rules and regulations
- Shop repair methods and specifications
- Tariff provisions.

2.04 In addition to the above disciplines CSTEC Support personnel should have a good appreciation for the following:

- Customer Provided Equipment (CPE) services
- Interconnect arrangements
- Other Common Carrier (OCC) services
- Interpositioning
- Registration interfaces.

2.05 CSTEC Support personnel must have sufficient technical experience to communicate effectively with individuals and organizations both within and outside the Bell System. Support personnel should also have a working knowledge of the Interfunctional Special Services Coordination (ISSC) plan and other administrative procedures and functions of FAST including DATEC, VOITEC, and SOFTEC.

B. Organization

2.06 The PBX and station system maintenance engineering and Technical Assistance Group (TAG) functions formerly performed by various organizations will reside in CSTEC.

2.07 CSTEC Support personnel are to be aligned within the FAST. The organization structure of FAST is designed to facilitate transition to future environmental change.

2.08 The FAST structure consists of Regional Fast Support Centers (RFSC) and High Activity Locations (HAL), and one AT&T FAST Staff.

2.09 The number of CSTEC Support personnel at a location will be influenced and determined by the makeup of its service area. Geographic area, field force size, business station population, and types and quantities of serving systems must be considered in staffing a CSTEC group at a location. These considerations should also be used to determine the degree of personnel specialization, if any, that will provide the most effective field support. Personnel must be able to travel to outlying points whenever necessary to carry out CSTEC responsibilities.

C. Responsibilities

2.10 The responsibilities of CSTEC Support personnel fall into two general categories: fundamental responsibilities and continuing responsibilities. The fundamental responsibilities apply directly to the main objective of CSTEC Support which is the technical backup of the field forces. Items that fall into this category demand immediate attention when they arise. The continuing responsibilities apply indirectly to the primary objectives of CSTEC Support and should be performed between fundamental case occurrences or during a particular case when they apply.

Fundamental Responsibilities

2.11 ***On-Site Technical Field Assistance:*** CSTEC Support personnel will be required to go to customer locations, test centers, and intermediate locations when necessary to identify and resolve PBX and station system service problems. The Support personnel should coordinate their efforts at these locations with the local work groups according to normal administrative procedures. When assistance is needed outside their assigned territories, Support personnel should coordinate their activities with the CSTEC Support people at the distant locations.

2.12 ***Technical Counsel:*** CSTEC personnel will provide advice on questions of a technical nature relating to PBX and station system products and services. These questions may come from inside or outside of the Bell System and may concern any of the following:

- Advice on trouble analysis and testing procedures (eg, what test to make, what to do first, second, and so forth)
- Specific options on PBX or station systems

- Compatibility between CPE and Bell System equipment in accordance with current interconnection, interpositioning, and registration guidelines
- Tariff and registration compliance of services with CPE terminals
- Advice on the technical feasibility of complex customer services.

Caution: Discretion must be followed when advising on questions of a technical nature when the person(s) receiving this advice are outside of the Bell System. Questions of a proprietary nature should be referred to your proprietary information coordinator or Independent Company Relations contacts.

2.13 ***Policy Counsel:*** The CSTEC Support personnel will assist the field forces in interpreting Bell System technical responsibilities in providing PBX and station services.

Some of the items of concern may be the following:

- Technical responsibilities outlined in the tariffs
- Technical reference requirements
- Maintenance philosophy on CPE and OCC services
- Activities at the interface of interconnection arrangements
- Performance expectations of Bell System-provided equipment, facilities, and services.

It is not intended that CSTEC, in providing technical counsel or policy counsel, would preclude or in any way change the responsibility of other organizations (eg, Marketing) to provide advice on such matters, but rather to supplement the efforts of those organizations.

2.14 ***Supplemental Training of Field Forces:*** CSTEC Support personnel will supplement the formal training of the field forces through telephone and on-site contacts on difficult service problems. The use of sophisticated test equipment and methods should be demonstrated and explained where practical. This training can be of great benefit to both the field forces and Support personnel by sharing knowledge gained during problem investigations.

Continuing Responsibilities

2.15 ***Quality Control:*** Quality control is a major continuing responsibility of CSTEC Support personnel. As a result of CSTEC Support involvement in a variety of service problems, they are in an excellent position to identify areas where improvement is needed and refer them to the responsible organizations. Items of concern should include the following:

- Test equipment shortages, updating, and maintenance
- Poor service order documentation or flow
- Recommendation of improvements in administrative procedures
- Feedback on initial service planning and installation problems to the groups originally responsible
- Engineering complaints, design advisories
- Technical recommendations for service improvements
- Recommendations to AT&T on system equipment design or BSP improvements.

2.16 ***Monitor Training Requirements and Effectiveness:*** CSTEC Support personnel's frequent contact with interdepartmental activities involved with PBX and Station System service presents an excellent opportunity to monitor training needs and effects. Some items to monitor may include:

- Repeated field force difficulty with similar problems
- Excessive time to complete BSP tests before escalating service problems
- Misunderstanding by sales force or customers of complex service operation, capabilities, or limitations.

Support personnel should document any training deficiencies and recommend improvements to the appropriate training organization for correction.

Availability

2.17 CSTEC Support personnel must always ensure that someone is accessible to assist on service problems during working hours. After-hours assistance requests should be handled through normal off-hour administrative channels. The Support personnel should not be so encumbered by administrative duties that they are not available to the field when needed for technical support activities.

D. Recording CSTEC Support Activities

2.18 All cases of CSTEC Support activity should be recorded on the RFSC Case Notes (Form BS-1289) outlined in the FAST Operations Guide. It is important to proper documentation that the Field Forces provide the information requested by CSTEC personnel for efficient case effort.

2.19 Documentation in the Technical Support Management System (TSMS) with an outline of the problem and its solution is an invaluable aid in appraising service efforts and CSTEC Support effectiveness. Nonescalated cases of advising on field questions over the telephone and assisting on another CSTEC Support team's service problems should also be documented on the FAST Activity Notes Form since much time could be involved.

2.20 Each RFSC and HAL CSTEC Support group will maintain its own file of CSTEC Case Reports.

2.21 Activity Summary Reports will be generated by the TSMS. These reports can display activities on a HAL, Region, Corporate, or FAST discipline (eg, CSTEC) basis.

2.22 Particular PBX and system service problem solutions may be of interest to CSTEC Support personnel in other areas. These CSTEC Case Reports should be entered into the Computer Assisted Technical Support/Data Bank (CATS/DB) system for transmission to the RFSC and to FAST Headquarters. If they are of systemwide interest, FAST Headquarters will use this information to generate Technical Advisories.

E. Job Aids

Interregional Communications

2.23 There is frequent need for intraregional and interregional communications among CSTEC Support and other FAST personnel. To encourage this communication, the names, telephone numbers, and addresses of the Support personnel throughout the Bell System will be entered in CATS/DB. Refer to Section 010-521-502 for instructions on accessing this data file.

2.24 The CATS/DB System is a data bank of stored information that assists in complex problem solving. It contains Technical Advisories, Flashes, and other technical inputs concerning known trouble conditions and their remedies.

Supportive Documentation

2.25 To keep adequately informed, Support personnel will require an up-to-date file of reference information in two general categories: information from Bell System sources and information from non-Bell System sources.

2.26 ***Information from Bell System Sources:*** Some useful Bell System documents that are PBX and station system service-related material are as follows:

(a) Bell System Practices are used as a reference source and a tool when working with the field forces and should be available at all CSTEC Support locations. A list of the basic BSPs necessary to support the CSTEC Support environment is given in the FAST Operational Guidelines. Local conditions should be analyzed to determine if a need for additional BSPs exists.

(b) Bell System Technical References give characteristics of the network, voice communications, radio and transmission engineering, attestation programs, conformance programs, and direct electrical connection of voiceband terminal equipment. Refer to the Bell System Technical Reference Catalog PUB 40000 for a complete listing. These items are available from the Western Electric (WE) Indiana Distribution Center (IDC). Local procedures should be used when placing your order.

- FCC Registration Program Installation and Repair Practices and Procedures

- Bell System Purchased Products Division (BSPPD) Product Evaluation Reports (PER) - Available through your General Trade Products Coordinator.

In addition to the above items, CSTEC Support personnel must have ready access to engineering letters (ELs), AT&T system letters, schematic drawings (SDs), circuit descriptions (CDs), Task Oriented Practices (TOPs), etc. Refer to the FAST Operational Guide for a detailed listing of required reference documents.

2.27 ***Information from Non-Bell System Sources:*** Some worthwhile references available from outside the Bell System included the following:

- Publications by various vendors on their equipment and its operation - Available from vendors or BSPPD
- Technical reference material on test equipment manufactured by outside vendors - Available from vendors or BSPPD.

A good working relationship should be developed between CSTEC Support personnel and PBX and station system vendors. Contacts should be made periodically to discuss mutual technical problems and to exchange information related to current PBX and station system services and equipment. Caution should be exercised to refrain from discussing proprietary information with people outside the Bell System.

3. ESCALATION AND SUPPORT

3.01 Formal and uniform escalation procedures are necessary to bring the proper resources to bear on PBX and station system service problems. Complex problems encountered by the field forces, such as incompatibility between equipment and the customer's method of operation or poor performance due to an unusual transmission impairment, often require expert assistance for prompt resolution of the problem. To improve the installation and maintenance of PBX and station system services and to help avoid long service outages and customer complaints, the field forces must be provided with rapid access to technical personnel who can assist in resolving these problems.

A. Administrative Support

3.02 Administration support addresses itself to problems of a nontechnical or administrative nature. It is not intended that CSTEC, in providing administrative support, would in any way assume the responsibility of other organizations (eg, marketing, engineering) to provide solutions to such matters but rather to supplement the efforts of those groups.

3.03 The following situations are representative to those areas in which administrative support by CSTEC is appropriate:

- Basic deficiencies in planned customer service
- Service order deficiencies - Orders late, incomplete, too many supplements, etc
- System design - Physical equipment layout, circuit design deficiencies, normal equipment option assignment, load balancing, known interface incompatibilities
- Field personnel availability
- Component availability and supply
- Inadequate test equipment - Availability
- Difficulty in coordinating personnel for end-to-end testing
- Customer training deficiencies.

B. Technical Escalation

3.04 Technical escalation is a process whereby PBX and station system service problems pass through a series of increasingly higher levels of technical support at predetermined stages to:

- Find the cause of the problem condition
- Solve the problem condition in the shortest period of time
- Permit problem solution at the lowest possible level in the technical support hierarchy.

3.05 The CSTEC technical escalation plan contains a four-tier support hierarchy:

- Tier 1 Installation and Maintenance Field Forces, Remote Mainte-

nance, Administration and Traffic System (RMATS), and the Customer Service Control Center (CSCC).

- Tier 2 — Technical Manager, RMATS
- Tier 3 — CSTEC Support
- Tier 4 — WE Regional Technical Assistance Center (RTAC), WE Product Engineering Control Center (PECC), Bell Telephone Laboratories (BTL), AT&T FAST Headquarters, or General Trade Product Equivalent.

The flowchart in Fig. 1 shows the interaction of these entities.

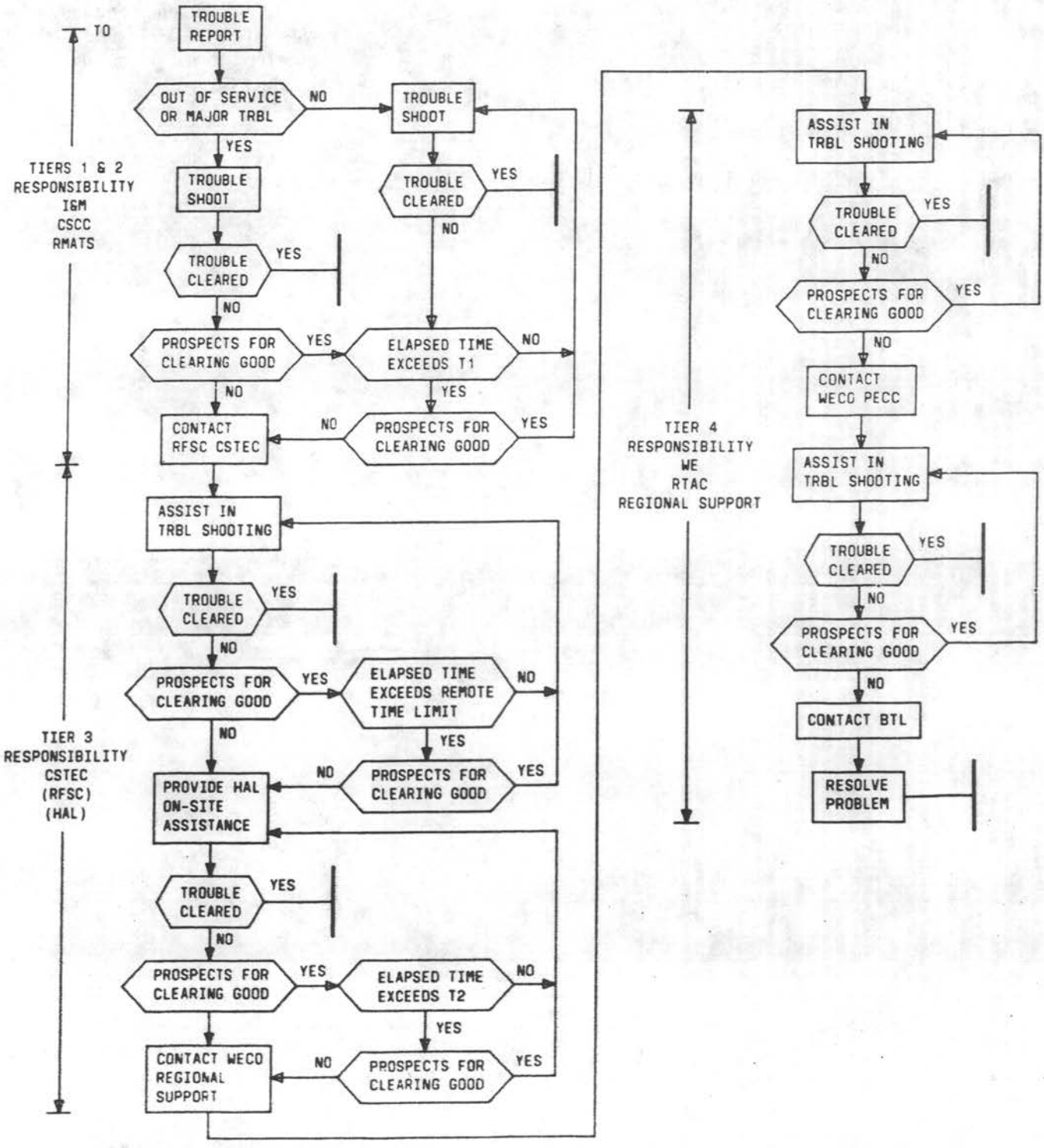

Fig. 1—CSTEC Technical Escalation Flowchart

3.06 Technical escalation of PBX and station system service problems is appropriate under the following conditions:

(a) Out-of-service conditions.

(b) The service meets Bell System specifications, but does not meet the customer's performance expectations.

(c) The service does not meet Bell System specifications and the problem source cannot be identified.

(d) The service has generated three or more similar trouble reports in 30 days.

C. Technical Escalation Timing

3.07 Technical escalation will only work successfully if a time limit for required actions is established and observed. Meeting the time limit will require local procedures to keep field supervision informed of the status and expected disposition of PBX and station system service problems.

3.08 The flowchart in Fig. 1 indicates time frames (T0-T4) at which determinations must be made to involve successive support tiers in a problem. Quantitative values designed to meet customer service requirements have been assigned to these time frames. They are:

- T0-T1—DIMENSION PBX—50 minutes on-site trouble shooting. Travel time is not included.
- T0-T1—All other PBX and station systems—1-1/2 hours on-site trouble shooting. Travel time is not included.
- T1-T2—All PBX and Station Systems—4 hours (assumes no field visit). If a field visit is required, the next contact should be made after 2 hours of on-site work.
- T2-T3—All PBX and station systems—4 hours (assumes no field visit). If field visit is required, the next contact should be made at a time when it is determined additional assistance is required.
- T3-T4—All PBX and station systems—Further escalation will be made at a time consistant with the nature of the trouble (ie, design, total outage, etc) and whether a field visit is made.

3.09 All on-site people should be given the latitude to adjust these times depending on the severity of the problem, the impact on the customer, and the outlook for resolution.

D. Escalation Procedures

3.10 The following is a step-by-step description of the activities resulting from a case of technical escalation (Fig. 1).

(a) Field force supervisors must request FAST assistance at the Tier 3 Level from CSTEC Support at an RFSC through the Customer Service Support Office (CSSO) or Maintenance Operational Control Center (MOCC).

(b) The Regional CSTEC Support personnel will render initial assistance by telephone. Some stubborn cases may not be cleared quickly by phone consultation and will require on-site assistance. CSTEC Support must arrange for HAL CSTEC to provide on-site assistance after 4 hours have expired (from the time they were first consulted) if resolution of the problem is not in sight. This procedure gives the field forces up to 5-1/2 hours of trouble investigation; 1-1/2 hours without and 4 hours with technical consultation by phone. Standard contingency travel arrangements should be planned in advance to all parts of the territory covered by the area CSTEC Support personnel.

(c) After 2 hours of on-site assistance by the HAL CSTEC Support personnel, contact the RFSC CSTEC for technical escalation to Tier 4 if resolution of the problem is not imminent.

(d) After Tier 4 support is requested from a WE RTAC or General Trade vendor, further escalation will vary depending on the circumstances. However, if the problem is not solved in a reasonable amount of time, AT&T FAST Headquarters Staff should be called in to review the problem. Additionally, AT&T FAST Headquarters Staff should be alerted on matters of logistics or policy.

4. COORDINATION

4.01 This section discusses some of the coordination aspects involved with the FAST CSTEC

Support effort. These coordination procedures are intended to supplement, not replace existing administrative and control office responsibilities and practices by efficiently bringing in the proper CSTEC Support assistance on PBX and station system technical problems.

4.02 There must be efficient coordination and cooperation among all the parties concerned with the provision of PBX and station system services. This applies equally to both intra and interregional relationships. When more than one RFSC or HAL CSTEC Support team is involved in a particular problem, the team that resolves the problem should always provide feedback of the results to the other teams that have assisted.

4.03 ***Interdepartmental Coordination:*** The successful fulfillment of the FAST CSTEC Support responsibilities depends upon how well the Support personnel, in turn, are supported by other organizations within the Region. The CSTEC designee must be able to freely contact and work with all other company organizations involved with PBX and station system services and vice versa. The quality of a customer's service is of utmost importance and the CSTEC Support personnel's recommendations for improvement should be taken in that light.

4.04 ***Coordination Between RFSC Organizations:*** CSTEC Support groups must coordinate their efforts with other Support groups to obtain assistance at work locations outside their territory. Situations arise where a PBX or station system service problem is escalated at one location resulting from a problem which exists at the far end or where the same service problem is escalated at each location. In these cases, coordination is necessary to clear the problem and restore service to the customer. An example of this type of coordination follows:

> ***Example:*** A special service voice circuit working as a tie line between two PBXs, one PBX in Region A and the other PBX in Region B, reports trouble. The trouble is escalated to CSTEC Support personnel in RFSC A. Investigation and testing shows the problem source to be in RFSC B. The RFSC A designee would consult with the RFSC B designee and relay test results and conclusions. The RFSC B designee should confirm the findings and agree to assume the major investigation role for the resolution of the problem. The RFSC A designee will assist as needed and will await feedback from the RFSC B designee as to the solution of the problem.

4.05 There are two general rules for coordination which apply on intraregion or interarea situations:

(a) In intraregional cases, the CSTEC Support Team will coordinate the problem investigation until either the case is resolved, or until it is mutually agreed that a CSTEC team in another RFSC or HAL can more effectively handle the investigation coordination due to the problem source, main customer location, etc.

(b) In interregional cases, the initial reporting RFSC or HAL CSTEC Support Team will coordinate the problem investigation with the assistance of the CSTEC team at the other RFSC or HAL until either the case is resolved, or the problem cause is indicated to be within the other CSTEC team's territory and they agree to assume coordination.

4.06 ***Coordination Between Network Technical Support (NTS) and RFSCs:*** RFSC Support personnel must coordinate their efforts with NTS Support personnel to obtain technical assistance at work locations outside their jurisdiction and vice versa. The coordination guidelines supplement normal control office procedures for difficult PBX system service problems.

4.07 The following general guidelines should be used for coordinating CSTEC Support activities involving NTS personnel:

(a) When a switched network service problem has been isolated by CSTEC Support personnel to a particular group of Long Lines or Bell Operating Company (BOC) facilities, the Control Office will assume the major investigative role, escalate to its Support personnel, if necessary, and provide feedback of the problem resolution to the CSTEC Support personnel.

(b) When a voice service problem on a circuit involving Long Lines and BOC facilities is reported to the Control Office and their testing indicates that the problem source is in a BOC's area of responsibility, escalation proceeds through

the BOC NTS Support hierarchy with Long Lines Support assistance, if necessary, until either the problem is resolved or its source is indicated elsewhere and the Long Lines Support personnel assume coordination.

(c) When a voice problem involving Long Lines and BOC facilities is reported to the Control Office and their testing indicates the problem source is in the Long Lines area of responsibility, escalation should proceed through the Long Lines NTS Support hierarchy, with BOC Support assistance, if necessary, until either the problem is resolved or its source is indicated elsewhere and the Long Lines Support personnel assume coordination.

4.08 ***Coordination With Independent Companies:*** Due to the traditional close-working relationship with Independent Telephone Companies, the coordination of CSTEC Support efforts on services partially provided by an Independent Company should be handled by the RFSC in whose Region the Independent Company operates. The coordination of service problem investigations should proceed similar to paragraphs 4.05 and 4.07, depending on the circuit configuration, and according to the guidelines of the local Bell Independent Relations department. On some particularly complex service problems, the Independent Company may request or agree to assistance from the Regional CSTEC Support personnel. This also should be handled in accordance with Bell Independent Relations procedures.

4.09 Two of the PBX and station system service problems that may arise should be handled as follows:

(a) When a problem develops on a service jointly provided by an Independent Company and the Field Service Support (FSS), and testing indicates the problem source appears to be in a Bell System location, escalation and coordination of the CSTEC Support efforts should be handled by the Region in whose area the problem source is indicated.

(b) When a problem develops on a service jointly provided by an Independent Company and the FSS and testing indicates the problem source appears to be in an Independent Company location, the local RFSC should handle coordination of CSTEC Support efforts with that Independent Company and agree to provide assistance, if necessary.

4.10 ***Coordination With Other Common Carriers (OCC):*** Coordination with OCCs should always be through the Trouble Reporting Control Office (TRCO) as outlined in the current issue of Section 471-200-001.

5. TEST EQUIPMENT

5.01 The complex nature of PBX and station system communication services demands that the personnel involved with the installation and maintenance of these services be adequately equipped with the proper test equipment. This section suggests the basic tests that should be made by the field people, and the additional transmission and specialized tests to be made by CSTEC Support personnel.

A. Field Force Test Equipment

Basic Test Equipment

5.02 The field forces who install and maintain the products and services listed in paragraph 1.08 must be equipped to perform the basic tests outlined in the BSPs for PBX and station systems. These same tests are usually made when a service problem arises for comparison to the most recently recorded test results. The tests that may be performed are as follows:

- Operational
- Software test routines and fault record checks
- Transmission tests
- Voltage, current, and continuity tests
- Signaling tests.

Accessible Test Equipment

5.03 The field forces will be responsible for the availability and proper maintenance of all test equipment specified in PBX and station systems practices for Tier 1 and 2 maintenance.

B. CSTEC Support Test Equipment

5.04 The test equipment needs of the RFSC/HAL CSTEC Support groups consist of that speci-

fied for Tier 1 and 2 use, plus having access to specialized test gear intended for Tier 3 and 4 use. This equipment falls into three categories as follows:

- Transmission test equipment
- Terminal test equipment
- Special test equipment

Recommendations regarding particular types of test equipment will be made in the FAST Operational Guide and updated as required.

5.05 The equipment specified in these categories should be available to CSTEC personnel. The recommendations are designed to provide the support groups with adequate equipment usable on a wide variety of systems. This equipment should be available to CSTEC personnel for use by themselves, field forces, or other FAST disciplines.

Transmission Test Equipment

5.06 CSTEC will occasionally require access to, or the results from, certain transmission test equipment to ensure compliance with overall circuit requirements. This equipment should have the capability of testing the following parameters:

- Loss
- Noise
- Frequency response
- Return loss
- Singing point margin
- Local channel impedance characteristics.

> ***Note:*** Sections 660-215-500 and 311-100-501 list the tests and equipment needed to perform these tests and should prove helpful.

Terminal Test Equipment

5.07 It is often necessary to ensure that customer terminal equipment is interacting properly with the transmission facility or Network switching equipment. The following types of tests are used at the demarcation point between our facilities and Bell System PBXs and station systems, CPE PBXs, or OCC facilities to test for proper operation of the circuit:

- Terminal or facility simulation tests
- Signaling tests.

Special Test Equipment

5.08 Occasionally, PBX and station system problems will develop where standard tests will not uncover the source of the problem. Some special test equipment is necessary in these instances to provide the capability of duplicating the problem in a controlled environment. When this is done, the test facility (located at the RFSC) should include the following:

- Artificial line
- Amplifier mountings with all available gain units
- Signaling mountings with all available signaling units
- Power line disturbance analyzer
- Test extenders for amplifiers and signaling units
- Variable ac and dc power sources
- Strip recorders
- Other acceptable standardized test equipment as required.

5.09 In other instances, it may be advisable to investigate the environmental conditions a system is exposed to in order to determine the cause of a problem. Devices suitable for this purpose are listed below:

- Hygrothermograph
- Temperature sensing labels
- Thermometers.

5.10 In rare cases it may be necessary for CSTEC Support personnel to design and build special-

ized test equipment or appliques to identify events or sequences that may be causing the trouble condition.

5.11 The special test equipment would be used on a small percentage of service problems and serves as a last resort when standard tests have not isolated the problem. The special test equipment should be obtained primarily for the CSTEC Support Group's use, but it may be made available to other knowledgeable personnel when difficult problems arise.