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SUBJ: MAINTENANCE OF FAA TELECOMMUNICATIONS INFRASTRUCTURE (FTI) SERVICES

1. PURPOSE. This handbook provides guidance, technical standards and tolerances, and procedures applicable to the maintenance of FAA Telecommunication Infrastructure (FTI) Services. This information augments information available in instruction books and other handbooks, and complements the latest edition of Order 6000.15, General Maintenance Handbook for NAS Facilities.

* **2. DISTRIBUTION.** This document requires actions by the Airway Transportation System Specialist (ATSS) at operational facilities with Facility, Service, and Equipment Profile (FSEP) equipment: DIST and DISTG.

a. The ATSS and all administrative personnel must subscribe to the Auto-Notifications Services for electronic library release notifications at http://technet.faa.gov/. Administrative offices can print these documents for local use as required.

b. For electronic copies, use the Technical Library website at http://nas.amc.faa.gov.

c. The ATSS must keep accurate FSEP records and Logistics Inventory System (LIS) addresses to receive printed copies. Printed copies are mailed to the ATSS at operational facilities with an accurate FSEP record using the LIS mailing address per Orders 6000.5D, Facility, Service, and Equipment Profile (FSEP) and Order 1720.30C, Distribution of Airway Facilities Technical Directives.

d. To update LIS, contact the LIS point of contact for your service area. To update FSEP information, visit this link:
https://intranet.faa.gov/faaemployees/org/linebusiness/ato/operations/technical_operations/ajw162/fsep/contacts/. *

3. MAINTENANCE AND MODIFICATION PROCEDURE.

a. Order 6000.15, this handbook, the applicable equipment instruction book, and other applicable handbooks shall be consulted and used together by the maintenance technician in all duties and activities for the maintenance of FTI facilities and equipment. The three documents shall be considered collectively as the single official source of maintenance policy and direction authorized by AJW-178. References located in the appropriate paragraphs of this handbook entitled Chapter 3, Standards and Tolerances; Chapter 4, Periodic Maintenance; and Chapter 5, Maintenance Procedures, shall indicate to the user whether this handbook and/or the equipment instruction book shall be consulted for a particular standard, key inspection element or performance parameter, performance check, maintenance task or maintenance procedure.

b. The latest edition of Order 6032.1, Modification to Ground Facilities, Systems, and Equipment in the National Airspace System, contains comprehensive direction concerning the development, authorization, implementation, and recording of modifications to facilities, systems, and equipment in commissioned status. It supersedes all instructions published in earlier editions of maintenance technical handbooks and related directives.

4. FORMS LISTING. In addition to forms required by Order 6000.15, an automated log is to be maintained at facilities that have remote maintenance monitoring capability.

5. RECOMMENDATIONS FOR IMPROVEMENT. Preaddressed comment sheets are provided at the back of this handbook. Users are encouraged to submit recommendations for improvement.



Richard A. Thoma
Director, Safety and Operations Support

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CHAPTER 1. GENERAL INFORMATION AND REQUIREMENTS

100. OBJECTIVE. This handbook provides the necessary guidance, to be used in conjunction with information available in instruction books and other handbooks, for the proper maintenance and inspection of the FAA Telecommunications Infrastructure (FTI) Services.

101. SAFETY. Personnel shall observe all safety precautions when working on equipment. For guidance, refer to Order 6000.15, General Maintenance Handbook for NAS Facilities.

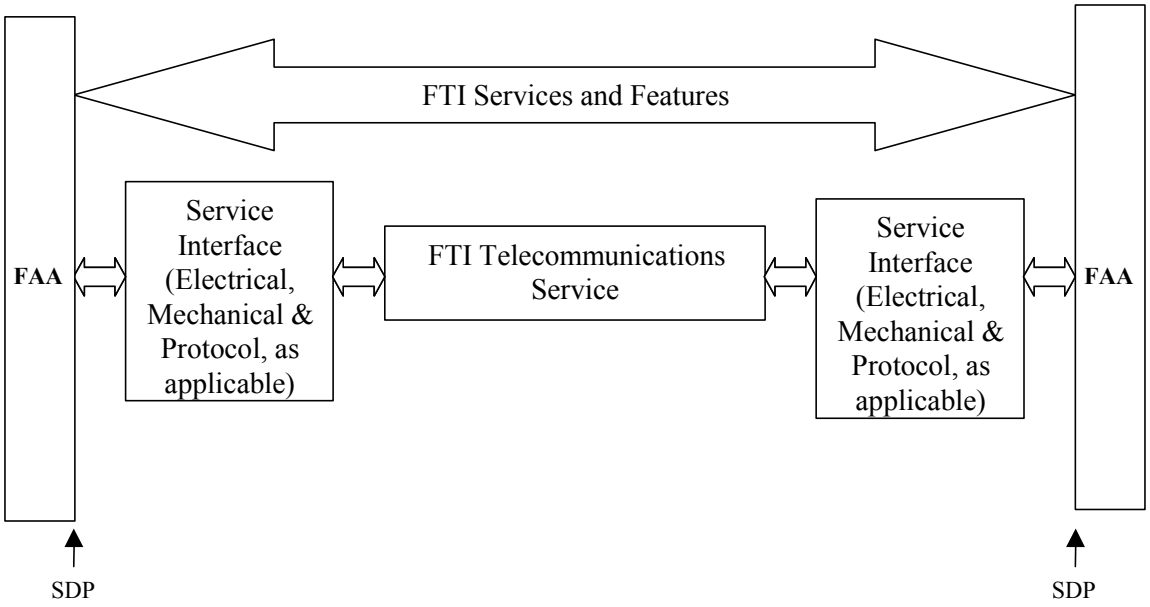
102. CERTIFICATION. Refer to Order 6000.15 for general guidance on the certification of systems, subsystems, and equipment. This order does not impose any additional certification requirements. For user services of FTI that require certification, refer to the appropriate paragraphs in Order 6100.1, Maintenance of NAS Enroute Stage A-Air Traffic Control System.

103. AIRCRAFT ACCIDENT. When aircraft accidents or incidents occur, Air Traffic Organization Technical Operations personnel are responsible, when requested by the Technical Operations Aircraft Accident Representative (AFAAR) through the appropriate Control Center, to evaluate and document the technical performance of the facilities which may have been involved (for some facilities, it may also be necessary to remove them from service, and to conduct flight inspection). This requires that facility operational data be obtained and recorded in the maintenance log and on technical performance records. These records are official documents, and may be used by an aircraft accident investigation board in the determination of facility operational status at the time of the accident. See Order 8020.16, Air Traffic Organization Aircraft Accident and Incident Notification, Investigation, and Reporting, for detailed guidance on requirements and activities following an aircraft accident/incident.

104. BACKGROUND.

a. FTI Services are defined as the services ordered by the Federal Aviation Administration (FAA) to satisfy operational requirements. These requirements are satisfied under the FTI contract through the application of commercial telecommunications services and the appropriate interfaces. Figure 1-1 depicts how the service interfaces and the telecommunications services combine to provide an FTI service from service delivery point to service delivery point (SDP to SDP).

FIGURE 1-1. FTI FUNCTIONAL SCHEMATIC



b. The service delivery point (SDP) is defined as the point where the contractor interfaces with the Government. Each connectivity has its own set of SDPs which may be physically collocated with other SDPs, or may be physically separated from any other SDP on a facility. In most cases, SDPs will be located at a Government facility. However, an SDP may also be located at a contractor, telco, or other non-Government facility in certain circumstances. The service orders will specify the locations of the SDPs.

105. FTI SERVICE CLASSES. The FTI supplies a wide range of voice, data, and video services to support operational requirements. The telecommunication services are grouped into service classes having similar sets of general performance requirements. These include reliability, maintainability and availability (RMA) category, latency, call set-up time, call blocking limits, and the capability to carry in-band tones and analog modem traffic.

a. These service classes cover the set of telecommunications services currently in use by the FAA. Future FAA systems will utilize this set of service classes to satisfy the telecommunications services required by a new FAA system. If a future FAA system's telecommunications requirement cannot be satisfied by any of the existing service classes, new service classes may be established to meet these requirements. As emerging services are brought into commercial use, new service classes may be established to reflect the availability of these services.

b. FTI shall conform to and meet the requirements of commercial and industry standards in accordance with applicable ANSI, Bellcore, EIA, IEEE, IETF, TIA, ISO/ISE and ITU documents.

106. REPORTING IRREGULARITIES, INTERRUPTIONS, AND OUTAGES. Reporting irregularities, interruptions and outages should be performed in accordance with Order 6000.15, General Maintenance Handbook for Airway Facilities, and Order 6040.15, National Airspace Performance Reporting System (NAPRS). Harris Corporation is responsible for leased-service maintenance, troubleshooting and repair. The FAA is responsible for government owned equipment maintenance, troubleshooting and repair. FAA technicians shall contact the appropriate Control Center to report the problem. The Control Center will contact the Harris FTI Primary Network Operations Control Center (PNOCC) Centralized Help Desk. The Help Desk at 1-877-384-6622 (1-877-FTI NOCC) provides a single point of contact for reporting irregularities, interruptions, and outages. The Help Desk is manned 24 hours a day, 7 days a week. This group initiates and tracks requests for corrective action and ensures that escalation notifications are addressed within established time parameters.

107. COORDINATION OF MAINTENANCE ACTIVITIES. Maintenance activities shall be coordinated with the appropriate Control Center to preclude interruptions to National Airspace System (NAS) communications and air traffic navigation and control facilities. Sufficient advance notice shall be given for maintenance activities so that appropriate notices to airman (NOTAM's) can be issued. (For guidance, refer to Order 7210.3, Facility Operation and Administration.)

108. TEST EQUIPMENT AND TOOLS FOR MAINTENANCE. Test equipment and tools required for performing routine maintenance and inspection of FTI leased services are listed in Order 6200.4, Test Equipment Management Handbook.

109. PRECAUTIONS WHEN USING TEST TONES. Extreme care shall be taken to avoid applying test tones or other signals in excess of those prescribed by the procedures of this directive. Excessive test levels will cause crosstalk in adjacent channels of the telephone company or FAA owned telecommunication equipment. This will cause annoyance to operating personnel when the interfering signals are delivered to controller positions or are intercepted by maintenance personnel at other points in the system.

110.-199. RESERVED.

CHAPTER 2. TECHNICAL CHARACTERISTICS

200. PURPOSE. This chapter provides technical background of the services that the Federal Aviation Administration (FAA) will acquire under the FAA Telecommunications Infrastructure (FTI) contract. These services include those for transmitting voice and data used in fulfilling the FAA's operational mission of controlling air traffic in the National Airspace System (NAS).

201.-209. RESERVED.

SECTION 1. DESCRIPTION OF SERVICES

210. SERVICE CLASS FEATURES. Service Classes are combinations of performance, interface and feature requirements that apply to FTI telecommunications services. Although generally associated with one or more existing service/program designator codes (SVC/PDC), (see appendix 2) the specific service class required for a telecommunications service will be specified by the FAA at the time the service is ordered. Service class features are determined by the following set of features:

a. RMA Category.

* FTI shall provide seven categories of reliability, maintainability and availability (RMA) representing seven different combinations of RMA parameters. These seven categories, designated RMA1 through RMA7, * reflect the particular RMA requirements of different types and classifications of FAA operational telecommunications applications and support services interfaces.

b. Latency Level. Latency is defined as the total time required to successfully transmit a unit of information across connectivity from one SDP to another. Each FTI telecommunications service class shall support one of the Latency Limits as specified in table 2-6 of this document.

c. Basic Security Level. FTI security requirements are grouped into basic voice, basic data, and various enhanced voice and data security levels. Table 2-11 identifies the basic security level required for each Service Class.

d. Call Set-up Time Limit.

(1) Defined as the length of time required by the FTI network to establish a connection between SDPs, excluding the time associated with manual or other call selection procedures performed by the user (e.g. dialing). Table 2-7, Call Set-up Time Limits, identifies six call set-up limits (CSL), each of which corresponds to a maximum set-up time. Each FTI telecommunications service class shall support one of the six CSLs.

(2) The call set up time for ringdown connectivity begins when an "off-hook" condition occurs at the originating SDP and ends when ringing and ringback are applied to the appropriate ends, or cut-through occurs at the receiving SDP.

(3) The call set up time for any connectivity that uses addressing to determine the connectivity begins when the last bit or digit is sensed at the originating SDP and ends when ringing and ringback are applied to the appropriate ends, cut-though occurs, or network layer communications is established at the receiving SDP. Call set-up time is not applicable to internet protocol (IP) services.

e. Call Blocking Limit. Call blocking is defined as a failure of the network to establish a user-requested connectivity due to the lack of an available communications path between SDPs. Call blocking shall apply to an individual connectivity and shall be measured as the number of blocked calls per 1000 attempts during any hour. Table 2-8, Call Blocking Limits, identifies the FTI requirements for call blocking. Each FTI

telecommunications service shall support one of the five call blocking limits (CBL). Call blocking time is not applicable to IP services.

f. In-band Signaling Compatibility. In-band signaling refers to any tone signaling that is transmitted using audio tones located within the audio passband of an analog connection. For in-band signaling compatibility, the following designations are used in table 2-11:

(1) NA - Not Applicable, in-band signaling is not used.

(2) YES - Indicates that line supervision, address signaling, or both are used on the connection.

(3) POLL - Indicates that periodic polling signals are used on the connection.

g. Modem Compatibility. Modem transmission refers to the transmission of data over an analog connection using various audio modulation techniques. For modem compatibility, the following designations are used in table 2-11:

(1) NA - Not Applicable, modems are not used on this connection.

(2) RCE - (radio control equipment) Indicates the use of a proprietary modem signal carrying supervision and other functional information for use with FAA air-to-ground communications. The RCE equipment is owned by the FAA and manufactured by Communication Systems Technology, Incorporated (CSTI).

(3) DMN - (data multiplexing network) Indicates the use of CODEX 3600 and 6250 modems.

(4) LS - Indicates the use of low speed (LS) modems with data rates up to 2.4 kbps.

(5) MS - Indicates the use of medium speed (MS) modems with data rates from 2.4 kbps to 9.6 kbps.

(6) V.34/90 - Indicates the use of commercial standard modems with data rates up to 56 kbps.

h. Voice Quality. The voice quality (VQ) of an analog service shall be defined in terms of a mean opinion score (MOS). The three voice quality levels given in table 2-10 shall apply to the FTI analog services.

211. NETWORK MANAGEMENT AND OPERATIONS BACKGROUND.

a. The FTI Network Management and Operations (NMO) is a group of functions performed by the Operational Support System (OSS) segment of the FTI system. Additionally, the OSS Segment performs other functions that are separately grouped in the Integrated Business System (IBS) and Security categories.

b. The NMO functions include primarily the following:

(1) Reporting of changes in service state (service states include: operational, jeopardy, outage, maintenance-jeopardy, and maintenance).

(2) Reporting of service degradation conditions.

(3) Service trouble ticketing.

(4) Service problem isolation and resolution.

(5) Service performance data collection, analysis, and reporting.

(6) Data administration.

c. NMO User Interface.

(1) The NMO User Interface provides an integrated view of service related information. Data available through the NMO User Interface reflects the current state of the FTI network. All of the information provided through the NMO User Interface is read-only, with the exception of the capability provided to submit trouble tickets.

(2) The NMO User Interface allows FAA NMO Users to view and/or manage the following types of information through use of a supported web browser:

(a) Trouble tickets.

(b) Service alarms and alerts.

(c) Service performance data (real-time, daily summary reports, raw database files).

(d) Service usage data (related to IP services).

(e) Reference data (service inventory, service configuration, and site access information).

d. FAA NMO Users.

(1) It is the FAA's responsibility to identify specific personnel to whom access to the NMO User Interface should be granted. These personnel are referred to as FAA NMO Users within this document. The FTI prime contractor is responsible for granting access to personnel who have followed and completed official procedures for obtaining an FAA NMO User account. All information related to FAA NMO Users, including but not limited to access/privilege levels and roles, is maintained at the FTI prime contractor premises. NMO User Manual contains details related to applying for an FAA NMO User account.

(2) The FTI contractor is responsible for performing all corrective and preventive maintenance activities on service-supporting FTI hardware and software resources. FAA NMO users are given access to information at the service level.

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* 212. AVOIDANCE AND DIVERSITY.

a. Introduction. Diversity and avoidance are terms that are frequently used together in FTI documents to refer to the separation between telecommunications paths such that the cause of a disruption or failure in one of the paths will not likely cause a failure in the other path, and therefore critical NAS service can continue in spite of the failure.

b. Diversity.

(1) Diversity means that multiple paths exist between two facilities for a single service such that the loss or failure of one path will not result in the loss of another path. For example, the use of two separate pairs within a single cable would not qualify as diversity, because whatever causes a failure in one pair is likely to affect the other in the same way. Two separate cables are not diverse if they are routed along a common path. For these reasons, the definition of diversity includes the concept of routing between the two (or possibly more than two) paths, and includes the notion of electrical, optical, and physical separation.

(2) According to the FTI Specification, interfacility diversity is "A physical, electrical, optical, and media separation in the routing of a single connectivity along either of two paths between the SDPs, such that a failure at one point on either path shall not cause the loss of both paths." Automatic switching to the non-failed path is included."

c. Partial Diversity. Situations may exist where full diversity, as described above, is neither practical nor affordable. The FTI contract does recognize these situations may exist and explicitly provides the following language: "When it is determined that the level of diversity available is less than requested to fulfill the order, the level of diversity to be provided shall be agreed to by the Government on a case by case basis as specified by the Government." In other words the FAA will deal with each of these situations on a case-by-case basis.

d. Avoidance.

(1) Avoidance refers to electrical, optical, and physical separation between two "connectivity's." A connectivity is a telecommunications path or circuit, either real or virtual, that effectively connects two endpoints and carries information (voice, data, etc.) between them. The effect of avoidance is to ensure that two different instances of connection service will not both fail due to a single cause or event. The point of an avoidance requirement is for a situation in which one of the connectivity's serves as a backup or a redundant connection to the other. This is slightly different from diversity in the sense that diversity refers to a single flow of traffic over the connection whereas avoidance refers to two flows carrying two different services (distinct SVC/PDCs) that, because of their relationship to each other, must be kept separate.

(2) According to the FTI Specification, interfacility avoidance is "A physical, electrical, optical, and media separation in the routing of two connectivities between the same or different facilities containing the respective SDP's, but not inclusive of respective collocated SDP's, such that a failure at one point on either path shall not cause the loss of both connectivities." If specified by the Government, automatic protection switching can be provided.

e. Partial Avoidance. Situations may exist where service avoidance, as described above, is neither practical nor affordable. The FTI contract does recognize these situations may exist and explicitly provides the following language: "When it is determined that the level of avoidance available is less than requested to fulfill the order, the level of avoidance to be provided shall be agreed to by the Government on a case by case basis as specified by the Government". In other words the FAA will deal with each of these situations on a case-by-case basis. *

* **f. Diversity Required By RMA1, RMA2, and RMA3.** RMA1, RMA2 or RMA3 service levels provide inherent full physical and electrical diversity unless it is not cost effective for the entire transmission route, in which case only electrical/optical diversity is provided within the non-physical diverse segment, (often a “last mile” situation). These characteristics must be determined on a case-by-case basis. *

213.-219. RESERVED.

SECTION 2. TECHNICAL DESCRIPTION

220. INTERFACE BACKGROUND. The following subsections provide interface requirements for all the FTI services.

a. Analog.

(1) FTI shall provide analog interfaces for voice, modem data, and in-band signaling between defined SDPs.

(2) The analog interfaces shall provide configurations as shown in table 2-1.

TABLE 2-1. ANALOG INTERFACE CONFIGURATIONS

Interface Number	Type	VG-1	VG-3	VG-6	VG-8	Multi-Point*	Signaling Type
AN1	Analog Line: POTS Two-Wire		X				Line - Loop Signaling
AN2	Analog Line: POTS Two-Wire		X				Line - Ground Start Signaling
AN3	Analog Line: Four-Wire		X	X			Line - Loop Signaling
AN4	Analog Line: Two-Wire	X	X				N/A
AN5	Analog Line: Four-Wire	X	X	X	X	X	N/A
AN6	Analog Line: Two-Wire		X			X	Line - SF Signaling
AN7	Analog Line: Four-Wire		X	X		X	Line - SF Signaling
AN8	Analog Line: Two-Wire		X				Line - E&M Signaling
AN9	Analog Line: Four-Wire		X		X		Line - E&M Signaling
AN10	Analog Line: Two-Wire FEX CO/PABX		X				Line - E&M Signaling
AN11	Analog Line: Four-Wire FEX CO/ PABX		X		X		Line - E&M Signaling
AN12	Analog Line: Two-Wire FEX CO/ PABX	X	X				Line - Loop Signaling
AN13	Analog Line: Four-Wire FEX CO/ PABX	X	X	X			Line - Loop Signaling
AN14	Analog Line: Two-Wire FEX SUB		X				Line - E& M Signaling
AN15	Analog Line: Four-Wire FEX SUB		X		X		Line - E& M Signaling
AN16	Analog Line: Two-Wire FEX SUB	X	X				Line - Loop Signaling
AN17	Analog Line: Four-Wire FEX SUB	X	X				Line - Loop Signaling
AN18	Analog Line: Ringdown Four-Wire	X	X				Line - Loop Signaling
AN19	Analog Line: Ringdown Two-Wire		X				Line - E&M Signaling
AN20	Analog Line: Ringdown Four-Wire		X		X		Line - E&M Signaling
AN21	Analog Line: Ringdown Two-Wire	X				X	Line - VOX
AN22	Analog Line: Ringdown Four-Wire	X		X		X	Line - VOX

TABLE 2-1. ANALOG INTERFACE CONFIGURATIONS (CONTINUED)

Interface Number	Type	VG-1	VG-3	VG-6	VG-8	Multi-Point[1]	Signaling Type
AN23	Analog Line: Ringdown Two-Wire		X			X	Line – SF Signaling
AN24	Analog Line: Ringdown Four-Wire		X	X		X	Line – SF Signaling
AN25	Analog Line: Ringdown Two-Wire	X				X	Line – SS-1 Signaling
AN26	Analog Line: Ringdown Four-Wire	X		X		X	Line – SS-1 Signaling
AN27	Analog Line: Ringdown Two-Wire	X				X	Line – SS-4 Signaling
AN28	Analog Line: Ringdown Four-Wire	X		X		X	Line – SS-4 Signaling
AN29	Analog Tie Line/Trunk: Two-Wire		X				Tie Line/Trunk - Loop Signaling (loop and ground start)
AN30	Analog Tie Line/Trunk: Two-Wire		X				Tie Line/Trunk – Reverse Battery Signaling (wink start)
AN31	Analog Tie Line/Trunk: Four-Wire		X				Tie Line/Trunk – Reverse Battery Signaling (wink start) with MF
AN32	Analog Tie Line/Trunk: Four-Wire		X				Tie Line/Trunk - E&M Signaling
AN33	Analog Tie Line/Trunk: Four-Wire		X				Tie Line/Trunk - E&M Signaling with MF
AN34	Analog Tie Line/Trunk: Four-Wire		X	X		X	Tie Line/Trunk - SF Signaling
AN35	Analog Tie Line/Trunk: Four-Wire		X	X		X	Tie Line/Trunk - SF Signaling with MF
AN36	Analog Tie Line/Trunk: Two-Wire		X			X	Tie Line/Trunk – ITU-TSS R2/No. 5 Signaling
AN37	Analog Tie Line/Trunk: Four-Wire		X	X		X	Tie Line/Trunk - E&M Signaling with ITU-TSS R2/No. 5 Signaling
AN38	Analog Tie Line/Trunk: Four-Wire			X		X	Line - SS-1 Signaling
AN39	Analog Tie Line/Trunk: Four-Wire			X		X	Line - SS-4 Signaling

[1] An X for both Multipoint and VG-n (n=1,3,6,8) indicates that multipoint with VG-n service shall be supported

(3) The analog interfaces shall be accordance with Bellcore TR-NWT-000335.

(a) VG-1 Interface. The VG-1 interface shall meet the following interface requirements:

1 Impedance - Each analog interface of the Category VG-1 circuit shall have an impedance of a nominal 600 ohms when measured at 1,004 Hertz (Hz).

2 Termination - Each category VG-1 circuit shall be connected to the SDPs by either two wires or by four wires.

3 Connectors – Standard commercial harware shall be used for all interfaces.

4 The SDP shall be a zero transmission level point (0 TLP) for transmitted and received signals for all analog interfaces.

(b) VG-3 Interface. The VG-3 interface shall meet the following interface requirements:

1 Impedance - Each analog interface of the Category VG-3 circuit shall have an impedance of a nominal 600 ohms when measured at 1,004 Hertz (Hz).

2 Termination - Each category VG-3 circuit shall be connected to the SDPs by either two wires or by four wires.

3 Connectors – Standard commercial hardware shall be used for all interfaces.

4 The SDP shall be a zero transmission level point (0 TLP) for transmitted and received signals for all analog interfaces.

(c) VG-6 Interface. The VG-6 interface shall meet the following interface requirements:

1 Impedance - Each analog interface of the Category VG-6 circuit shall have an impedance of a nominal 600 ohms when measured at 1,004 Hertz (Hz).

2 Termination - Each category VG-6 circuit shall be connected to the SDPs by four wires, including a transmit pair and a receive pair.

3 Connectors – Standard commercial hardware shall be used for all interfaces.

4 Maximum Signal Power at Demarcation:

a The SDP shall be a zero transmission level point (0 TLP) for transmitted and received signals for all analog interfaces.

b The FTI shall accept signals at the SDP that have a maximum power of -13 dBm as averaged over any three-second interval at the 0 TLP.

(d) VG-8 Interface. The VG-8 interface shall meet the following interface requirements:

1 Impedance - Each analog interface of the Category VG-8 circuit shall have an impedance of a nominal 600 ohms when measured at 1,004 Hertz (Hz).

2 Termination - Each category VG-8 circuit shall be connected to the SDPs by four wires, including a transmit pair and a receive pair.

3 Connectors - Standard commercial hardware shall be used for all interfaces.

4 Maximum Signal Power at Demarcation.

a The SDP shall be a zero transmission level point (0 TLP) for transmitted and received signals for all analog interfaces.

b The FTI shall accept signals at the SDP that have a maximum power of -13 dBm as averaged over any three-second interval at the 0 TLP.

b. Switched Analog.

(1) Provisioning of switched analog access at SDPs shall meet these requirements:

(a) Analog line supervision and address signaling shall be provided in accordance with Bellcore Notes on the Network (SR-TSV-002275).

(b) 2-Wire Analog, 4-Wire Analog, 2-Wire Analog Tie Line and Trunk, and 4-Wire Analog Tie Line and Trunk interfaces shall be supported.

(2) 2-Wire Analog Interface.

(a) The analog 2-wire analog interface shall be considered primarily for Plain Old Telephone Service (POTS).

(b) The 2-wire analog interface shall meet the requirements of VG-1 and VG-3 interfaces.

(c) The 2-wire loopstart lines shall have a talk battery as the default configuration. Other 2-wire lines shall have the option of having a talk battery.

(d) The 2-wire analog interface shall support the operation of a standard telephone (such as 2500 type telephones) across the FTI network.

(e) POTS, ringdown without ear and mouth (E&M), and foreign exchange (FX) line(s) without E&M.

1 These types of SDP interfaces shall be supported.

2 Standard commercial connectors shall be used for all connectivities.

(f) POTS, FX, and ringdown line(s) with E&M.

(g) Depending on the type of E&M service, this interface shall require either two or four leads in addition to the two wires for voice.

(h) Standard commercial connectors shall be used for all connectivities.

(3) 4-Wire Analog Interface.

(a) The 4-wire analog interface shall be split into a transmit pair and a receive pair.

(b) The 4-wire analog interface shall meet the requirements of analog interface specified in paragraph 220a.

(c) The 4-wire loopstart transmit pair shall have talk battery. The other 4-wire lines shall have the option of having the talk battery on either pair.

(d) The impedance of the 4-wire analog interface shall be primarily 600 ohms on both pairs with an option for 900 ohms.

(e) Connectors - Standard commercial connectors shall be used for all connectivities.

(4) 4-Wire Line(s) for Dial, Ringdown and FX with E&M. Depending on the type of E&M service, this interface shall require either two or four leads in addition to the 4-wires for voice.

(5) 2-Wire Analog Tie Line and Trunk Interface.

(a) The 2-wire tie line interface shall be used to interconnect two voice switches, such as between two private branch exchanges (PBXs) or between a PBX and an operational voice switch.

(b) The 2-wire trunk interface shall be used to interconnect two voice switches or to provide connections to an external network.

(c) The analog 2-wire analog tie line and trunk interface shall meet the requirements of the VG-3 interface.

(d) The FTI shall supply talk battery.

(e) The tie lines and trunks interface shall support either one-way or two-way operation.

(f) Connectors – Standard commercial connectors shall be used for all connectivities.

(6) 2-Wire Line(s) for Tie Line(s) and Trunk(s) with E&M. Depending on the type of E&M service, this interface shall require either two or four leads in addition to the two wires for voice switches.

(7) 4-Wire Analog Tie Line and Trunk Interface.

(a) The 4-wire tie line interface shall be used to interconnect two voice switches, such as between two PBXs or between a PBX and an operational voice switch.

(b) The 4-wire trunk interface shall be used to interconnect two voice switches or to provide connections to an external network.

(c) The 4-wire analog tie line and trunk interface shall meet the requirements of analog interfaces.

(d) The FTI shall provide talk battery in transmit, receive, or both pairs as a provisioning option to be specified at time of order.

(e) The tie line or trunk interface shall support either one-way or two-way operation.

(f) The impedance of the 4-wire analog tie line and trunk interface shall be primarily 600 ohms on both pairs with an option for 900 ohms.

(g) The single 4-wire dial, ring-down and FX line with E&M, depending on the type of E&M service, shall require zero (0), two or four leads in addition to the 4-wires for voice.

(h) Connectors - Standard commercial connectors shall be used for all connectivities.

c. Low Speed Digital Interface.

(1) Digital Data Service (DDS) Interface.

(a) The DDS interface shall conform to the requirements of ANSI T1.410-1992, Bellcore TA-NWT-000436, and Bellcore GR-499-CORE Section 10.1.2.

(b) The DDS interface shall support data transfer rates of 2.4, 4.8, 9.6, 19.2, 56 and 64 kbps.

(c) The DDS interface shall support DS-0B and DS-0A formatting.

(d) DDS interface shall provide the secondary channel, if required.

(e) The DDS interface shall be connected to the SDP by four wires terminated with a RJ-48 connector or punched down.

(2) RS-232 Interface. The RS-232 interface shall meet the requirements for grounding, data, operational control leads, and timing specified in ANSI/EIA/TIA-232-C or ANSI/EIA/TIA-232-D or ANSI/EIA/TIA-232-E.

(a) The RS-232 interface shall support data transfer rates up to 19.2 kbps.

(b) The RS-232 uses a DB 25 connector.

(3) 449 Interface. The 449 interface shall meet the requirements for grounding, data, synchronization, and operational control leads specified inEIA/TIA-449.

(a) The 449 interface shall support timing leads required for synchronous circuits.

(b) The 449 interface shall supports data rates up to 1.54 mbps.

NOTE: The 449 interface pin assignments have been changed from normal DB-37 connector pin assignments to conform to the DB-25 pin assignments. These pin assignments are the same as the 530 interface.

(4) 530 and 530A Interface.

(a) The 530 interface shall meet the requirements for grounding, data, operational control leads, and synchronization specified in EIA-530.

1 The 530 interface shall support timing leads required for synchronous circuits.

2 The 530 interface shall supports data rates up to 1.54 mbps.

3 The 530 interface uses a DB 25 connector.

(b) 530A Interface shall meet the requirements specified for grounding, data, operational control leads, and synchronization in EIA/TIA-530A.

1 The 530A interface shall support timing leads required for synchronous circuits.

2 The 530A interface shall supports data rates up to 1.54 mbps.

3 The 530A interface uses a DB 25 connector.

(5) V.35 Interface. The V.35 interface shall meet the requirements for grounding, data, operational control leads, and synchronization specified in ITU V.35 and ISO 2593 for the physical/mechanical requirements.

(a) The V.35 interface shall support timing leads required for synchronous circuits.

(b) The V.35 interface uses a M34 connector.

(c) The V.35 interface shall supports data rates up to 1.54 mbps.

NOTE: The FTI contractor is implementing a V.35 Hybrid interface at some locations due to long cable runs from the SDP to the end user equipment. The V.35 Hybrid uses RS-422 drivers that have much higher voltages than the standard V.35 drivers.

(6) X.21 Interface. At the SDP, the X.21 interface shall have the capability to be configured in either of two ways:

(a) Data circuit-terminating equipment (DCE) interface, or

(b) Data termination equipment (DTE) interface.

(c) X.21 interface shall conform to ITU recommendation X.21. The X.21 interface synchronization shall be compatible with providing the receive clock and the transmit clock on a single connector pin.

d. High Speed Digital Interface.

(1) T-1 Interface. Five types of T-1 interfaces shall provide digital data transmissions between defined SDPs. The T-1 interface types are composed of fractional T-1 (F1), fractional bulk T-1 (FB1), T1C-
* 1536, T1B-1536 and T1-1544. The T-1 interface shall also provide transmissions over trunks and tie lines that *
interconnect switches.

(a) Fractional T-1 (F1) Interface. The fractional T-1 (F1) interface shall conform to the requirements of ANSI T1.403-1999, GR-436-CORE, and ANSI-T1.403, except as otherwise specified herein.

1 The F1 interface digital signal shall meet the requirements of the extended superframe (ESF) format at the SDP.

2 The F1 interface shall provide up to twenty-four, clear channel DS-0 signals of 64 kbps each shall all be provided at the SDP.

3 Provide synchronization between the F1 interface and government equipment.

4 The F1 interface shall provide clear channel capability using bipolar with eight-zero substitution (B8ZS) line coding. The digital signal shall not be constrained by "ones density" and number of consecutive zero requirements.

5 Robbed bit signaling capability on the ESF frames shall be available for the government’s use.

(b) Fractional Bulk T-1 (FB1) Interface. The fractional T-1 (FB1) interface shall conform to the requirements of ANSI T1.403-1999, GR-436-CORE, and ANSI-T1.403, except as otherwise specified herein.

1 The FB1 interface shall use clear-channel DS-0 signals in an un-channelized format.

2 The bandwidth shall be allocated in contiguous time slots in the DS-1 frames.

3 FTI shall provide an FB1 interface, which has a bandwidth in kbps equal to the suffix following the "FB" of the type designator.

4 The FB1 shall provide twenty-four clear channel DS-0 signals of 64 kbps each shall all be provided at the SDP.

5 Provide synchronization between the FB1 interface and government equipment.

6 FB1 interface shall provide clear channel capability using B8ZS line coding.

7 The digital signal shall not be constrained by "ones density" and number of consecutive zeros requirements.

(c) T1C-1536 Interface. The T1C-1536 interface shall conform to the requirements of ANSI T1.403-1999, GR-436-CORE, and ANSI-T1.403, except as otherwise specified herein.

1 The T1C-1536 interface shall provide the digital signal rate of 1536 kbps.

2 The T1C-1536 interface digital signal shall meet the requirements of the ESF format at the SDP.

3 Provide up to twenty-four clear channel DS-0 signals of 64 kbps each.

4 Provide synchronization between the T1C-1536 interface and government equipment.

5 The T1C-1536 interface shall provide clear channel capability using B8ZS line coding.

6 The digital signal shall not be constrained by "ones density" and number of consecutive zero requirements.

(d) T1B-1536 Interface. The T1B-1536 interface shall conform to the requirements of ANSI T1.403-1999, and GR-436-CORE, except as otherwise specified herein.

1 The T1B-1536 interface shall provide digital signal speeds of 1536 kbps in an un-channelized format.

* (e) T1-1544 Interface. The T1-1544 interface shall conform to the requirements of ANSI T1.403-1999, GR-436-CORE, and ANSI-T1.403, except as otherwise specified herein.

1 The T1-1544 interface shall provide the digital signal rate of 1544 kbps in a channelized format yielding 24 clear-channel DS-0 signals with overhead for framing, alarm signaling, and digital order wire functions.

2 The T1-1544 interface digital signal shall meet the requirements of ESF format.

3 The entire ESF signal (i.e. framing bits) shall be transported end-to-end over the transport path regardless of whether terrestrial or satellite media is used.

4 Twenty-four clear channel DS-0 signals of 64 kbps each and one 8 kbps circuit of F Bits shall all be provided at the SDP.

5 The facility data link (FDL) portion of the F Bits shall be for the sole use of the government.

6 Provide synchronization between the T1-1544 interface and government equipment.

7 The T1-1544 interface shall provide clear channel capability using B8ZS line coding. *

8 The digital signal shall not be constrained by "ones density" and number of consecutive zeros requirements.

9 The FDL portion of the F Bits will be used by the government. The contractor shall not use the 4 kbps FDL portion of the ESF signal for transmittal of alarm information.

10 Robbed bit signaling capability on the ESF frames shall be made available for the Government's use.

(f) The T-1 interfaces shall be connected to the SDP by four wires terminated with a RJ-48 connector or punched down.

(2) ISDN PRI Interface.

(a) The Integrated Services Digital Network (ISDN) Primary Rate Service (PRI) interface shall support the 23B+D (1.544 Mbps) configuration at reference points U, S and T.

(b) The interface shall conform to the requirements specified in the following standards.

1 ANSI T1.403.01-1999, Telecommunications - Network and Customer Installation Interfaces - Integrated Services Digital Network (ISDN) Primary Rate Layer 1 Electrical Interface Specification.

2 ANSI T1.408 Integrated Services Digital Network (ISDN) Primary Rate - Customer Installation Metallic Interfaces (Layer 1 Specification).

3 ITU I.431, Integrated Services Digital Network (ISDN) - ISDN User-Network Interfaces (03/93), section 4, Interface at 1544 kbit/s.

(3) T-3 Interface. Two types of T-3 interfaces shall be required to provide primarily digital data transmissions between defined SDPs. The T-3 interfaces types are composed of Fractional T-3 (F3) and T-3 (DS-3). The sections to follow provide the specific interface requirements for T-3 interfaces.

(a) Fractional T-3 Interface.

1 The fractional T-3 (F3) interface shall be in accordance with the requirements specified in Bellcore GR-499-CORE Section 10.5.4.

2 The F3 interface shall be capable of accepting 1 to 27 DS-1 (1.544 Mbps) channels and multiplexing these channels into a DS-3 channel using M-Frame format and C-Bit parity.

(b) T-3 Interface shall be used primarily for data transmissions services.

e. Remote access interfaces.

(1) PPP (Point-to-Point) Interface. The PPP interface will provide a standard method for transporting multi-protocol datagrams over point-to-point links. The PPP interface shall conform to internet engineering task force request for comments (IETF RFC) 1661, the point-to-point protocol (PPP), IETF RFC 1663, PPP Reliable Transmission, and other associated standards as specified in the following sections. The PPP interface physical layer shall support EIA/TIA-232 EIA/TIA-449 EIA530 EIA/TIA-530A V.35 ISDN T-1 interfaces, and Dialup.

(2) Serial Line Interface Protocol (SLIP) Interface.

(a) Physical Layer. The SLIP interface physical layer shall support dedicated serial links and dialup lines with line speeds from 1.2 kbps to 19.2 kbps.

(b) Data Link Layer. The SLIP interface data link layer shall be in accordance with IETF RFC 1055, A Standard for Transmission of IP Datagrams over Serial Lines: SLIP.

f. Ethernet Interface.

(1) Physical Layer. The Ethernet interface physical layer shall be in accordance with IEEE 802.3 1998 Edition section 6 and section 7 and support the following media:

(a) 10BASE-T, 100Base-T, and Gigabit.

(b) Uses four wire twisted pair Cat 5 cable, terminated at the SDP with a RJ-45 connector or punched down.

(2) Data Link Layer.

(a) Media access control (MAC) layer shall support both IEEE 802.3, and Ethernet II.

(b) Logical Link Control Layer. The Ethernet interface logical link control layer shall be in accordance with IEEE 802.2 Logical Link Control.

g. Fiber Distributed Data Interface (FDDI).

(1) Data Link Layer.

(a) Logical Link Control (LLC) Layer. The FDDI MAC layer shall interface with an IEEE 802.2 LLC.

(b) Media Access Control (MAC) Layer. The FDDI MAC interface shall be as specified in ANSI X3.239-1994.

(2) Physical Layer.

(a) Protocol Sublayer. The FDDI protocol sublayer shall be as specified in ANSI X3.231-1994.

(b) Physical Media Dependent (PMD) Sublayer. The FDDI PMD sublayer shall be as specified in the following standards:

1 For multimode fiber as specified in ANSI X3.166-1990.

2 For single mode fiber as specified in ANSI X3.184.

h. X.25 Interface.

(1) The X.25 interface network and data link layer shall conform to the requirements of ITU Recommendation X.25 (1984), ITU Recommendation X.28, and ITU Recommendation X.32.

(2) The X.25 interface shall support packet level protocol, switched virtual circuit (SVC) services, permanent virtual circuit (PVC) services, and packet formats.

(a) Access to network services for X.25 subscribers shall be controlled in accordance with FAA-STD-043A.

(3) The X.25 interface data link layer shall support the link access procedure for balanced operation (LAPB).

(4) Link Level parameters shall be as specified in table 3-1 of the interface control document (ICD) for NADIN PSN X.25 Packet Mode Users, NAS-IC-4302001.

(5) Physical Layer. The X.25 interface physical layer shall support EIA/TIA 232 interface for line speeds less than 20 kbps, and EIA 530 interface for line speeds greater than 20 kbps :

i. Internet Protocol (IP) Service Interface.

(1) Physical Layer. The IP Service physical layer shall support EIA/TIA-232 , EIA/TIA-449, EIA-530, EIA/TIA-530A, V.35, ISDN, T-1, and T-3 interfaces and Ethernet and FDDI.

(2) Data Link Layer. The IP Service data link layer shall support PPP, SLIP, Ethernet, and FDDI.

(3) Network Layer. The network layer for the IP Service shall support features specified for individual service classes.

j. DDC Operational Control Leads. Operational control leads, ready to send (RTS), clear to send (CTS), data set ready (DSR), data carrier detect (DCD), and data terminal ready (DTR) shall operate end-to-end across the telecommunications network or shall be controlled locally. The implementation of operational control leads is dependent on the government's requirements and the FTI contractor's engineering design.

k. Cable Lengths and Types. All interfaces shall be capable of operating over the government-defined cable length at the maximum required data for each interface using Standard (Std.) 26 AWG and Low Capacitance (LoCap) 24 AWG insulated cabling as indicated in table 2-2. Low capacitance cables have capacitance values of approximately 12 pF/ft, measured from conductor to conductor. The FTI service provider shall recommend the cable type and length of cable that will allow the interface performance requirements to be met. (The requirements in this section supersede any other cabling requirements as defined in any of the referenced standards or recommendations for service interfaces.)

TABLE 2-2. GOVERNMENT DEFINED CABLE LENGTHS FOR EACH INTERFACE

DDC Interface	Maximum Defined Data Rate (bps)	Maximum Cable Length from DCE to DTE using Standard Cable (feet)	Maximum Cable Length from DCE to DTE using LoCap Cable (feet)
232	19.2 K	50	200
449	1.536 M	200	500
530/530A	1.536 M	200	500
V.35	1.536 M	200	500

221.-229. RESERVED.

SECTION 3. PERFORMANCE AND TEST PARAMETERS

230. PARAMETERS USED IN SERVICE CLASS FEATURE MAINTENANCE AND TESTING.

a. Reliability/Maintainability/Availability (RMA).

(1) Service Restoration and Customer Times. The restoration time for each outage for each connectivity and each support system interface shall meet the Maximum Restoration Time requirements of Table 2-3, Restoration Times by RMA Category. Service restoration time is defined as the total time an FTI

service is unavailable for use by the government, or fails to meet all performance requirements of this specification, due to an unplanned outage. Service restoration time includes all failure detection, diagnostic, travel, repair, test and return to service times. Restoration time does not include customer time. Customer Time is defined as time during which one or more of the following applies: a) FAA or it's representative is unable to provide site access (or chooses to delay site access), and site access is required to restore the service; b) FAA does not respond to requests for additional information and such information is necessary in order to restore the service; c) or the FAA authorizes it for other reasons.

TABLE 2-3. RESTORATION TIMES BY RMA CATEGORY

PARAMETER	RMA1	RMA2	RMA3	RMA4	RMA5	RMA 6	RMA7
Maximum Restoration Time	6 Seconds	58.8 Seconds	8.00 Minutes	180 Minutes	240 Minutes	NBD	1440 Minutes
Maximum Diversity/Redundancy Restoration Time (minutes)	180	180	180	180	240	N/A	N/A

(2) Restoration of Diversity and Redundant Capability. To meet the required service restoration time for some RMA categories, it is expected that FTI will incorporate various forms of diversity and redundancy, including but not limited to electrical, physical and equipment. Therefore, the proper operation of the FTI network and the ability of the FTI contractor to provide telecommunications services is dependent upon timely restoration when one of the elements which provides that diversity and redundancy fails. Diversity and redundancy restoration times are defined as the time required to restore full diversity and redundancy to a service. The restoration time for each RMA category shall be specified by the contractor, and shall be consistent with the requirements for maximum restoration times and maximum number of outages for the corresponding RMA category.

(3) Security Levels.

(a) FTI security requirements are grouped into basic voice, basic data, and various enhanced voice and data security levels. Table 2-4 lists and defines the security levels. Table 2-11 identifies the basic security level required for each Service Class.

TABLE 2-4. FTI SECURITY LEVELS

SECURITY LEVEL	SECURITY TYPE
BV1	Basic Voice
EV1	Voice Closed User Group
BD1	Basic Data
ED2	Encryption
ED3	VPN Technology
ED4	Extranet
ED5	X.25 Closed User Group
ED6	Packet Filtering Firewall
ED7	Bastion Host Firewall

TABLE 2-4. FTI SECURITY LEVELS (CONTINUED)

SECURITY LEVEL	SECURITY TYPE
DS	Dedicated Service
NMO-1	Network Management Data
IBS-1	Integrated Business System data

(b) Dedicated Service (DS) Security Level. FTI shall provide any telecommunications service of any service class with a dedicated service (DS) security level when ordered by the Government. Enhanced security level DS shall not utilize IP, asynchronous transfer mode service (ATMS) or frame relay switching or routing devices unless all such devices used to provide the service are dedicated to carrying only FTI traffic. No IP, ATM or Frame Relay switching or routing device that provides DS service shall be shared with or carry any non-FTI traffic.

(c) Enhanced Security Level Combinations. FTI shall provide any combination of enhanced security levels shown in table2-5, when ordered by the government. The combinations in table 2-5 shall only apply to those service classes for which the enhanced security features include all of the individual eEnhanced security levels that comprise the combination.

TABLE 2-5. COMBINATIONS OF FTI ENHANCED SECURITY LEVELS

Combination Number	EV1	ED2	ED3	ED4	ED5	ED6	ED7	DS
1		X			X			
2		X				X		
3			X			X		
4		X			X			X
5		X				X		X
6			X			X		X
7		X						X
8			X					X
9				X				X
10					X			X
11						X		X
12							X	X
13	X							X

(4) Latency.

(a) Latency is defined as the total time required to successfully transmit a unit of information across a connectivity from one SDP to another.

(b) Table 2-6, Latency Limits, identifies seven latency limits (LL), each of which corresponds to a maximum latency. The seventh latency limit, LL-7, has been included to account for services needing special latency values. Each FTI telecommunications service class shall support one of the Latency Limits.

(c) IP and X.25 Services.

1 For IP and X.25 services, latency is measured from the moment in time that the last bit in a packet departs the originating SDP to the moment in time that the last bit in the same packet arrives at the receiving SDP. Latency will also include time required for retransmission of lost or corrupted frames or packets where the retransmission occurs wholly within the contractor's network.

2 For IP and X.25 services, the specified latency limits in table 2-6 are to be interpreted as the 99th percentile latency for a specific service over a rolling period of 24 hours.

3 Service Classes 68 and 70 through 76 are included in this requirement.

(d) Services Other Than IP and X.25.

1 For all services except IP and X.25, latency is measured from the moment in time that the first bit, or an instantaneous point in an analog signal, departs the originating SDP to the moment in time that the same bit, or the same instantaneous point in an analog signal, arrives at the receiving SDP.

2 For all services except IP and X.25, the specified latency limits in table 2-6 are to be interpreted as the maximum latency.

TABLE 2-6. LATENCY LIMITS

Latency Limit Identifier	LL-1	LL-2	LL-3	LL-4	LL-5	LL-6	LL-7	LL-8
Latency Limit (msec)	50	90	225	350	750	1000	Other	370

(5) Call Set-Up Time.

(a) Call Set-Up Time is defined as the length of time required by the FTI network to establish a connection between SDPs, excluding the time associated with manual or other call selection procedures performed by the user (e.g. dialing). Table 2-7, Call Set-up Time Limits, identifies six call set-up limits (CSL), each of which corresponds to a maximum set-up time. Each FTI telecommunications service class shall support one of the six CSLs.

(b) The call set up time for ringdown connectivity begins when an "off-hook" condition is occurs at the originating SDP and ends when ringing and ringback are applied to the appropriate ends, or cut-through occurs at the receiving SDP.

(c) The call set up time for any connectivity that uses addressing to determine the connectivity begins when the last bit or digit is sensed at the originating SDP and ends when ringing and ringback are applied to the appropriate ends, cut-though occurs, or network layer communications is established at the receiving SDP.

(d) Call set-up time is not applicable to IP services.

TABLE 2-7. CALL SET-UP TIME LIMITS

Call Set-Up Limits	CSL-1	CSL-2	CSL-3	CSL-4	CSL-5	CSL-6
Call Set-Up Time (seconds)	0	0.125	0.250	1	5	30

(e) Connectivities which have traditionally been full time dedicated circuits may be emulated by permanent virtual circuits (PVC), switched virtual circuits (SVC), or switched circuits. Generally, the existing FAA equipment, which uses dedicated circuits, does not have the capability to initiate a call set up procedure.

(f) If a switched service is used to emulate a dedicated connectivity, the service shall meet the following:

1 The sum of the call set up time and the latency shall not exceed the latency requirement for the service class.

2 No information shall be lost due to the call setup procedure.

(6) Call Tear-Down Time.

(a) Call tear-down time is defined as the overall length of time required to tear down or clear a switched call between end users. Call tear-down time shall not exceed 15 seconds for any FTI service.

(b) Call tear-down time is not applicable to IP services.

(7) Call Blocking.

(a) Call blocking is defined as a failure of the network to establish a user-requested connectivity due to the lack of an available communications path between SDPs. Call blocking shall apply to an individual connectivity and shall be measured as the number of blocked calls per 1000 attempts during any hour.

(b) Table 2-8, Call blocking limits, identifies the FTI requirements for call blocking. Each FTI telecommunications service shall support one of the five call blocking limits (CBL).

(c) Call blocking time is not applicable to IP services.

TABLE 2-8. CALL BLOCKING LIMITS

Call Blocking Limits	CBL-1	CBL-2	CBL-3	CBL-4	CBL-5
Maximum Number of Blocked Calls Permitted Per 1000 Attempts per hour	0	0.1	1.0	10.0	20.0

(8) Cold Start Time. Cold start time is defined as the time interval that begins in a cold start condition with the application of power to FTI equipment, and ends when the affected FTI services are available for use by the government, with all contracted functions fully operational. FTI cold start times shall be dependent upon RMA category in accordance with Table 2-9, Cold Start Time.

TABLE 2-9. COLD START TIME

PARAMETER	RMA1	RMA2	RMA3	RMA4	RMA5	RMA6	RMA7
Cold Start Time (minutes after application of power)	5	5	5	5	5	N/A	10

(9) Voice Quality.

(a) The voice quality (VQ) of an analog service shall be defined in terms of a mean opinion score (MOS). The three voice quality levels given in table 2-10 shall apply to the FTI analog services.

TABLE 2-10. VOICE QUALITY

PARAMETER	VQ-1	VQ-2	VQ-3
Mean Opinion Score	4.3	4.0	3.6

(b) The digital encoding, decoding, and transport properties used for a service shall provide the required MOS level.

(c) The MOS for a specific type of encoding and transmission scheme shall be determined using ITU-T Recommendation P.800.

(10) Summary of Parameters and Features by Service Class. Table 2-11 provides examples of telecommunications service parameters and features by Service Class.

TABLE 2-11. SERVICE CLASS PARAMETERS EXAMPLES

SERVICE CLASS	RMA CAT.	LATENCY LEVEL	BASIC SECURITY LEVEL	CALL SET-UP TIME	CALL BLOCKING LIMIT	IN-BAND SIGNALING COMPATIBLE	MODEM COMPATABILITY	VOICE QUALITY	INTERFACE TYPE
1	RMA2	LL-1	BV1	CSL-1	CBL-1	YES	NA	VQ-1	VG
2	RMA3	LL-1	BV1	CSL-3	CBL-3	YES	NA	VQ-1	VG
3	RMA4	LL-1	BV1	CSL-1	CBL-1	YES	NA	VQ-1	VG
4	RMA4	LL-1	BV1	CSL-1	CBL-1	NA	RCE	VQ-1	VG
5 Reserved									
6	RMA4	LL-1	BV1	CSL-2	CBL-2	YES	NA	VQ-1	VG
7	RMA4	LL-3	BV1	CSL-5	CBL-3	NA	NA	VQ-2	VG
8	RMA4	LL-4	BV1	CSL-4	CBL-3	YES	NA	VQ-1	VG
9	RMA5	LL-1	BV1	CSL-1	CBL-1	NA	RCE	VQ-1	VG
10	RMA5	LL-1	BV1	CSL-2	CBL-2	YES	NA	VQ-1	VG
11	RMA5	LL-1	BV1	CSL-3	CBL-2	YES	NA	VQ-1	VG
12	RMA5	LL-3	BV1	CSL-4	CBL-3	NA	NA	VQ-2	VG
13	RMA5	LL-3	BV1	CSL-5	CBL-4	YES	NA	VQ-2	VG
14 Reserved									
15 Reserved									
16	RMA4	LL-1	BD1	CSL-1	CBL-1	NA	DMN	NA	VG DDC DDS T-1
17	RMA1	LL-1	BD1	CSL-1	CBL-1	NA	NA	NA	DDC DDS T-1

TABLE 2-11. SERVICE CLASS PARAMETERS EXAMPLES (CONTINUED)

SERVICE CLASS	RMA CAT.	LATENCY LEVEL	BASIC SECURITY LEVEL	CALL SET-UP TIME	CALL BLOCKING LIMIT	IN-BAND SIGNALING COMPATIBLE	MODEM COMPATABILITY	VOICE QUALITY	INTERFACE TYPE
18	RMA2	LL-1	BD1	CSL-1	CBL-1	NA	NA	NA	DDC T-1 T1C-1544
19	RMA1	LL-3	BD1	CSL-1	CBL-1	NA	MS	NA	VG DDC
20	RMA2	LL-3	BD1	CSL-1	CBL-1	NA	MS	NA	VG DDC DDS T-1
21	RMA2	LL-3	BD1	CSL-1	CBL-1	NA	NA	NA	VG DDC DDS T-1
22	RMA2	LL-3	BD1	CSL-5	CBL-4	NA	MS	NA	VG DDC
23	RMA-3	LL-1	BD1	CSL-1	CBL-1	NA	MS	NA	VG DDS T-1
24	RMA3	LL-3	BD1	CSL-1	CBL-1	NA	MS	NA	VG DDC DDS T-1
25	RMA3	LL-4	BD1	CSL-1	CBL-1	YES	LS	NA	VG
26 Reserved									
27 Reserved									
28 Reserved									
29	RMA3	LL-3	BD1	CSL-3	CBL-3	NA	MS	NA	VG DDC
30	RMA3	LL-4	BD1	CSL-1	CBL-1	YES	MS	NA	VG DDC
31	RMA3	LL-4	BD1	CSL-5	CBL-4	NA	NA	NA	DDC
32	RMA4	LL-1	BD1	CSL-1	CBL-1	NA	MS	NA	VG
33	RMA4	LL-1	BD1	CSL-1	CBL-1	POLL	MS	NA	VG

TABLE 2-11. SERVICE CLASS PARAMETERS EXAMPLES (CONTINUED)

SERVICE CLASS	RMA CAT.	LATENCY LEVEL	BASIC SECURITY LEVEL	CALL SET-UP TIME	CALL BLOCKING LIMIT	IN-BAND SIGNALING COMPATIBLE	MODEM COMPATABILITY	VOICE QUALITY	INTERFACE TYPE
34	RMA4	LL-3	BD1	CSL-1	CBL-1	NA	V.34/90	NA	VG DDC DDS T-1
35	RMA4	LL-3	BD1	CSL-1	CBL-1	NA	MS	NA	VG DDC
36	RMA4	LL-4	BD1	CSL-5	CBL-5	NA	MS	NA	VG DDC DDS T-1
37 Reserved									
38	RMA4	LL-1	BD1	CSL-1	CBL-1	YES	MS	NA	VG
39 Reserved									
40	RMA4	LL-3	BD1	CSL-1	CBL-1	NA	LS	NA	VG
41 Reserved									
42 Reserved									
43	RMA4	LL-3	BD1	CSL-5	CBL-3	NA	V.34/90	NA	VG DDC
44 Reserved									
45	RMA4	LL-3	BD1	CSL-5	CBL-4	NA	MS	NA	VG
46	RMA5	LL-1	BD1	CSL-1	CBL-1	NA	NA	NA	DDC T-1
47	RMA5	LL-3	BD1	CSL-1	CBL-1	POLL	DMN	NA	VG DDS
48	RMA5	LL-3	BD1	CSL-1	CBL-1	NA	LS	NA	VG
49	RMA5	LL-3	BD1	CSL-1	CBL-1	POLL	MS	NA	VG DDC T-1
50	RMA5	LL-3	BD1	CSL-5	CBL-3	NA	MS	NA	VG DDC
51	RMA5	LL-3	BD1	CSL-1	CBL-1	NA	NA	NA	T-1
52	RMA5	LL-3	BD1	CSL-5	CBL-5	YES	NA	NA	VG
53	RMA5	LL-4	BD1	CSL-5	CBL-4	YES	LS	NA	VG
54	RMA5	LL-4	BD1	CSL-5	CBL-4	NA	V.34/90	NA	VG T-1

TABLE 2-11. SERVICE CLASS PARAMETERS EXAMPLES (CONTINUED)

SERVICE CLASS	RMA CAT.	LATENCY LEVEL	BASIC SECURITY LEVEL	CALL SET-UP TIME	CALL BLOCKING LIMIT	IN-BAND SIGNALING COMPATIBLE	MODEM COMPATABILITY	VOICE QUALITY	INTERFACE TYPE
55	RMA5	LL-4	BD1	CSL-5	CBL-5	NA	MS	NA	VG DDS T-1
56	RMA5	LL-4	BD1	CSL-5	CBL-5	YES	MS	NA	VG
57	RMA5	LL-6	BD1	CSL-5	CBL-4	NA	NA	NA	VG DDC DDS
58 Reserved									
59	RMA5	LL-4	BD1	CSL-5	CBL-5	YES	NA	VQ-2	VG DDC T-1
60 Reserved									
61 Reserved									
62 Reserved									
63 Reserved									
64 Reserved									
65 Reserved									
66 Reserved									
67 Reserved									
68	RMA2	LL-6	BD1	CSL-4	CBL-5	NA	NA	NA	DDC
69	RMA4	LL-7	BD1	CSL-1	CBL-1	NA	NA	NA	DDC
70 Reserved									
71	RMA2	LL-3	BD1	NA	NA	NA	NA	NA	ETHERNET DDC
72	RMA3	LL-3	BD1	NA	NA	NA	NA	NA	ETHERNET DDC T-1

TABLE 2-11. SERVICE CLASS PARAMETERS EXAMPLES (CONTINUED)

SERVICE CLASS	RMA CAT.	LATENCY LEVEL	BASIC SECURITY LEVEL	CALL SET-UP TIME	CALL BLOCKING LIMIT	IN-BAND SIGNALING COMPATIBLE	MODEM COMPATABILITY	VOICE QUALITY	INTERFACE TYPE
73	RMA3	LL-3	BD1	NA	NA	NA	NA	NA	ETHERNET DDC
74	RMA3	LL-3	BD1	NA	NA	NA	NA	NA	VG ETHERNET ISDN-PRI
75	RMA4	LL-3	BD1	NA	NA	NA	NA	NA	ETHERNET FDDI DDC
76 Reserved									

231.-299. RESERVED.

CHAPTER 3. STANDARDS AND TOLERANCES

300. GENERAL. This chapter prescribes the standards and tolerances for the FAA Telecommunications Infrastructure (FTI) leased services, as defined and described in Order 6000.15, General Maintenance for NAS Facilities. All key performance parameters and/or key inspection elements are clearly identified by an arrow (→) placed to the left of the applicable item.

301. NOTES. For the Attenuation Distortion test on FTI voice grade services, the plus sign (+) in the tolerance/limits columns indicates more loss than the 1004 Hz net loss reference. The minus sign (-) indicates less loss than the 1004 Hz net loss. For example, if the control site injects a 1004 Hz signal at –13 dB level and the remote site reads –14 dB, this represents a 1 dB net loss. When a –13dB signal is injected at any frequency for the same services and the tolerance/limit is stated as +5, -1 dB (from the 1004 Hz net loss), the service will be out of tolerance if the reading for that frequency is outside the limits of -19 to -13 dB.

302.-309. RESERVED.

SECTION 1. PERFORMANCE CHECKS

	Parameter	*Reference*	*Standard*	*Tolerance/Limit*	
				Initial	*Operating*
	310. FTI VOICE GRADE 1 (VG-1)	503			
→	**a.** 1004-Hz net loss	503	0 dB	± 4.0 dB	Same as initial
	b. Attenuation Distortion	503			
*	(1) 304-3004 Hz		1004-Hz net loss	-3.3, +12 dB	Same as initial
	(2) 404-2804 Hz		1004-Hz net loss	-2.3, +10 dB	Same as initial
	(3) 504-2504 Hz		1004-Hz net loss	-2.3, +8 dB	Same as initial
	311. FTI VOICE GRADE 3 (VG-3)	503			
→	**a.** 1004-Hz net loss	503	0 dB	± 1.5 dB	Same as initial
	b. Attenuation Distortion	503			
	(1) 304-3004 Hz		1004-Hz net loss	-1.3, +5 dB	Same as initial
	(2) 404-2804 Hz		1004-Hz net loss	-1.3, +3 dB	Same as initial *
	312. FTI VOICE GRADE 6 (VG-6)	503			
→	**a.** 1004-Hz net loss	503	0 db	± 1.5 db	Same as initial
	b. Attenuation Distortion	503			

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

	Parameter	Reference	Standard	Tolerance/Limit	
				Initial	*Operating*
*	(1) 304-3004 Hz		1004-Hz net loss	-1.3, +5 dB	Same as initial
	(2) 404-2804 Hz		1004-Hz net loss	-1.3, +4 dB	Same as initial
	(3) 504-2504 Hz		1004-Hz net loss	-1.3, +3 dB	Same as initial
→	**c.** Signal-to-C-notched-noise ratio	503	≥ 32 dB	> 30 dB	Same as initial
	d. Intermodulation[1] Distortion	503			
	(1) Second Order		≥ 35 dB	> 33 dB	Same as initial
	(2) Third Order		≥ 42 dB	> 40 dB	Same as initial
	e. Envelope delay[1] distortion (804-2604 Hz)	503	≤ 650 µsec	≤ 700 µsec	Same as initial
	f. Phase jitter[1]	503			
	(1) 4-300 Hz		≤ 9º	< 10º	Same as initial
	(2) 20-300 Hz		≤ 4º	< 5º	Same as initial
	g. Impulse noise at[1] threshold noted	503	≤ 15 counts in 15 min. (at 65 dBRNC0)	≤ 15 counts in 15 min. (at 67 dBRNC0)	Same as initial
	h. Frequency Shift	503	≤ ±1 Hz	≤ ±1 Hz	Same as initial
	313. FTI VOICE GRADE 8 (VG-8)	503			
→	**a.** 1004-Hz net loss	503	0 dB	± 1.5 dB	Same as initial
	b. Attenuation Distortion	503			
	(1) 304-3004 Hz		1004-Hz net loss	-1.3, +5 dB	Same as initial
	(2) 404-2804 Hz		1004-Hz net loss	-1.3 +2 dB	Same as initial
→	**c.** Signal-to-C-notched-noise ratio	503	≥ 34 dB	> 32 dB	Same as initial
	d. Intermodulation distortion[1]	503			
	(1) Second Order		≥ 46 dB	> 45 dB	Same as initial
	(2) Third order		≥ 49dB	> 48 dB	Same as initial

*

[1]Parameters apply to lines used exclusively in data applications.

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

	Parameter	Reference	Standard	Tolerance/Limit	
				Initial	*Operating*
	e. Envelope delay[1] ..... distortion (804-2604 Hz)	503	≤ 650 µsec	≤ 700 µsec	Same as initial
	f. Phase jitter[1]	503			
*	(1) 4-300 Hz		≤ 8º	< 9º	Same as initial *
	(2) 20-300 Hz		≤ 3º	< 4º	Same as initial
	g. Impulse noise at[1] ..... threshold noted	503	≤ 15 counts in 15 min. (at 65 dBRNC0)	≤ 15 counts in 15 min. (at 67 dBRNC0)	Same as initial
	h. Frequency Shift.....	503	≤ ±1 Hz	≤ ±1 Hz	Same as initial
	314. DIGITAL DATA SERVICE (DDS) 2.4, 4.8, 9.6, 19.2, 56 AND 64 Kbps	505			
→	Percent error free ..... seconds (%EFS)	505	≥ 99.9% in 24 hours	Same as standard	Same as initial
	315. DIRECT DIGITAL CONNECT (DDC)	506			
	DDC-0.075 (.075 kb/s)				
	DDC-0.300 (.300 kb/s)				
	DDC-1.2 (1.2 kb/s)				
	DDC-2.4 (2.4 kb/s)				
	DDC-4.8 (4.8 kb/s)				
	DDC-7.2 (7.2 kb/s)				
	DDC-9.6 (9.6 kb/s)				
	DDC-12.0 (12.0 kb/s)				
	DDC-14.4 (14.4 kb/s)				
	DDC-16.8 (16.8 kb/s)				
	DDC-19.2 (19.2 kb/s)				
	DDC-28.8 (28.8 kb/s)				
	DDC-38.4 (38.4 kb/s)				
	DDC-56 (56 kb/s)				
	DDC-64 (64 kb/s)				
	DDC-128 (128 kb/s)				
	DDC-192 (192 kb/s)				
	DDC-384 (384 kb/s)				
	DDC-448 (448 kb/s)				
	DDC-512 (512 kb/s)				
	DDC-576 (576 kb/s)				
	DDC-640 (640 kb/s)				
	DDC-704 (704 kb/s)				
	DDC-768 (768 kb/s)				
	DDC-832 (832 kb/s)				

[1]Parameters apply to lines used exclusively in data applications.

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

	Parameter	Reference	Standard	Tolerance/Limit	
				Initial	*Operating*
	DDC-896 (896 kb/s) **DDC-960 (960 kb/s)** **DDC-1024 (1024 kb/s)** **DDC-1088 (1088 kb/s)** **DDC-1152 (1152 kb/s)** **DDC-1216 (1216 kb/s)** **DDC-1280 (1280 kb/s)** **DDC-1344 (1344 kb/s)** **DDC-1536 (1536 kb/s)**				
→	Percent error free ..... seconds (%EFS)	506	≥ 99.9% in 24 hours	Same as standard	Same as initial
	316. FRACTIONAL T-1 (F1)..... **CHANNELIZED SERVICES** **F1-64 (64 kb/s)** **F1-128 (128 kb/s)** **F1-192 (192 kb/s)** **F1-256 (256 kb/s)** **F1- 320 (320 kb/s)** **F1-384 (384 kb/s)** **F1-448 (448 kb/s)** **F1-512 (512 kb/s)** **F1-576 (576 kb/s)** **F1-640 (640 kb/s)** **F1-704 (704 kb/s)** **F1-768 (768kb/s)** **F1-832 (832 kb/s)** **F1-896 (896 kb/s)** **F1-960 (960 kb/s)** **F1-1024 (1024 kb/s)** **F1-1088 (1088 kb/s)** **F1-1152 (1152 kb/s)** **F1-1216 (1216 kb/s)** **F1-1280 (1280 kb/s)** **F1-1344 (1344 kb/s)** **F1-1408 (1408 kb/s)** **F1-1472 (1472 kb/s)**	507			
→	**a.** T-1 signal level	507			
	(1) Transmit dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
	(2) Transmit Voltage		3 V peak	± 0.6 V	Same as initial
	(3) Receive dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
	(4) Receive Voltage.....		3 V peak	± 0.6 V	Same as initial
	b. Pulse Mask.....	508	Within template	Same as standard	Same as initial
→	**c.** Percent error free ..... seconds (%EFS)	507	≥ 99.9% in 24 hours	Same as standard	Same as initial

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

	Parameter	Reference	Standard	Tolerance/Limit	
				Initial	*Operating*
	317. FRACTIONAL BULK T-1 (FB1) UNCHANNELIZED SERVICES	507			
	F1-64 (64 kb/s) **F1-128 (128 kb/s)** **F1-192 (192 kb/s)** **F1-256 (256 kb/s)** **F1- 320 (320 kb/s)** **F1-384 (384 kb/s)** **F1-448 (448 kb/s)** **F1-512 (512 kb/s)** **F1-576 (576 kb/s)** **F1-640 (640 kb/s)** **F1-704 (704 kb/s)** **F1-768 (768kb/s)** **F1-832 (832 kb/s)** **F1-896 (896 kb/s)** **F1-960 (960 kb/s)** **F1-1024 (1024 kb/s)** **F1-1088 (1088 kb/s)** **F1-1152 (1152 kb/s)** **F1-1216 (1216 kb/s)** **F1-1280 (1280 kb/s)** **F1-1344 (1344 kb/s)** **F1-1408 (1408 kb/s)** **F1-1472 (1472 kb/s)**	507			
→	**a.** Signal level	507			
	(1) Transmit dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
	(2) Transmit Voltage		3 V peak	± 0.6 V	Same as initial
	(3) Receive dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
	(4) Receive Voltage		3 V peak	± 0.6 V	Same as initial
	b. Pulse Mask	508	Within template	Same as standard	Same as initial
→	**c.** Percent error free seconds (%EFS)	507	≥ 99.9% in 24 hours	Same as standard	Same as initial
	318. T-1 (T1B-1536) UNCHANNELIZED SERVICES	507			
→	**a.** Signal level	507			
	(1) Transmit dBdsx		0 dBdsx	± 2 dBdsx	Same as initial

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

Parameter	Reference	Standard	Tolerance/Limit	
			Initial	*Operating*
(2) Transmit Voltage		3 V peak	± 0.6 V	Same as initial
(3) Receive dBdsx		0 dBdsx	±2 dBdsx	Same as initial
(4) Receive Voltage		3 V peak	± 0.6 V	Same as initial
b. Pulse Mask	508	Within template	Same as standard	Same as initial
→ **c.** Percent error free seconds (%EFS)	507	≥ 99.9% in 24 hours	Same as standard	Same as initial
319. T-1 (T1C-1536) CHANNELIZED SERVICES	507			
→ **a.** Signal level	507			
(1) Transmit dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
(2) Transmit Voltage		3 V peak	± 0.6 V	Same as initial
(3) Receive dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
(4) Receive Voltage		3 V peak	± 0.6 V	Same as initial
b. Pulse Mask	508	Within template	Same as standard	Same as initial
→ **c.** Percent error free seconds (%EFS)	507	≥ 99.9% in 24 hours	Same as standard	Same as initial
* **320. T-1 (T1-1544) CHANNELIZED SERVICES**	507			*
→ **a.** Signal level	507			
(1) Transmit dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
(2) Transmit Voltage		3 V peak	± 0.6 V	Same as initial
(3) Receive dBdsx		0 dBdsx	± 2 dBdsx	Same as initial
(4) Receive Voltage		3 V peak	± 0.6 V	Same as initial
b. Pulse Mask	508	Within template	Same as standard	Same as initial
→ **c.** Percent error free seconds (%EFS)	507	≥ 99.9% in 24 hours	Same as standard	Same as initial

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

	Parameter	*Reference*	*Standard*	*Tolerance/Limit*	
				Initial	*Operating*
	321. INTERNET PROTOCOL (IP) SERVICES	509			
→	Latency Limits (msec)	509			
	(1) Latency Level 1		≤ 50 msec	Same as standard	Same as initial
	(2) Latency Level 2		≤ 90 msec	Same as standard	Same as initial
	(3) Latency Level 3		≤ 225 msec	Same as standard	Same as initial
	(4) Latency Level 4		≤ 350 msec	Same as standard	Same as initial
	(5) Latency Level 5		≤ 750 msec	Same as standard	Same as initial
	(6) Latency Level 6		≤ 1000 msec	Same as standard	Same as initial
*	(7) Latency Level 7[1].				
	(8) Latency Level 8		≤ 370 msec	Same as standard	Same as initial
	322.-399. RESERVED.				

[1] LL 7 is added to account for services needing special latency values. *

CHAPTER 4. PERIODIC MAINTENANCE

400. GENERAL.

a. This chapter establishes the maintenance activities that are required for FAA Telecommunications Infrastructure (FTI) leased services on a periodical, recurring basis and the schedules for their accomplishment. The chapter is divided into two sections. The first section identifies the performance checks (i.e., tests, measurements, and observations) of normal operating controls and functions, which are necessary to determine whether operation is within the established tolerances/limits. The second section identifies other tasks that are necessary to prevent deterioration and/or ensure reliable operation.

b. The tables of performance checks and maintenance tasks presented in sections 1 and 2 represent the maximum intervals permitted between tasks. (For guidance, refer to Order 6000.15, General Maintenance Handbook for NAS Facilities.)

401. - 410. RESERVED.

SECTION 1. PERFORMANCE CHECKS

Performance Checks	*Reference Paragraph*	
	Standards & Tolerances	*Maintenance Procedures*
411. AS REQUIRED ANALOG.		
a. On all Analog Services, as part of initial testing, verify all parameters..... of the particular line as identified in chapter 3[1].	310, 311, 312, 313	503
b. To revalidate an FAA analog line returned to service after failure[2]:		
(1) Point-to-point lines. Check to ensure that the reported parameter..... is within the applicable operating tolerance listed in chapter 3.		503
(2) Multipoint lines. Perform functional checks to ensure required service is provided.		
412.-419. RESERVED.		
420. AS REQUIRED DIGITAL.		
a. On all Digital Services, as part of the initial testing, verify parameters ..... of the particular line as identified in chapter 3[1,2].	314, 315, 316a, 316c, 317a, 317c, 318a, 318c, 319a, 319c, 320a, 320c	505, 506, 507

[1] Local FAA authorities may accept FTI Services from the vendor without requiring FAA qualified personnel to conduct separate service acceptance test. The vendor's tests must be witnessed or test results analyzed by qualified personnel who are able to judge satisfactory results. The District Office manager will determine qualification of FAA or FAA contract personnel that witness tests or analyze test data. The vendor will provide an electronic or hard copy of test data demonstrating satisfactory test results that meets or exceeds established * service parameters. If the ATSS decides to conduct separate service acceptance test, they can use FAA Form 6000-10 to record test results. *

[2] A service that is returned to operation from an out-of-service condition must be revalidated. The FTI contractor will conduct service revalidation testing to ensure the service is restored and ready for operation and update the status of the service via the NMO interface. FAA personnel may accept the FTI contractor's assessment that the service has been fully restored or perform their own revalidation testing before returning the service to operation.

SECTION 1. PERFORMANCE CHECKS (CONTINUED)

Performance Checks	*Reference Paragraph*	
	Standards & Tolerances	*Maintenance Procedures*
b. On T-1 (F1), (FB1), (T1B-1536), (T1C-1536), and (T1-1544) digital ..... transmission lines, to troubleshoot a line, measure pulse mask.	316b, 317b, 318b, 319b, 320b	508
421. AS REQUIRED INTERNET PROTOCOL (IP).		
a. On IP Services as part of the initial testing, verify parameters of the ..... service as identified in chapter 3[1,2].	321	509

[1] Local FAA authorities may accept FTI Services from the vendor without requiring FAA qualified personnel to conduct separate service acceptance test. The vendor's tests must be witnessed or test results analyzed by qualified personnel who are able to judge satisfactory results. The District Office manager will determine qualification of FAA or FAA contract personnel that witness tests or analyze test data. The vendor will provide an electronic or hard copy of test data demonstrating satisfactory test results that meets or exceeds established * service parameters. If the ATSS decides to conduct separate service acceptance test, they can use FAA Form 6000-10 to record test results. *

[2] A service that is returned to operation from an out-of-service condition must be revalidated. The FTI contractor will conduct service revalidation testing to ensure the service is restored and ready for operation and update the status of the service via the NMO interface. FAA personnel may accept the FTI contractor's assessment that the service has been fully restored or perform their own revalidation testing before returning the service to operation.

SECTION 2. OTHER MAINTENANCE TASKS

Performance Checks	*Reference Paragraph*	
	Standards & Tolerances	*Maintenance Procedures*
422. - 499. RESERVED.		

CHAPTER 5. MAINTENANCE PROCEDURES

500. GENERAL. This chapter establishes the procedures for accomplishing the various essential maintenance activities which are required for the FAA Telecommunications Infrastructure (FTI) leased services on either a periodic or incidental basis.

501. BASIC MAINTENANCE PROCEDURE FOR ANALOG, DIGITAL, AND INTERNET PROTOCOL (IP) SERVICES. This chapter identifies procedures that will ensure timely testing while fully satisfying acceptance, safety, and other operational requirements.

* **502. FAA FORMS AND PERFORMANCE RECORDS FOR ANALOG, DIGITAL AND IP SERVICES.** Order 6000.15, General Maintenance Handbook for NAS Facilities, contains guidance and detailed instructions for field utilization of FAA Form 6000 series Technical Performance Record forms as applicable to FTI services. Entries shall be made in accordance with the instructions in Order 6000.15. *

SECTION 1. ANALOG SERVICES

503. ANALOG SERVICE PROCEDURES.

a. Object. This procedure provides guidance for using manually operated communications test sets to perform testing required for initial acceptance of analog services, and for revalidating analog services that were out-of-service for maintenance.

b. Discussion. The following procedures are used to perform testing of analog services.

(1) This testing may require two individuals and two test sets, one at each end of the service, with communications between the two to coordinate the testing. Testing is accomplished by injecting a known signal into one end of the service and analyzing the signal received at the other end for impairments created by the service. This process is done in both directions, transmit and receive.

(2) The HP4935 Transmission Impairment Measurement System (TIMS), or its equivalent, is commonly found in the field and is capable of testing all parameters listed in chapter 3 used for voice-grade services. The Hekimian 3700 communications test system (CTS) and CXR Telcom 5200 universal transmission analyzer (UTA), or equivalent, will test all chapter 3 parameters, including those required for data applications. Refer to the operators' manual to ensure that the unit planned for use is capable of performing the tests required.

* (3) Chapter 3, Standards and Tolerances, lists the specific performance parameters, tolerances, and limits applicable to all classes of analog services used within the FAA. When taking as needed measurements, intended for trending analysis, personnel may use FAA Form 6000-16, see example TPR figure 5-3, or a blank FAA Form 6000-8 to record data taken and calculated values for parameters applicable to the analog service. A separate form is required for each end of a service. For initial acceptance, local personnel may use computer printouts (from FTI contractor-automated testing equipment) or electronic forms having the same information as the record for such maintenance, or conduct separate acceptance test and record test data on a FAA form 6000-10. *

c. Test Equipment Required. For analog services used in voice applications, two HP4935 TIMS or equivalent are required. The Hekimian 3700 CTS and the CXR Telcom 5200 UTA are equivalent test sets.

d. Conditions.

(1) Contact the appropriate Control Center to ensure that the analog service to be tested has been released from operation by air traffic control personnel or other users. FTI service may be released from

operation by switching to an alternate route, or by scheduling maintenance time with the user.

(2) The maximum FAA test tone power level applied at any frequency shall be –13 dBm at the 0 TLP.

NOTE: This power level is used for measuring frequency attenuation, measuring net loss at 1004 Hz, and other service performance evaluations. Equipment lineup levels are specified in applicable equipment orders.

(3) Ensure that the operating equipment at each end has been disconnected.

(4) The specialist should be familiar with the operation of the test equipment used, and should review the users manual for the test equipment before and during the testing.

e. Troubleshooting.

(1) Monitoring, troubleshooting and repair are the responsibility of the FTI contractor. FAA personnel should ensure that FAA equipment is not at fault before reporting trouble to the Harris FTI PNOCC. FAA personnel should be prepared to support the contactor's legitimate requests for assistance in troubleshooting and fault isolation.

(2) FAA personnel, upon indication of a service failure condition, should contact the appropriate Control Center to determine if a trouble ticket has already been generated by the FTI contractor. If a trouble ticket has not been generated, FAA personnel may perform loopback testing after obtaining a release from the Control Center to isolate the problem. FAA personnel should notify the Harris FTI PNOCC prior to loopback testing. If the remote site does not have test equipment to perform service parameter tests, the local site can loopback the responder (refer to Appendix 1, Responder Loopback Procedures, for responder information and procedures) or have the remote site install a loopback plug at the SDP and perform service parameter tests to isolate the problem.

f. Detailed Procedure.

NOTE: The following procedure is written in generic terms so that it may be used with different test sets.

(1) 1004-Hz Net Loss, Attenuation Distortion, and Frequency Shift.

(a) At both ends of the analog service to be tested, set up a test set configured as follows: transmit and receive impedance to 600 Ω; transmit frequency to 1004 Hz; output level to –13 dBm.

(b) At both ends of the analog service to be tested, connect the transmit and receive sections of the test set to the corresponding transmit and receive pairs of the service. Connection should be made to the line side of the jackfield, if one is provided at the demarcation for the analog service.

* (c) 1004-Hz Net Loss. At both ends of the analog service to be tested, read the received signal power level to ensure it meets the standards and tolerances specified in chapter 3.

(d) Frequency Shift. With the test frequency still at 1004 Hz, monitor the received frequency at both ends for a minimum of 5 minutes to ensure it meets the standards and tolerances specified in chapter 3.

(e) At both ends of the analog service to be tested, set the transmit frequency to 304 Hz and ensure the output level remains at –13 dBm. At both ends of the analog service to be tested, read the received signal power level. *

* (f) Repeat step 503f(1)(e) above for frequencies 404Hz - 3004Hz in 100 Hz increments.

(2) Signal-to-C-Notched Noise Ratio. At both ends of the analog service to be tested, set the transmit frequency to 1004 Hz and the output level to −13 dBm. Select C-message filtering on the receive section of the test set and set measurement mode to signal-to-noise ratio. Read the signal-to-C-notched noise ratio (dB) directly on the test sets. If the test sets used do not directly compute signal-to-C-notched noise ratio, perform the following:

(a) Select a C-message filter on the receive section and read the power level (dBm) of the tone plus noise.

(b) Select a C-notch filter on the receive section and read the power level (dBm) of the noise only.

(c) Compute the signal-to-C-notched noise by subtracting the reading of step 503f(2)(b) above from that of step 503f(2)(a).

(3) Impulse Noise. At both ends of the analog service to be tested, set transmit frequency to 1004 Hz and level to −13 dBm. Set receive filtering to C-notch (the C-message filter of the TIMS includes a 1010-Hz notch) and measurement mode to impulse noise. Set threshold to that indicated in the *Standards* column of chapter 3 for the service being tested, and duration to 15 minutes. After the 15 minutes is up, note the number of impulses counted by the test sets.

(4) Envelope Delay Distortion.

(a) At both ends of the analog service being tested, set up a test set (HP 4935 or equivalent), and set test mode to DELAY or EDD. Designate and set one test set as MASTER and one as SLAVE. The test set designated as MASTER will display results of testing regardless of the direction of the service being tested.

(b) Set up the transmit section of each test set for the frequency range applicable for the service being tested. Set frequency step for 100 Hz. Set output level to −13 dBm.

(c) Set up test sets for return reference measurements. In this mode, amplitude modulated, swept frequency, voice frequency (vf) signals are transmitted from the master to the slave. The slave test set extracts the modulating signal and uses it to modulate a reference 1804-Hz vf signal, which is sent back to the master. This test checks the delay of the service pair transmitting vf from the master end of the service to the slave end. Read test results from the master test set for this service pair.

(d) Set up test sets for forward reference measurements. In this mode, an amplitude modulated 1804-Hz vf signal is transmitted from the master to the slave. The slave test set extracts the modulating signal and uses it to modulate swept frequency, vf signals, which are sent back to the master. This test checks the delay of the service pair transmitting vf from the slave end of the service to the master end. Read test results from the master test set for this service pair.

(5) Intermodulation Distortion.

(a) At both ends of the analog service being tested, set up a test set (HP 4935 or equivalent), and set test mode to IMD. Set output level to −13 dBm.

(b) Read the noise-corrected levels for the second and third order intermodulation products. On the CXR5200, the corrected levels may be read directly on the display. On the Hekimian 3700, procedures contained in the Hekimian users manual must be followed to correct the levels for noise contribution. *

(6) Phase Jitter.

(a) At both ends of the analog service being tested, set up a test set (HP 4935 or equivalent), and select PHS/AMP JTR test. Set test mode to PHASE. Set output level to −13 dBm.

* (b) Phase jitter is measured over two frequency ranges, standard and standard plus low frequency. The standard range is 20 Hz to 300 Hz, while the standard plus low frequency range is 4 Hz to 300 Hz. Read the phase jitter for both ranges. On the CXR5200, both readings are present on the display. The Hekimian 3700 uses a soft key to enable/disable the low frequency. On this unit, read the phase jitter with the softkey set to **LF** for the standard (20- to 300-Hz) range and read the phase jitter with the softkey set to **LF** for the 4- to 300-Hz range. *

SECTION 2. DIGITAL SERVICES

504. DIGITAL SERVICE PROCEDURES.

a. Objective. These procedures are designed for use with manually operated communications test sets when used to perform testing on digital services.

* **b. Discussion.** Chapter 3, Standards and Tolerances, lists the specific performance parameters, tolerances, and limits applicable to all classes of digital services used within the FAA. Use FAA Form 6000-17, see example TPR figure 5-4, to record data taken and calculated values for parameters applicable to the digital service. A separate form is required for each end of a service. Local personnel may also utilize computer printouts (from FTI contractor-automated testing equipment) or electronic forms having the same information as the record for such maintenance, or conduct separate acceptance test and record test data on a FAA Form 6000-10. *

c. Test Equipment Required. The testing requires ParaScope 2000 or equivalent test sets, laptops, and the appropriate interface cables to connect to the service delivery point (SDP). This testing will require two individuals and two test sets, one at each end of the digital service, with communications between the two to coordinate the testing.

d. Troubleshooting.

(1) Monitoring, troubleshooting and repair are the responsibility of the FTI contractor. FAA personnel should ensure that FAA equipment is not at fault before reporting trouble to the Harris FTI PNOCC. FAA personnel should be prepared to support the FTI contactor's legitimate requests for assistance in troubleshooting and fault isolation.

(2) FAA personnel, upon indication of a service failure condition, should contact the appropriate Control Center to determine if a trouble ticket has already been generated by the FTI contractor. If a trouble ticket has not been generated FAA personnel may perform loopback testing after obtaining a release from the Control Center to isolate the problem. The Control Center should notify the Harris FTI PNOCC prior to loopback testing. If the remote site does not have test equipment to perform end-to-end service parameter tests, the local site can call the Harris FTI PNOCC and request the PNOCC personnel to loopback the customer premise equipment (CPE) equipment at the remote site.

505. FTI DIGITAL DATA SERVICE (DDS) SERVICES.

a. Objective. To verify that DDS services are within operating specifications.

b. Test Equipment Required. DDS testing requires a ParaScope 2000 or equivalent test sets, laptops, and the appropriate interface cables to connect to the service delivery point (SDP). This testing will require two individuals and two test sets, one at each end of the digital service, with communications between the two to coordinate the testing.

c. Detailed Procedures.

(1) At the **From** and **To** site, connect the DDS interface source cable between the ParaScope 2000 and the SDP jack, for the service in test at the **From** site.

(2) At the **From** and **To** site, obtain the FELINE PCMCIA (Personal Computer Memory Card International Association) Adapter cable included with the ParaScope 2000. Insert the card into the laptop and connect the other end of the cable to the ParaScope. Connect the power supply to the ParaScope and turn the power on using the switch at the bottom of the front panel. Power up the laptop.

(3) At the **From** and **To** site, launch the **WanXL.exe** application (usually in the C:\Program Files\FELINE WanXL folder).

(4) At the **From** and **To** site, configure the ParaScope 2000 to use the DDS interface type.

(a) From the **Quick Start** window, click on the DDS interface in the **Line Interface** section and click the **Setup…** button.

(b) In the **DDS Interface Setup** window, verify the **Clock Source:** is set to **Recovered** and the **Recover Rate:** is set to the required interface speed. When complete, select the **More…** button.

(c) From the **Line Parameters Setup** window, select the **Bit Oriented** tab and ensure the **Clock Source:** is set to **External**. Then select the **OK** button twice to return to the **Quick Start** window.

(5) At the **From** and **To** site, configure the ParaScope to send the correct data signal.

(a) From the **Quick Start** window, click on **BERT** in the **Application** section and click the **Setup…** button.

(b) In the **BERT Config** window, select the **Sync** tab and verify the **Clock Source:** is set to **External**, **Pattern** is set to **2047**, and ensure **Error Rate:** is set to **NONE**. Also verify **Round Trip Time** and **Loopback Type – None** is selected.

(c) When complete, select the **OK** button. In the **Application** section of the **Quick Start** window, click the **Run** button.

(6) Verify the end-to-end connectivity by noting the **Statistics** section of the **BERT** window shows **IN-LOCK**.

(7) Reset the counters by selecting the button on the right of the sub-menu bar (mouse-over the button to reveal **Reset Status and/or Counters**).

(8) Monitor the service for 30 minutes. Verify that the percent error free seconds (%EFS) and signal levels meets the standards and tolerances specified in Chapter 3, Standards and Tolerances. The %EFS measured over a 30 minute period is assumed to be valid for verifying the chapter 3 standards and tolerances, which is 24 hours.

506. FTI DIGITAL DIRECT CONNECTION (DDC) SERVICES.

a. Objective. To verify that DDC services are within operating specifications.

b. Test Equipment Required. The testing requires ParaScope 2000 or equivalent test sets, laptops, and the appropriate interface cables to connect to the service delivery point (SDP). This testing will require two

individuals and two test sets, one at each end of the digital service, with communications between the two to coordinate the testing. Depending on the type of service, the following cables will be required:

(1) V.35: M34-DB37 Y cable (Fredrick Engineering Part# 210031) and M34 to M34 cable

NOTE: If the test sets do not show **IN LOCK** synchronization, check the indicators on the Parascope 2000 for the presence of a clock. If a clock is not present, the send timing (ST) and transmit timing (TT) must be looped. Install jumpers on the Parascope 2000, one from ST(A) to TT(A) and another from ST(B) to TT(B).

(2) RS-530/449: DB37-DB25 adapter cable (Fredrick Engineering Part# CBCC211876) and DB25-DB25 cable (210042)

(3) RS-232: DB25-DB25 cable (Fredrick Engineering Part# 210042)

c. Detailed Procedures.

(1) At the **From** and **To** site, connect a source cable between the ParaScope and the SDP jack for the service in test. Use the following cables and adapter cables for the service's respective interface.

(2) At the **From** and **To** site, obtain the FELINE PCMCIA (Personal Computer Memory Card International Association) adapter cable included with the ParaScope 2000. Insert the card into the laptop and connect the other end of the cable to the ParaScope. Connect the power supply to the ParaScope and turn the power on using the switch at the bottom of the front panel. Power up the laptop.

(3) At the **From** and **To** site, launch the **WanXL.exe** application (usually in the C:\Program Files\FELINE WanXL folder).

(4) At the **From** and **To** site, configure the ParaScope to use the proper interface type. From the **Quick Start** window, click on the desired interface in the **Line Interface** section and click the **Setup…** button.

(a) For V.35, RS-232 (Sync), or RS-530/449 interfaces: in the **Line Parameters Setup** window select the **Bit Oriented** tab and verify the **Clock Source:** is set to **External** and the **Bit Rate (BPS):** is set to the required interface speed.

(b) For RS-232 (Async) interfaces: in the **Line Parameters Setup** window select the **Async** tab and verify the **Clock Source:** is set to **Internal** and the **Bit Rate (BPS):** is set to the required interface speed. When complete, select the **OK** button.

(5) At the **From** and **To** site, configure the ParaScope to send the correct data signal. From the **Quick Start** window, click on **BERT** in the **Application** section and click the **Setup…** button.

* (a) For V.35, RS-232 (Sync), or RS-530/449 interfaces, in the **BERT Config** window select the **Sync** tab and verify the **Clock Source:** is set to **External**, **Pattern** is set to **2047 or 63 for services implemented with Circuit Emulation (CEM)**, and the **Bit Rate (BPS):** is set to the required interface speed.

(b) For RS-232 (Async) interfaces, in the **BERT Config** window select the **Async** tab and verify the **Clock Source:** is set to **Internal**, **Pattern** is set to **2047 or 63** and the **Bit Rate (BPS):** is set to the required interface speed. For all interfaces, ensure **Mode:** is set to **Full Duplex DTE** and **Error Rate:** is set to **NONE**. *

(c) Also verify **Round Trip Time** is selected. When complete, select the **OK** button. In the **Application** section click the **Run** button.

(6) Verify the end-to-end connectivity as indicated by the following steps. Verify the **Statistics** section of the **BERT** window shows **IN-LOCK**.

(7) Monitor the service for 30 minutes. Verify that the percent error free seconds (%EFS) meets the standards specified in Chapter 3, Standards and Tolerances. The %EFS measured over a 30 minute period is assumed to be valid for verifying the Chapter 3, Standards and Tolerances, which is 24 hours.

507. FTI T-1 SERVICES.

a. Objective. To verify that T-1 services are within operating specifications.

b. Test Equipment Required. The testing requires ParaScope 2000 or equivalent test sets, laptops, and the appropriate interface cables to connect to the service delivery point (SDP). This testing will require two individuals and two test sets, one at each end of the digital service, with communications between the two to coordinate the testing.

c. Detailed Procedures.

(1) At the **From** and **To** site, connect a source cable between the ParaScope RJ-45 port and the SDP jack for the service in test at the From site.

(2) At the **From** and **To** site, obtain the FELINE PCMCIA (Personal Computer Memory Card International Association) adapter cable included with the ParaScope 2000. Insert the card into the laptop and connect the other end of the cable to the ParaScope. Connect the power supply to the ParaScope and turn the power on using the switch at the bottom of the front panel. Power up the laptop.

(3) At the **From** and **To** site, launch the **WanXL.exe** application (usually in the C:\Program Files\FELINE WanXL folder).

(4) At the **From** and **To** site, configure the ParaScope to use the T-1 interface type. From the **Quick Start** window, click on the T-1 interface in the **Line Interface** section and click the **Setup…** button. In the **T-1 Interface Setup** window, ensure that **ESF** framing is selected and verify the **Line Code** is set to **B8ZS** and the **Eq. Gain** is set to **-30dB**. When complete, select the **Setup Simulate** button.

(5) At the **From** and **To** site, from the **T-1 Simulation Setup** window verify **Idle Fill** is set to **Tx Idle Code 7E**, **Clock Source** is **Recovered** and **Transmit Pattern** is **Data**. When complete, select the **OK** button to return to the **T-1 Interface Setup**. Then select the **OK** button to return to the **Quick Start** menu.

(6) At the **From** and **To** site, configure the ParaScope to send the correct data signal. From the **Quick Start** window, click on **BERT** in the **Application** section and click the **Setup…** button. In the **BERT Config** window, select the **Sync**' tab and verify the **Duration:** is set to **Continuous**. Ensure **Error Rate:** is set to **NONE**. Also verify **Round Trip Time** is selected. Verify BERT pattern (2**23)-1 is set. When complete, select the **OK** button. Then from the **Quick Start** menu in the **Application** section click the **Run** button.

(7) Verify the end-to-end connectivity by verifying the Statistics section of the BERT window shows IN-LOCK.

(8) Monitor the service for 30 minutes. Verify that the percent error free seconds (%EFS) and signal levels meets the standards specified in Chapter 3, Standards and Tolerances. The %EFS measured over a 30 minute period is assumed to be valid for verifying Chapter 3, Standards and Tolerances, which is 24 hours.

508. TEST PROCEDURES FOR PULSE MASK MEASUREMENT.

a. Objective. This procedure provides a method to perform a T-1 pulse mask measurement for types T-1 * (F1), (FB1), (T1B-1536), (T1C-1536), and (T1-1544) digital services. *

b. Discussion. This procedure is intended to be used only for troubleshooting cases in which the service satisfies either the Voltage Level and/or dBdsx measurements but the service is still experiencing problems. Construction of a simple circuit is required to match the impedance of the T-1 service to the oscilloscope. The technician should construct the circuit before performing the procedures. The procedures do not require service provider participation, however notification to the provider is encouraged. Observation and hard-copy printout of test results, when maintenance tests are performed by the service provider, can be used instead of FAA personnel performing actual maintenance tests. The procedures must be performed at each end-facility for the digital service under test, and therefore coordination between the two end-facilities is required.

c. Test Equipment Required. Tektronix 465 oscilloscope or equivalent. The 465 is a 100 MHz dual-trace analog oscilloscope used for general test and measurement activities. The instrument has a 1 mega-ohm, 24-picofarad input impedance. Differential measurements are made using the channel A plus channel B-inverted function.

d. Conditions. This is an intrusive test, and requires coordination with the appropriate Control Center before testing. The digital service under test is tested from FAA SDP to SDP between facilities. Ensure that the digital service is available and that all services on the digital service have been rerouted. Operational service performance tests for type F, FB, DS-1 and DS-1B services are made using the procedures in this paragraph. Configure and operate the test equipment at each end-facility as described below.

e. Detailed Procedures.

(1) Tektronix 465 equipment setup.

(a) Power on the oscilloscope by pulling the POWER switch.

(b) Check the accuracy of the scope probes used for the channel 1 and 2 measurement. Connect each scope probe to the CAL bar on the front of the scope. View the display and adjust the scope probe for a square waveform.

(c) Configure the scope as follows:

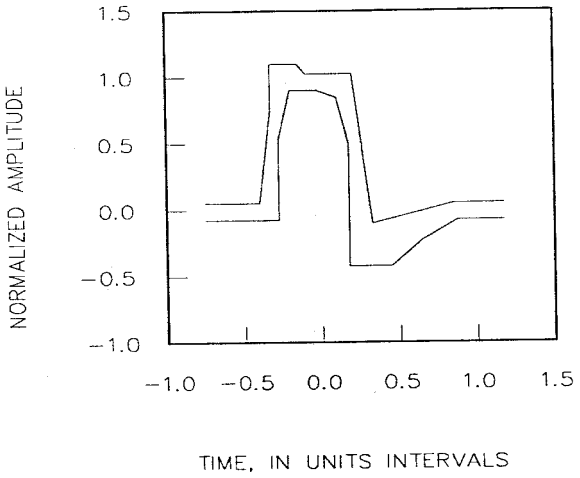
CH 1: AC, 1V/DIV
CH 2: AC, 1V/DIV, INVERT (button in)
VERT: ADD
TIME/DIV: 0.1 uS/DIV
SOURCE: NORM
TRIG MODE: AUTO
COUPLING: AC
HORIZ DISPLAY: A LOCK KNOBS

(2) Pulse mask measurement procedures.

(a) Connect both scope probes to the CAL bar and verify that a horizontal trace is present.

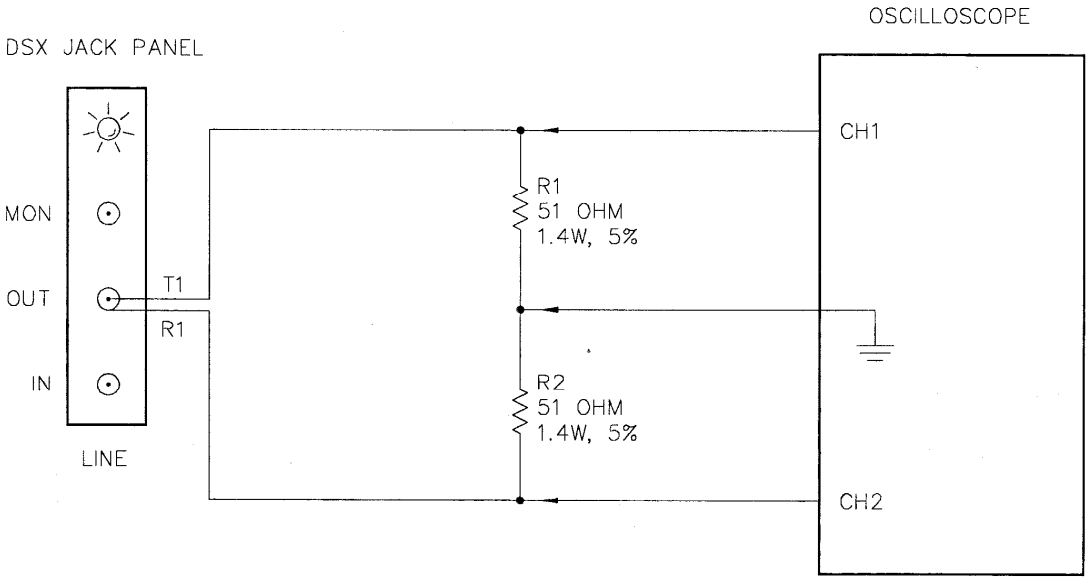
(b) Use pulse mask transparency located in Order 6000.47, Maintenance of Digital Transmission Channels, chapter 7, paragraph 121. Position the template on the oscilloscope screen so that the dotted lines on the template are aligned with the lines on the oscilloscope. For reference, a pulse mask template is shown in figure 5-1.

FIGURE 5-1. PULSE MASK



(c) Connect the oscilloscope to the circuit shown in figure 5-2 for the digital service under test.

FIGURE 5-2. PULSE MASK TEST CIRCUIT



(d) Adjust the A TRIGGER knob to obtain an oscilloscope waveform with orientation that is compatible with template orientation.

(e) Adjust the horizontal FINE POSITION and CH 1 vertical POSITION controls for the best fit of the waveform in the template.

(f) If the waveform is significantly outside of the template borders, notify the service provider immediately.

(g) Return all equipment and lines to normal operating status.

SECTION 3. INTERNET PROTOCOL (IP) SERVICES

509. INTERNET PROTOCOL (IP) SERVICE TEST PROCEDURES.

a. Objective. To verify that IP services are within operating specifications.

b. Test Equipment Required. The IP service verification requires an Ethernet interface. The test can be completed with a laptop and, for redundant services, a hub. From the laptop, the extended ping command can be utilized to gather latency data. This section is written using the Microsoft Windows 2000 Operating System. General Microsoft Operating system knowledge can be used to adapt this procedure for other operating systems.

* **c. Discussion.** Chapter 3, Standards and Tolerances, lists the specific performance parameters, tolerances, and limits applicable to all classes of IP services used within the FAA. Use FAA Form 6000-17, see example TPR figure 5-4, to record data taken and calculated values for parameters applicable to the IP service. A separate form is required for each end of a service. Local personnel may also utilize computer printouts (from FTI contractor-automated testing equipment) or electronic forms having the same information as the record for such maintenance, conduct separate acceptance test and record test data on a FAA Form 6000-10. *

d. Detailed Procedures.

(1) Connect an Ethernet cable from the laptop network port to the SDP. Refer to the Service Implementation Document for the SDP port at the From site.

(2) Reference the Service Implementation Document and obtain the From Host IP Address, Subnet Mask, and Gateway. Configure the laptop network interface card to the correct IP Address, Subnet Mask, and Gateway.

(a) From the laptop select the Start menu, the Settings option, and Network and Dial-up Connections from the pop-up menu.

(b) From the Network and Dial-up Connections window, open the Local Area Connection icon.

(c) From the General tab, highlight the internet protocol (TCP/IP) and select the Properties button.

(d) From the Internet Protocol (TCP/IP) window select the radio button for Use the following IP * address: and enter the IP address, Subnet mask:, and Default gateway. Contact local NAS IP user for address information. *

(e) Then select the OK button to return to the Local Area Connection Properties window and again select the OK button.

(3) From the Network and Dial-up Connections window, right-click on the Local Area Connection and select Disable from the menu. Then double-click on the Local Area Connection icon to enable the interface.

(4) From the desktop of the laptop select the Start menu and the Run… option. From the Run window enter cmd in the Open field and select the OK button to launch the command window.

(5) At the command prompt type the following command, substituting the <Dest_IP> with the IP address of the remote end:

```
ping –t –w 1000 –l 248 <Dest_IP>
```

(6) Run the test for 5 minutes. Press Ctrl-C on the laptop to stop the test. Divide the approximate average round-trip time by two, for one-way latency. Verify that the latency value meets the standards specified in Chapter 3, Standard and Tolerances.

* **510. DISPOSITION OF DATA.**

Compare readings with published standards and tolerances found in chapter 3. If readings are within tolerance, disconnect equipment and return the service back to operation. If test results are recorded, they can be stored and used as a benchmark in future testing of the service. If the service is not within tolerance, contact the service provider for corrective action.

511. TECHNICAL PERFORMANCE RECORDS (TPR) EXAMPLES. *

TECHNICAL PERFORMANCE RECORD — **FAA Telecommunications Infrastructure (FTI) Analog Services**

FACILITY	DATES	SUPERVISOR'S SIGNATURE
ZTL ARTCC	FROM / TO	

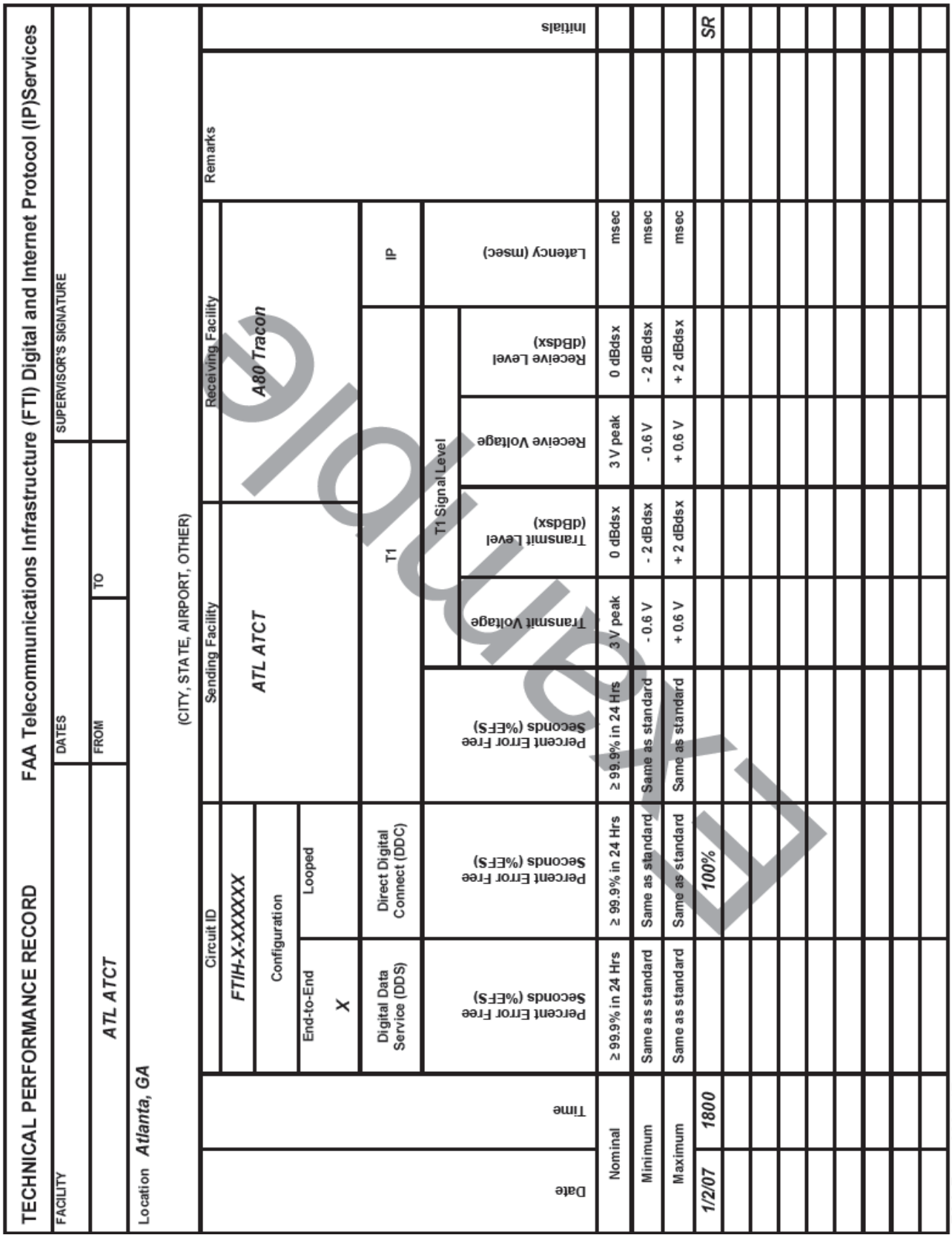
LOCATION *Hampton, GA* (CITY, STATE, AIRPORT, OTHER)

Date	Time	Circuit ID				Sending Facility						Receiving Facility						Remarks	Initials
		FTIH-X-XXXXXX				*ZTL ARTCC*						*ZTL ATCT*							
		Configuration		Usage		Line Test Set-Up (1004 Hz)													
		End-to-End	Looped	Voice	Data	Send Point						Receive Point					Line Type		
		X		*X*		0	TLP	-13	dBm	0	TLP	-13	dBm	*VG-8*					
		VG-1 1004 Hz Net Loss		VG-3 1004 Hz Net Loss		VG-6 1004 Hz Net Loss			VG-6 Signal-to-C-notched Noise ratio		VG-8 1004 Hz Net Loss			VG-8 Signal-to-C-notched Noise ratio					
		Level (dB)		Level (dB)		Level (dB)			Level (dB)		Level (dB)			Level (dB)					
Nominal		0 dB		0 dB		0 dB			> 32 dB		0 dB			≥ 34 dB					
Minimum		-4.0 dB		-1.5 dB		-1.5 dB			> 30 dB		-1.5 dB			> 32 dB					
Maximum		+4.0dB		+1.5 dB		+1.5 dB					+1.5 dB								
01/01/08	*1330*										*+0.4*			*34*					*SR*

FAA Form 6000-16

Draft

FIGURE 5-3. ANALOG TPR EXAMPLE



TECHNICAL PERFORMANCE RECORD — FAA Telecommunications Infrastructure (FTI) Digital and Internet Protocol (IP)Services

FACILITY: ATL ATCT | DATES: FROM | TO | SUPERVISOR'S SIGNATURE

Location: Atlanta, GA (CITY, STATE, AIRPORT, OTHER)

Date	Time	Circuit ID	Sending Facility	Receiving Facility	Remarks	Initials
		FTIH-X-XXXXXX	ATL ATCT	A80 Tracon		
		Configuration: End-to-End X; Looped				

Date	Time	Digital Data Service (DDS) Percent Error Free Seconds (%EFS)	Direct Digital Connect (DDC) Percent Error Free Seconds (%EFS)	T1 Percent Error Free Seconds (%EFS)	T1 Signal Level: Transmit Voltage	T1 Signal Level: Transmit Level (dBdsx)	T1 Signal Level: Receive Voltage	T1 Signal Level: Receive Level (dBdsx)	IP Latency (msec)	Remarks	Initials
Nominal		≥ 99.9% in 24 Hrs	≥ 99.9% in 24 Hrs	≥ 99.9% in 24 Hrs	3 V peak	0 dBdsx	3 V peak	0 dBdsx	msec		
Minimum		Same as standard	Same as standard	Same as standard	- 0.6 V	- 2 dBdsx	- 0.6 V	- 2 dBdsx	msec		
Maximum		Same as standard	Same as standard	Same as standard	+ 0.6 V	+ 2 dBdsx	+ 0.6 V	+ 2 dBdsx	msec		
1/2/07	1800		100%								SR

FAA Form 6000-17

Obsolete FTI

FIGURE 5-4. DIGITAL AND IP TPR EXAMPLE

512.-599. RESERVED.

CHAPTER 6. FLIGHT INSPECTION

600. GENERAL. Since FTI services are an integral part of various certifiable radar and air/ground communication systems, an independent flight check of FTI services is not required. Refer to the latest version of OAP 8200.1, United States Standard Flight Inspection Manual, for more information.

601.-699. RESERVED.

APPENDIX 1. RESPONDER LOOPBACK PROCEDURES

1. OBJECTIVE. Specific types of analog testing services may require control of remote responder equipment. These procedures will provide guidance on how to remotely loopback the responder using a Transmission Impairment Measurement System (TIMS) test equipment. These procedures should be used along with other procedures to test and validate analog services.

2. TEST EQUIPMENT REQUIRED. Hekiman Model 3700 or equivalent.

3. DETAILED PROCEDURES.

a. Turn on the TIMS.

b. Configure the TIMS to Terminate Mode.

c. Configure the TIMS to send DTMF codes. Refer to the TIMS operations manual for detailed procedures.

d. Depress the # sign key. This is a clearing code.

e. Using the keypad of the TIMS, enter the appropriate three digit address of the responder, followed by the one digit action code.

#XXX1 LOOPBACK
#XXX2 QUIET TONE
#XXX3 MILL/WATT
#XXX4 RESET
#XXX5 TONES
#XXX6 TONES
#XXX7 SLOPE TONE
#XXX8 P/AR TONE

Where **XXX** is the three-digit address of the responder to be used.

NOTE: The send side of the TIMS is the receive side of the Responder.

APPENDIX 2. SVC/PDC DESCRIPTIONS EXAMPLES

SVC	PDC	PDC Description
SVFA	AB	INTER-ARTCC CKTS USED FOR CRITICAL ATC/HAND-OFF INFO
SVFB	AC	ARTCC TO NON-ARTCC CIRCUITS (NOT ARTCCS TO AFSSS) FOR HAND-OFF/ATC
SVFC	AE	INTERPHONE CIRCUITS (NOT ARTCC) CRITICAL TO INTERFACILITY COM
SVFD	AL	OVERSEAS CIRCUITS USED FOR HAND-OFF/AIR TRAFFIC CONTROL
CFCS	AA	TMS (CENTRAL FLOW) VOICE CIRCUITS
SVFC	AQ	EXTERNAL OVERRIDE CIRCUITS (NOT ARTCC) CRITICAL TO INTERFAC COM
ECOM	CA	RCAG PRIMARY CIRCUITS
ECOM	CE	BUEC CIRCUITS
TCOM	CT	TERMINAL RTR CIRCUITS
ECOM	CC	RCAG CKTS PHYSICALLY & ELECTRICALLY DIVERSE FOR SAME FREQ/AIRSPACE
ECOM	CY	BUEC CKTS DIVERSE FROM RCAG CKTS FOR SAME FREQUENCY & AIRSPACE
EFAS	CJ	EFAS CIRCUITS
EFAS	CK	HI-EFAS CIRCUITS
FCOM	CH	FLIGHT SERVICE STATION RCO CIRCUITS
FCOM	FD	CKTS FOR NAVAID MONITORING & SIMULTANEOUS A/G VOICE TRANSMISSION
TCOM	CU	DIVERSE PATH OF TERMINAL RTR CIRCUITS
SVFB	AD	ARTCC TO AFSS CIRCUITS
ATIS	CN	A/G BROADCAST OF RECORDED MESSAGES FROM TERMINAL FACILITIES
PBRF	CO	A/G BROADCASTS OF RECORDED MSGS FROM FSS FACILITIES (HIWAS, TWEB)
MNTC	OA	INTERPHONE CIRCUITS FOR OPERATIONAL CONTROL CENTERS
ECOM	CB	RCAG BACKUP CIRCUITS
SVFA	AP	INTER-ARTCC CIRCUITS OTHER THAN FOR CRITICAL ATC/HAND-OFF INFO
SVFB	AR	ARTCC TO NON-ARTCC CIRCUITS NOT USED FOR HAND-OFF/ATC
SVFC	AS	NON-CRITICAL INTERPHONE CIRCUITS (EXCLUDES ARTCC)
SVFD	AY	OVERSEAS INTERPHONE CIRCUITS

SVC	PDC	PDC Description
SVFD	AM	MISCELLANEOUS INTERPHONE CIRCUITS
MISC	CM	MISCELLANEOUS RADIO CIRCUITS
PBRF	AF	FLIGHT ASSISTANCE PRIVATE LINE CIRCUITS
DMN	UF	TRUNKS CARRYING CRITICAL DMN CKTS: RDAT, BDAT, IDAT, FDAT, RMMS, ETC.
IDAT	KP	OPERATIONAL DATA CIRCUITS FOR ERAP (DSR TO DSSC)
SAT	UX	WIDE AREA AUGMENTATION SYSTEM (WAAS) CIRCUITS
BWM	UU	BANDWIDTH MANAGER T1 CIRCUITS
HCAP	US	CRITICAL T-1 ACCESS CIRCUITS
BDAT	DI	BEACON-ONLY NARROWBAND RADAR CIRCUITS (PRIMARY PATH)
BDAT	DK	BACK-UP BEACON-ONLY NARROWBAND RADAR CIRCUITS
IDAT	BP	ATC COMPUTER CIRCUITS, ARTCC TO ARTCC
RDAT	DA	NARROWBAND RADAR CIRCUITS (PRIMARY PATH)
RDAT	DJ	BACK-UP NARROWBAND RADAR CIRCUITS
FDAT	BF	FDIO DATA CIRCUITS
IDAT	BR	ATC COMPUTER CIRCUITS, ARTCC TO ATCT/TRACO
TRAD	DC	TERMINAL PRIMARY RADAR CIRCUITS (PRIMARY PATH)
TRAD	DT	ASR-9 REMOTE CIRCUITS (PRIMARY PATH)
CFCS	BY	CRITICAL TMS (CENTRAL FLOW) DATA CIRCUITS
RTRD	DR	REMOTE TERMINAL RADAR CIRCUITS (TML, DBRITE, RTAD, ETC.)
ODAP	BO	ODAPS CIRCUITS
TNAV	FC	ILS TERMINAL NAVAID CIRCUITS
TNAV	FE	MLS TERMINAL NAVAID CIRCUITS
TDWR	WC	TERMINAL DOPPLER WEATHER RADAR CIRCUITS
TSEC	DD	TERMINAL SECONDARY RADAR CIRCUITS
CFCS	BV	NON-CRITICAL TMS (CENTRAL FLOW) DATA CIRCUITS
FSSA	BI	NON-CRITICAL 1A (AFSS/ARTCC) DATA CIRCUITS AND ASSOCIATED EQUIPMENT
FSSA	BJ	FSDPS MODEL 1 FULL CAPACITY (AFSS/ARTCC) DATA CIRCUITS

SVC	PDC	PDC Description
VNAV	FO	APPROACH-LIGHT-SYSTEMS CIRCUITS
FSSA	BJ	FSDPS MODEL 1 FULL CAPACITY (AFSS/ARTCC) DATA CIRCUITS
ARIN	NS	PRE-DEPART. CLEARANCE,FLIGHT DATA,& DIGITAL ATIS DATA TRANSMISSION
LABS	BA	HIGH SPEED DATA CIRCUITS, SVCA AND SVCB
MNTC	OU	NIMS HIGH-SPEED DATA CIRCUITS
ENAV	FA	NON-DIRECTIONAL BEACON RADIO NAVAID (NDB, HDME) CIRCUITS
ENAV	FR	LORAN C CIRCUITS
ENAV	FB	NAVAID MONITOR & CONTROL CKTS W/OUT VOICE FOR VOR/TACAN/DME, ETC.
METI	FI	CRITICAL REMOTE WEATHER-MEASURING CKTS FOR RVR & LLWAS
NAMS	UA	NADIN IA DATA CIRCUITS
NDNB	UC	NADIN II TRUNK DATA CIRCUITS
MODS	DS	MODE-S REMOTE CIRCUITS
TNAV	FT	NON-ILS/NON-MLS TERMINAL NAVAID CIRCUITS
MNTC	UH	CRITICAL MONITOR & CONTROL CKTS - ARSR, ILS, VOR, ETC.
NXRD	WA	NEXRAD CIRCUITS
DMN	UI	TRUNKS CARRYING CRITICAL DMN CIRCUITS (BACKUP CRITICAL PATH)
DIRF	CL	DF REMOTING CIRCUITS
METI	BW	AWIS DATA CIRCUITS
METI	BX	WEATHER SERVICE FACILITIES (WSO, WSFO) DATA CIRCUITS
METI	NH	INFORMATION DISPLAY SYSTEM CIRCUITS
TRAD	DL	BACK-UP TERMINAL RADAR CIRCUITS
SAT	UN	NATIONAL SATELLITE TEST BED DATA CKTS FOR SATELLITE NAVIGATION
HCAP	UP	NON-CRITICAL T-1 ACCESS CIRCUITS
DMN	UL	TRUNKS CARRYING NON-CRITICAL DMN CKTS FOR ASOS, CBI, & MMS
ASOS	FX	NAVAID BROADCASTED ASOS CIRCUITS
AWOS	FW	NAVAID BROADCASTED AWOS CIRCUITS
ASOS	MG	DEDICATED WEATHER NETWORK CIRCUITS (ADAS)

SVC	PDC	PDC Description
AWOS	BU	DEDICATED WEATHER NETWORK CIRCUITS (ADAS)
METI	FN	NON-CRITICAL REMOTE WX-MEASURING CKTS FOR RRH, RBC, DASI, & GOES
RTRD	DQ	DBRITE - SECONDARY CIRCUITS
MISC	DM	MISCELLANEOUS NON-WEATHER RADAR REMOTING
VNAV	FL	VISUAL NAVAIDS & ARPT LIGHTING CKTS (VASI, REIL, ETC.)
MISC	BM	MISCELLANEOUS DATA NON-RADAR CIRCUITS
MNTC	UG	NON-CRITICAL MMS CKTS (E.G., AUTO-LOGGING, NAPRS, VOT)
MNTC	UB	ALARM AND MONITOR CIRCUITS FOR OTHER THAN ATC SYSTEMS
AFTN	BK	AFTN CIRCUITS
MISC	UM	MISCELLANEOUS CIRCUITS
NDNB	U1	NADIN II PORT-TO-PORT DATA CIRCUITS
ECOM	NX	NEXCOM CIRCUITS
		FUTURE OPERATIONAL IP SERVICES (e.g. CBI, AFTN, etc.)
IDAT	RC	CIRCUITS FOR THE ENHANCED TRAFFIC MANAGEMENT SYSTEM (ETMS)
IDAT	PU	USER REQUEST EVALUATION TOOL (URET) PROVIDED OVER IP NETWORK
MNTC	PO	OPERATIONAL CONTROL CENTER (OCC) AND NIMS/MPS DATA PROVIDED OVER IP NETWORK
METI	MT	CIRCUITS FOR THE INTEGRATED TERMINAL WEATHER SYSTEM (ITWS)
AWOS	PW	WEATHER SERVICES (WARP) PROVIDED OVER IP NETWORK
FSSA	NA	OPERATIONS AND SUPPORTABILITY IMPLEMENTATION SYSTEM (OASIS) PROVIDED OVER IP NETWORK
NDNB	HY	SPECIAL USE AIRSPACE MANAGEMENT SYSTEM (SAMS)
NDNB	U2	NADIN II PORT-TO-PORT DATA PROVIDED OVER IP NETWORK
IDAT	PS	RADAR DATA (STARS) PROVIDED OVER IP NETWORK
IDAT	RB	CIRCUITS FOR THE CENTER-TRACON AUTOMATION SYSTEM (CTAS)
ARIN	PA	ATN SERVICE PROVIDED OVER IP NETWORK
LABS	NT	AERONAUTICAL INFORMATION SYSTEM (AIS) CIRCUITS

GLOSSARY AND ACRONYMS

A and B Signaling. The procedure most often used in T1 transmission facilities in which one bit, robbed from each of the 24 subchannels in every sixth frame, is used for carrying dial and control information.

AC. Alternating Current.

Acceptance Limit (AL). A telecommunications industry term for the maximum value of, or deviation from, a design parameter that is allowed at service turnup or acceptance.

ACF. Area Control Facility.

ACK. Acknowledgement, message in a protocol.

Acoustic Coupler. A device that converts electrical signals into audio signals, enabling data to be transmitted over telephone lines via a conventional telephone hand-set.

Active/Passive Device. A device capable of supplying the current for the loop (active) and a device that must draw its current from connected equipment.

Adaptive Routing. A means of selecting the optimum path for message transfer or packet routing.

Address. A unique sequence of letters or numbers for the location of data or the identity of an intelligent device.

ADPCM (Adaptive Differential Pulse Code Modulation). A technique that allows analog signals to be car-ried on a 32 kb/s digital channel. Sampling is performed at 8 Hz with 3 or 4 bits used to describe the difference between adjacent samples.

ADTN. Agency Data Telecommunications Network.

AFAAR. Technical Operations Aircraft Accident Representative.

AH. Authentication Header.

AIS. All Ones Signal.

Algorithm. A set of instructions or mathematical formulas used to solve a given communications problem.

Alternate Route. A redundant transmission route that provides the same telecommunications connectivity as the primary route to which it is referenced.

AMI (Alternate Mark Inversion). Line coding for T1 spans.

AN. Assumed On.

Analog. An electrical signal that varies continuously in amplitude or frequency depending on changes in sound, light, heat, etc.

Analog/Digital Converter (A/D). A device that converts an analog transmission signal into digital format

ANSI. American National Standards Institute; the principle standards development body supported by over 1000 American trade organizations, professional socie-ties and companies. The US member body to ISO (International Standards Organization).

AOCNET. Airlines Operations Control Network.

ARTCC. Air Route Traffic Control Center.

ASCII. American Standard Code for Information Interchange; a seven bit plus parity code established by ANSI to establish a uniform means of transferring information between data processing systems, communications systems, and terminal equipment.

Asynchronous Transmission. Transmission is controlled by start and stop bits at the beginning and end of each character.

ATC. Air Traffic Control.

ATCP. AppleTalk Control Protocol.

ATIS. Alliance for Telecommunications.

ATMS. Asynchronous Transfer Mode Service.

ATSCC. Air Traffic Control System Command Center.

Attenuation Distortion. The difference in loss at one frequency with respect to the loss at a reference frequency; the reference frequency is 1004 Hz unless otherwise specified. Attenuation distortion is controlled either at specified frequen-cies, or throughout a frequency band (See also Slope).

Automatic. A capability which results in an action being initiated within the network without human intervention.

AWG. American Wire Gauge, conventional designator of wire size.

B3ZS. Binary 3 zero substitution or bipolar with three zero substitution, line encoding technique used for DS-3 transmission channels.

B8ZS. Binary 8 zero substitution, a technique used to accommodate the ones density requirements of digital T-carrier facilities in the public network, while allowing 64 kb/s clear data per channel. Rather than inserting a one for every seven consecutive zeroes (see ones density), B8ZS inserts two violations of the bipolar line encoding technique used for digital trans-mission links.

Backbone Network. A transmission facility designed to interconnect lower-speed distribution channels or clusters of dispersed user devices.

Backbone. The part of the Leased System composed of all the nodes and all the interconnecting paths.

Bandpass. The portion of a band, expressed in frequency differences (bandwidth), in which the signal lost (attenuation) of any frequency when compared to the strength of a reference frequency is less than the value specified in the measurement.

Bandwidth. The range of frequencies available for signaling; the difference expressed in Hertz between the highest and lowest frequencies of a band. Often used in digital transmission terminology to indicate the speed at which a given network topology, channel or communication line operates.

Baud. Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second (Baud is an older term that was used mostly for teletypes, the newer term is bits per second).

BD1. Basic Data.

Bell Operating Company (BOC). Any of the 22 operating companies created by the AT&T divestiture.

BERT. Bit error rate test, or tester.

BER. Bit Error Rate.

Bipolar Violation (BPV). Two pulses of the same polarity in a row.

Bisynchronous Transmission (BSC). A byte or character-oriented IBM communications protocol that has become the industry standard. It uses a defined set of control characters for synchronized transmission of binary coded data between stations in a data communications system.

Bit Error Rate. Ratio of incorrect bits detected to total bits received. Useful for detecting error bursts over specific bit intervals.

Bit Errors. Count of bits whose logical state (0,1) changed along the transmission path. Base measurement for judging circuit quality and availability.

Bit. Binary digit; the smallest unit of information in a binary system; a 1 or 0 condition.

Blocking. Isolation of a device from the network while maintaining proper termination characteristics.

BPS or b/s. Bits per second; unit of data transmission rate.

BNOCC. Harris Backup Network Operations Control Center.

BRI. Basic Rate Interface

Bus. A data path shared by many devices (e.g. multipoint line) with one or more conductors for transmitting signals, data or power.

BV1. Basic Voice.

BWM (Bandwidth Manager). A multiservice access platform used as the core of a multi-service backbone network. On a single platform, a BWM system fully integrates the functions of a voice and data networking multiplexer, a multi-protocol router, and a network management system. BWM is a FAA owned system.

Byte. A binary element string functioning as a unit. Eight-bit bytes are most common. Also called a character.

C Conditioning. Type of line conditioning that controls attenuation, distortion, and delay distortion so they lie within specific limits.

Call. The sequence of events begun when an end user makes a request for service and provides an address code, and concluded when communication between the end users has terminated.

CBL. Call Blocking Limits.

CC. DCE Ready.

CDR. Call Detail Records.

Central Office (CO). The telephone company switching facility or center at which subscribers' local loops terminate. It handles a specific geographic area and is identified by the first three digits of the local telephone number. Since divestiture, these are invariably the facilities of the local Bell operating company.

CFA (Carrier Fail Alarm). Detection of red (local) or yellow (remote) alarm on T1.

CFR. Code of Federal Regulations.

Channel Bank. Equipment, typically in a telephone central office, that performs multiplexing of lower speed, generally digital, channels into a higher speed composite channel, the channel bank also detects and transmits signaling information for each channel and transmits framing information so that time slots allocated to each channel can be identified by the receiver. A channel bank can also be located at the customer premises when DS-1 or higher digital service is ordered by the customer.

Channel Service Unit (CSU). A component of customer premises equipment used to terminate a digital circuit, such DDS or T1, at the customer site; performs certain line conditioning functions, ensures network compliance per FCC rules, and responds to loopback commands from the central office also, ensures proper ones density in transmitted bit stream and performs bipolar-violation correction (also see DSU).

Channel. In communications, a physical or logical path allowing the transmission of information; the path connecting a data source and a data sink (receiver). In general, a channel may include a local access segment at each end, and a backbone segment.

CHAP. Challenge Handshake Authentication Protocol.

Circuit Diversity. A physical and electrical separation in routing of transmission paths such that a failure at one geographical location will not cause loss of both paths.

Circuit. A physical or logical path allowing the transmission of information; the path connecting a data source and a data sink (receiver). The term circuit may be used interchangeably with channel, line, or path.

Clear Channel. Characteristic of a transmission path wherein the full bandwidth is available to the user; said primarily of telephone company digital circuits that do not require that some portion of the channel be reserved for carrier framing or control bits.

Clear To Send (CTS). Signal that indicates to the DTE device to begin transmission.

CTS. Communications Test System.

CLINs. Contract Line Item Numbers.

CLK. Clock.

Clock. Timing signals used in synchronous trans-mission. More generally, the source(s) of timing signals sequencing electronic events.

C-Message Noise. The frequency-weighted, short-term average noise within an idle line. The frequency weighing, called C-message, is used to account for the variations in 500-type telephone set transducer efficiency and user annoyance to tones as a function of frequency.

CMIP. Common Management Information Protocol.

C-Notched Noise. On a line with a holding tone, the C-message, frequency-weighted noise that is removed at the measuring end through a notch (very narrow band) filter.

CO. Central Office.

Comite Consultatif International de Telephonie et de Telegraphie (CCITT). International Consultative Committee for Telephone and Telegraph, a United Nations organization.

Composite Line. An end-to-end analog line made up of two or more line segments provided by different suppliers.

Concentrator (Statistical Multiplexor). A device used to divide a data channel into two or more channels of lower average speed, dynamically allocating channel space according to demand in order to maximize throughput.

Consecutive Severely Errored Second (CSES) Event. For the digital service, a CSES event shall be deemed to have occurred when a period of 5 severely errored seconds have occurred consecutively.

Control Station. The station on a network that supervises control procedures, including polling, calling, and error recovery.

Copper Facility. Any wire based transmission medium utilizing copper.

COS. Class of Service.

COTS. Commercial off-the-Shelf.

CPE. Customer Premise Equipment.

Crosstalk. The unwanted transmission of a signal on a channel that interfaces with another channel.

CSES. Consecutive Severely Errored Seconds.

CSL. Call Set-Up Limits.

CSS. Circuit Switched Services.

CSU. Channel Service Units.

CTS. Clear to Send.

CUG. Closed User Group

Customer-Premise Equipment (CPE). Equipment and facilities on the customer/FAA side of the point of interconnection with the telecommunications net-work.

Cutover. The connection and activation of an operational signal source (e.g.; a radar) from one transmission system to another.

Cyclic Redundancy Check (CRC). A basic error-detection mechanism for link-level data transmission; a characteristic link-level feature of (typically) bit-oriented data communications protocols, wherein the data integrity of a received frame, or a packet, is checked by the use of a polynomial algorithm based on the content of the frame and then matched with the result that is performed by the sender and included in a (most often 16-bit) field appended to the frame.

D Conditioning. A type of conditioning that controls harmonic distortion and signal-to-noise ratio so that they reside within specified limits.

D/I. See Drop and Insert below.

D4 Framing. T1 12-frame format in which the 193rd bit is used for framing and signaling information; ESF is an equivalent, but newer, 24 frame technology.

Data Circuit-Terminating Equipment (DCE). Data communications equipment; in a communications link, equipment that is either part of the network, an access point to the network, a network node, or equipment at which a network circuit terminates; in the case of an RS-232-C connection, the modem is usually regarded as DCE, while the user device is DTE, or data terminal equipment; in a CCITT X 25 connection, the network access and packet-switching node is viewed as the DCE.

Data Service Unit (DSU). Component of customer premises equipment used to interface to a digital circuit (e.g. DDS or T1), combined with a channel service unit, performs conversion of customer's data stream to bipolar format for transmission.

Data Terminal Equipment (DTE). Generally, user devices, such as terminals and computers, that connect to data circuit terminating equipment; they either generate or receive the data carried by the network; in RS-232-C connections, designation as either DTE or DCE determines the signaling role in handshaking; in a CCITT X 25 interface, the device or equipment that manages the interface at the user premises; see DCE.

Data Transfer Rate. The average number of bits, characters, or blocks per unit of time transferred from a data source to a data sink.

Data. Digitally represented information, which includes voice, text, facsimile, and video.

Database. Collection of data which is structured and organized in a disciplined fashion to facilitate information retrieval.

DB (Decibel). The logarithmic unit of signal power ratio commonly used in telephony. It is used to express the relationship between two signal powers, usually between two acoustic, electric, or optical signals; it is equal to 10 times the common logarithm of the ratio of the 2 signal powers.

dBdsx. Decibel referenced to the nominal signal level measured at the dsx jack panel.

DBM. Decibel referenced to one milliwatt; relative strength of a signal, calculated in decibels, when the signal is compared in a ratio to a value of one milliwatt; used mainly in telephony to refer to relative strength of a signal (e.g., at 0 dBm, a signal delivers 1 milliwatt to a line load, while at -30 dBm a signal delivers .001 milliwatt to a load).

DBRN. A unit used to express noise power relative to one picowatt (-90 dBm).

DBRNC. Noise power in dBRN, measured with C-message weighing.

DBRNC0. Noise power in dBRNC referred to or measured at a zero transmission level point (0/TLP).

DCD. Data Carrier Detect.

DCE. Data Circuit Terminating Equipment.

DCR. DCE Ready.

DDC. Direct Digital Connectivity.

DDS. Digital Data Services.

Delay Distortion. Change in signal from transmitting end to receiving end resulting from the non-uniform speed of transmission of various frequency components of a signal through a transmission medium.

Delay Time, End-To-End. The time to traverse the Leased System from one end user location to another including processing, queuing, connecting, transmission/retransmission and propagation delays. Measure of round trip transmission delay. Useful for detecting possible cause of protocol timeouts.

Demarcation (DEMARC) Point. The demarcation point between the wiring that comes in from the local telephone company, and customer-premises equipment or CPE.

Demodulation. The process of retrieving digital (computer) data from a modulated analog (telephone) signal.

Deviation. The departure from a standard or specified value.

Digital Bridge. Allows the connection of subchannel de-vices (either DCE or DTE) to a single main channel.

Digital Data. Information transmitted in a coded form (from a computer) represented by discrete signal elements.

Digital. Referring to communications procedures, techniques, and equipment by which information is encoded as either a binary 1 or 0; the representation of information is discrete binary form, discontinuous in time, as opposed to the analog representation of information in variable, but continuous, waveforms.

Digroup. A digital group or when twenty-four voiceband analog channels are combined or multiplexed to form a DS-1 signal.

DIP Site. A drop and insert point, usually on the RCL, at which voice grade lines are dropped and inserted.

Direct Digital Connection (DDC). A private line digital service which offers a direct connection to the user's DTE, negating the need for a DSU/CSU. Typical DTE interfaces sup-ported for DDC are CCITT V 35, EIA/TIA-232, EIA/TIA-530.

DISA. Defense Information Systems Agency.

DISN. Defense Information Systems Network.

Diversity. A physical and electrical separation in the routing of transmission paths such that a failure at one geographical location will not cause the loss of both paths.

DMN. Data Multiplexing Network.

DNCP. DECnet Phase IV Control Protocol.

DNIC. Data Network Interface Circuit, 2B+D ISDN U interface.

DoV. Data over Voice, modems combine voice and data on one twisted pair.

DQDB. Distributed Queue Dual Bus; an IEEE 802 6 protocol to access MAN's, typically at 45 mb/s.

Drop And Insert. A term applied to a multiplexer that can add data (insert) to a T1 data stream, or act as a terminating node (drop) to other multiplexers connected to it.

Drop Cable. In local area networks, a cable that connects perpendicularly to the main network cable, or bus, and attaches to data terminal equipment (DTE).

DS. Dedicated Service.

DS. Digital Signal.

DS-0. Digital Signal, level 0; 64,000 bits per second, the world-wide standard rate for pulse code modulated (PCM) digitized voice channels.

DS-1. Digital Signal, level 1; 1 544 mb/s in North America, effectively synonymous with T1.

DS-3. Digital Signal, level 3; equivalent of 28 T1 channels, communications access operating at 44 736 mb/s; effectively synonymous with T-3.

DSP. Digital Signal Processor; specialized chip optimized for fast computations.

DSR. Data Set Ready; an RS-232 interface control signal indicating DCE and line ready to receive data.

DSS1. Digital Subscriber Signaling System No. 1.

DSU. Data Service Units.

DSU/CSU. Data service unit/ channel service unit.

DSX-1. Digital Signal cross connect, level 1; part of the DS-1 specification. The master demarcation system's (MDS) digital interface for wideband digital circuits up to T1.

DTE. Data Termination Equipment.

DTM. Digital time division multiplexer. Combines several digital input channels in discrete time-slots for transmission over a single channel. Used in conjunction with the DSU/CSU.

DTR. Data Terminal Ready; an RS-232 interface control signal indicating DTE is ready for transmission.

DTS. Dedicated Transmission Service.

E&M. Ear and Mouth.

EAP. Extensible Authentication Protocol.

Echo Return Loss (ERL). A frequency-weighted measure of return loss over the middle of the voiceband (approximately 560 to 1965 Hz), where talker echo is most annoying.

Echo. Part of a signal transmission reflected or other-wise returned with sufficient magnitude and delay to be received as interference.

ED2. Encryption.

ED3. VPN Technology.

ED4. Extranet.

ED5. X 25 Closed User Groups.

ED6. Packet Filtering Firewall.

ED7. Bastion Host.

EFS. Error Free Seconds.

EI. External Independent.

EIA (Electronics Industry Association). A U.S. standards organization specializing in the electrical and func-tional characteristics of interface equipment.

End User. An end user may be either an FAA or con-tractor person who will operate equipment that uses the telecommunications medium.

Envelope Delay Distortion (EDD). A characteristic of analog lines that results when some frequencies arrive ahead of others, even though they were transmitted at the same time. It is normally expressed as a difference in time between arrival of the frequencies at the receive end of a line; difference in times between the frequency that arrived last and the frequency that arrived first.

Error Free Second (EFS). An EFS is any second of data in which no bit errors are received.

Errored Seconds. Count of seconds in which one or more bit errors occurred. Base measure of circuit quality. An errored second for the extended superframe formatted digital service is a second in which one or more ESF error events have occurred. An errored second for the DS-3 digital service is a second in which a CRC-9 error event, an Out-Of-Frame (OOF) state, or both have occurred. An errored second for the DDS service is a second in which one or more bit errors are received.

ESF. Extended Superframe Format.

ESF Error Event. An ESF error event is an ESF that contains either a CRC-6 error event, an out-of-frame (OOF) state, or both as stated in AT&T PUB 54016.

ESP. Encapsulating Security Payload.

EU-POT. End-User Point of Termination.

EV1. Voice Closed User Groups.

Exchange. A unit established by a telephone company for the administration of communications service in a specified geographic area that usually embraces a city, town, or village and its environs.

Expected Measured Loss (EML). The calculated value of the 1004-Hz loss that one would expect to measure between two test points with the proper terminating impedances at the test points. It is the sum of the inserted connection loss and test access loss including any test pads.

Extended Superframe Format (ESF). An AT&T proposed T1 framing standard that provides frame synchronization, cyclic redundancy checking, and data link bits; frame consist of 24 bits instead of the previous standard 12 bits; the standard allows error information to be stored and retrieved easily, facilitating network performance monitoring and maintenance.

F1. Fractional T-1.

F3. Fractional T-3.

FAA. Federal Aviation Administration.

FAA Designated Demarcation Point. This DEMARC is the physical point interconnecting the government com-munications equipment and the leased system.

FAA Telecommunications Infrastructure (FTI). Services the FAA will acquire for transmitting voice and data used in fulfilling the FAA's operational mission of controlling air traffic in the National Air Space.

FAATSAT (FAA Telecommunications Satellite). A system to provide satellite-based telecommunications services to aid in the elimination of single points of failure. FAATSAT incorporates both fixed and transportable earth stations in the main domestic network and incorporates mobile stations for use in emergency situations worldwide. FAATSAT is a leased service.

FAC. Facility Code.

Facilities. Any telephone company cable, poles, conduit, microwave, or carrier equipment, wire center distrib-uting frames, central office, switching equipment, com-puters (both hardware and software), business machines, etc., utilized to provide services offered.

FB1. Fractional Bulk T-1.

FCC. Federal Communications Commission, regulates U.S. communications.

Fiber Distributed Data Interface (FDDI). 100 mb/s fiber optic standard for a LAN or WAN.

FDL. Facility Data Link.

FEX. Foreign Exchange.

FF. Forced Off.

Filter. Device that transmits a certain range of frequen-cies while suppressing unwanted frequencies or noise, or while separating lines in communications lines.

FIP. Federal Information Processing Standard Publication.

FN. Forced On.

FR. Frame Relay.

Fractional T1 (FT1). Digital capacity of N x 64 kb/s but usually less than 1/2 a T1. A communications line consisting of some fraction of a standard T1 line. Fractions are allocated in multiples of 64 kb/s. A T1 line can support up to 24 64-kb/s channels.

Frame. A group of bits sent serially over a communications channel; generally, a logical transmission unit sent between data link layer entities that contains its own control information for addressing and error checking, the basic data transmission unit employed with bit oriented protocols, similar to blocks; also, in video transmission, a set of electron scan lines (usually 525 in the United States) that comprise a television picture.

Framing. A control procedure used with multiplexed digital channels, such as T1 carriers, whereby bits are inserted so that the receiver can identify the time slots that are allocated to each subchannel; framing bits may also carry alarm signals indicating specific alarm conditions.

Frequency Shift. The difference between the frequency of a signal applied at the input of a line and the frequency of that signal at the output of the line.

FRS. Frame Relay Service.

FSEP. Facility, Service, and Equipment Profile.

FTI. FAA Telecommunications Infrastructure.

FTP. File Transfer Protocol.

FTSD. FTI Telecommunications Services Description.

Full Duplex. Transmission in either direction, at the same time.

FX. Foreign Exchange.

Gain/Frequency Characteristic. The gain-versus-frequency characteristic of the line over the bandwidth provided/.

GETS. Government Emergency Telecommunications Service.

GFE. Government-Furnished Equipment.

GMII. Gigabit Media Independent Interface.

Government Facility. A Government facility is a location owned, operated, leased, or contracted by or for the Government.

Half Duplex. Transmission in either direction, but not at the same time.

Harmonic. An alternating signal whose frequency is an integral multiple of the fundamental basic frequency.

HDLC. High-Level Data Link Control.

Hertz (Hz). Measurement that distinguishes electro-magnetic waveform energy, number of cycles, or complete waves, that pass a reference point per second; measurement of frequency, by which one Hertz equals one cycle per second.

HTTP. Hypertext and Transfer Protocol.

Hybrid. An electronic line or transformer that inter-connects a local (two-wire) loop with four-wire long-haul facilities.

Hz. Hertz.

IBS. Integrated Business System.

ICD. Interface Control Document.

ICMP. Internet Control Message Protocol.

IEEE. Institute of Electrical and Electronics Engineers.

IETF. Internet Engineering Task Force.

II. Internal Independent.

IKE. Internet Key Exchange.

IL. Internal Locked.

Immediate Action Limit (IAL). A telecommunications industry term for the bound of acceptable performance and the threshold beyond which the local exchange carrier will accept a customer's trouble report and take immediate corrective action.

Impulse Noise. Any momentary occurrence of the noise on a line significantly exceeding the normal noise peaks. It is analyzed by counting the number of occurrences that exceed a threshold during a specified period of time.

In-Band Signaling. Use of audio tones inside the con-ventional voice frequency line to convey signaling information.

Interexchange Carrier (IXC). Any corporation engaged for hire in interstate or foreign communication by wire, fiber, or radio between two or more local access and transport areas (LATA's).

Interface. The point at which two systems, or two parts of one system, interconnect.

Interference. Any unwanted noise or crosstalk on a communications line that reduces the intelligibility of the desired speech or signal.

Intermodulation Distortion (IMD). A measure of the nonlinearity of a line. It is measured using four tones and evaluating the ratios (in decibels) of the transmitted composite four-tone signal power to the second-order products of the tones (R2), and the third-order products of the tones (R3).

IP. Internet Protocol.

IPCP. Internet Protocol Control Protocol.

IPS. Internet Protocol Service.

IPSec. IP Security.

IPXCP. Internetwork Packet Exchange Control Protocol.

Integrated Services Digital Network (ISDN). A network system that utilizes the same digital communications equipment for all voice, data, fax, and video, and integrating transmission over the same digital line.

ISO. International Standards Organization.

ISS. Information Systems Security.

ITU. International Telecommunications Union.

ITU-R. International Telecommunications Union-Radio.

ITU-T. International Telecommunications Union Telecommunications.

Jitter. The slight movement of a transmission signal in time or phase that can introduce errors and loss of synchronization in high-speed synchronous communications; see Phase jitter.

K/bits or kb/s. Kilobits per second; standard measure of data rate and transmission capacity.

Kilohertz (kHz). One thousand Hertz or one thousand cycles per second.

LAN. Local Area Network.

LAPB. Link Access Procedure for Balanced (operations).

LCP. Layer Control Protocol.

LDCELP (Low Delay Code Excited Linear Prediction). LDCELP is a voice compression method that uses a backward-adaptive analysis-by-synthesis algorithm defined by ITU Recommendation.

LDM (Limited Distance Modem). A signal converter which contains and boosts a digital signal so it may be transmitted much further than a standard RS-232 signal.

LED (Light Emitting Diode). A semiconductor light source that emits visible light or invisible infrared radiation.

LID. Location Identifier.

Line Conditioning. Telephone company service that reduces envelope delay, noise, and attenuation distortion, enabling the subscriber to transmit higher speed data than over traditional telephone lines.

LL. Latency Limits.

LL. Local Loop.

LLC. Logical Link Control.

Local Access And Transport Area (LATA). One of 161 local telephone serving areas in the United States, generally encompassing the largest standard statistical metropolitan areas; subdivisions established as a result of the Bell divestiture that now distinguish local from long distance service; circuits with both end-points within the LATA (intra-LATA)are generally the sole responsibility of the local telephone company, while circuits that cross outside the LATA (inter-LATA) are passed on to an inter-exchange carrier.

Local Area Network (LAN). A data communications system confined to a limited geographical area with moderate to high data rates (100 kb/s to 50 mb/s). The area may consist of a single building, a cluster of buildings or a campus-type arrangement. The network uses some type of switching technology, and does not use common carrier circuits,although it may have gateways or bridges to other public and private networks.

Local Exchange Carrier (LEC). An organization that provides intra-LATA telecommunications services to the public.

LoCap. Low Capacitance.

Loopback. Diagnostic procedure used for transmission devices. A test message is sent by a device being tested. The test message is then sent back (or looped) to the receive line(s) and compared with the original transmission. Loopback testing may be done locally or conducted remotely, over a communications circuit. Loopback is also called loop-up.

Loop-Up. See loopback.

Loss Deviation. The departure of the actual loss from the designated value.

LS. Low Speed.

M13. Multiplexer between DS-1 and DS-3 levels.

M24. Multiplexer function between 24 DS-0 channels and a T1, a channel bank.

MAC. Media Access Control.

Main Distribution Frame. In telephony, a structure in which telephone-subscriber lines are terminated; in conjunction with a private branch exchange, the place where central office telephone lines are connected to on-premises extensions; at a telephone central office, a site where subscriber lines terminate. In the FAA, the main distribution frame is the MDS.

MAU. Medium Attachment Unit.

Mbps. Megabits Per Second.

MDS. Master demarcation system. The centralized demarcation system adopted by the FAA that defines physical and electrical requirements of all analog and digital signals entering or leaving a facility. See Main Distribution Frame.

MF. Multi-Frequency.

MII. Media Independent Interface.

MODEM. Modulator/demodulator; electronic device that enables digital data to be sent over analog transmission facilities.

Modulation. Modifying some characteristics of a wave form.

Monitor. A video display or any hardware or software that supervises the operation of a system and indicates any deviation from its standard operating procedure.

MOU. Memorandum of Understanding.

MOS. Mean Opinion Score.

Ms. Milliseconds.

MS. Medium Speed.

MSN. Message Switching Network.

MSS. Modem substitution switch. Switches up to two spare modems online in the event that a primary modem fails.

MTBF. Mean Time Between Failures. Average for one device.

MTBO. Mean Time Between Outage.

MTTR. Mean Time To Repair.

Multidrop Line. A single communications channel (typically, a leased telephone circuit) that interconnects many stations, each of which contains terminal devices.

Muliplexing/Multiplexer. The combining of multiple data channels onto a single transmission medium; any process through which a circuit normally dedicated to a single user can be shared by multiple users; typically user data streams are interleaved on a bit or byte basis (time division) or separated by different carrier frequencies (frequency division).

Multipoint Line. A line providing simultaneous transmission among three or more separate points. Also a multidrop line.

N/A. Not Applicable.

NA. Not Applicable.

NADIN. National Airspace Data Interchange Network.

NAPRS. National Airspace Performance Reporting System.

NAS. National Airspace System.

NBFCP. NetBIOS Frames Control Protocol.

NCS. National Communication System.

NEC. National Electric Code.

Network Control Signaling. The transmission of signals in the telecommunications system that perform functions such as supervision (control, status, and charge signals), address signaling (e.g. dialing), calling and called number identifications, rate of flow, service selection, error control, and audible tone signals (call-progress signals indicating reorder or busy conditions, and alerting) to control the operation of the telecommunications system.

Network Management and Operations (NMO). Network management and operations services in support of FTI services.

Network Termination Equipment (NTE). Network compo-nent that links directly to the terminating equipment.

NFPA. National Fire Protection Association.

NIMS. NAS Infrastructure Management System.

NIST. National Institute of Standards and Technology.

NMC. Network Management Control.

NOCC. National Operations Control Center.

Node. A point in the network which is interconnected to at least two other nodes via digital facilities (paths) which are physically diverse. A node may be located at a vendor location or at an FAA location.

Noise. Random electrical signals, introduced by line components or natural disturbances that tend to degrade the performance of a communications line.

Non-Blocking. A capability of the network such that the total number of available transmission paths is equal to the number of ports. Therefore, all ports can have simultaneous access through the network.

Non-Return To Zero (NRZ). A binary encoding and transmission scheme in which ones and zeros are represented by opposite and alternating, high and low voltages; wherein there is no return to a reference (zero) voltage between encoded bits.

NOTAM. Notices to Airman.

Nyquist Theorem. In communications theory, a formula stating that two samples per cycle is sufficient to characterize a band limited analog signal, in other words, the sampling rate must be twice the highest frequency component of the signal (e.g. sampling at 8 Khz for a 4 Khz analog signal).

OCTET. Implies a meaningless mix of bits, not a coherent sample or byte.

Off-Hook. The supervisory state indicative of the active (in use) condition.

Ones Density. The requirement for digital transmission lines in the public switched telephone network that eight consecutive zeros cannot be in a digital data stream; exists because repeaters and clocking devices within the network will lose timing after receiving eight zeros in a row; any number of techniques or algorithms used to insert a one after every seventh-consecutive zero.

On-Hook. The supervisory state indicative of the idle condition.

OOS. Out of Service.

OSHA. Occupational Safety and Health Administration.

OSINLCP. OSI Network Layer Control Protocol.

OSS. Operational Support System.

Out-of-Band Signaling. Use of narrowband filters to place the voice signal on a carrier line below 3400 Hz, reserving the 3400-to-3700-Hz band for supervisory signals.

Out-Of-Frame State (OOF). An OOF state begins when any two of four consecutive frame synchronizing bits received from the network are incorrect. An OOF state ends when reframe occurs.

PABX. Private Automatic Branch Exchange.

PAM. Pulse amplitude modulation.

Parity Bit. A bit that is set at 0 or 1 in a character to ensure that the total number of 1 bits in the data field is even or odd.

Parity Check. The addition of non-information bits that make up a transmission block to ensure that the total number of 1's is always either even or odd.

Path. An analog or digital route between two nodes.

Pattern Slips. Data pattern condition caused by an added or deleted bit to transmitted pattern. Typically indicates circuit equipment or system timing problem.

PBX. Private Branch Exchange.

PCM (Pulse Code Modulation). Digital transmission technique that involves sampling of an analog information signal at regular time intervals and coding the measured amplitude value into a series of binary values, which are transmitted by modulation of a pulsed or intermittent carrier; a common method of speech digitizing using 8 bit code works or samples and a sampling rate of (typically) 8 kHz.

Peak to Average Ratio (P/AR). A test to determine a line's overall bandwidth and phase nonlinearity and thus its ability to effectively transmit high-speed data traffic.

Percent EFS. The percent of error free seconds is the ratio of 1 second intervals not containing any bit errors to the total number of seconds in an observation period multiplied by 100. Measure of circuit quality.

Phase Jitter. In telephony, the measurement, in degrees out of phase, that an analog signal deviates from the referenced phases of the main data-carrying signal; often caused by alternating-current components in a telecommunications network.

PLL. Phase Locked Loop.

PMD. Physical Media Dependent.

PNOCC. Harris FTI Primary Network Operations Control Center.

POC. Point of Contact.

Point Of Presence (POP). A physical location within a LATA established by an IXC for the purpose of obtaining LATA access and LEC-provided access services. A POP applies to both switched and dedicated access, although different POPs may be used for different services.

Point-To-Point. Describing a circuit that interconnects two points directly, where there are generally no intermediate processing nodes, computers, or branched circuits, although there could be switching facilities.

POLL. Indicates that periodic polling signals are used on the connection.

Polling. A means of determining if devices on a multi-point line are alive and responding.

POTS. Plain old telephone service.

Power Level. The ratio of the power at a given point to an arbitrary amount of power chosen as a reference. Usually expressed in decibels based on 1 milliwatt (dBm) or 1 watt (dBw).

PPP. Point-to-Point Protocol.

PPSN. Public Packet Switched Network.

PPSNGR. Public PSN Generic Requirement.

PRA. Primary Rate Access.

Preventive Maintenance. Maintenance, such as periodic inspection, cleaning, and adjustment intended to prevent system malfunction.

PRI. Primary Rate Service.

Protocol. A formal set of conventions governing the formatting and timing of message exchange between two communicating systems.

PSN. Packet Switched Network.

PSS. Packet Switched Service.

PSTN. Public Switched Telephone Network.

PVC. Permanent Virtual Circuit.

QoS. Quality of Service.

RAM (Random Access Memory). Semiconductor read-write volatile memory. Data stored is lost if power is removed.

RCE. Radio Control Equipment.

RFC. Requests for Comments.

Ringdown. Signaling used in manual systems where picking up one phone automatically rings another or signals an operator.

RL. Remote Loop.

RLSD. Received Line Signal Detector.

RMA. Reliability, Maintainability, and Availability.

RS-232. Interface between data terminal equipment and data communications equipment employing serial binary data interchange.

RT. Receive Timing.

RTP. Real Time Protocol.

RTS. Request to Send.

RX. Receive.

SA. Service Acceptance tests.

SDP. Service Delivery Point.

SDS. Switched Data Services.

Serial Transmission. The sequential transmission of the bits constituting an entity of data over a data circuit.

Severely Errored Seconds (SES). For the digital service using the ESF format, any second in which 150 or more ESF error events and/or an Out-Of-Frame state occurs shall be deemed a Severely Errored Second. For DS-3 service, any second in which 4000 or more CRC-9 error events and/or an Out-Of-Frame state occurs shall be deemed a Severely Errored Second. For DDS service, a severely errored second is any second in which the Bit Error Rate is worse than 1x10-3.

SF. Single Frequency.

SI. Slaved Independent.

SIA. Site Acceptance Tests.

Signal-to-Noise Ratio (SNR). The ratio of the signal power to noise at a given point in a given system (usually expressed in decibels).

SIR. Screening Information Request.

Site Level Verification. This level of verification is performed at the designated site and verifies overall system requirements.

SL. Slave Lock.

SLIP. Serial Line Interface Protocol.

Slope. The loss at 404 and 2804 Hz relative to that at 1004 Hz. Also Three-Tone Slope or Gain Slope.

SMO. System Management Office.

SMTP. Simple Mail Transfer Protocol.

SNACP. SNA Control Protocol.

SNMP. Simple Network Management Protocol.

SOC. Service Operations Center.

Span Line. Same as channel.

SQL. Structured Query Language.

SS. Selective Signaling.

ST. Send Timing.

Stability. The property of maintaining a constant value during a specified time interval. Variations from the initial value may be called drift if the change is relatively slow, and jitter or noise if the change is relatively fast.

Start Bit. In asynchronous transmission, the first bit or element in each character, normally a space, which prepares the receiving equipment for the reception and registration of the character.

Status Reporting. The process by which the routing of status information concerning leased system failures and repairs are broadcast to all devices that may need the information for message routing and system monitoring and control.

Stop Bit. In asynchronous transmissions, the last transmitted element in each character, which informs the receiver to come to an idle condition before accepting another character.

Subsystem. A grouping of one or more equipment items that is a relatively independent, identifiable entity.

Subsystem-Level Verification. Level of verification usually accomplished at the contractor's facility that will verify subsystem requirements under ambient conditions.

SVC. Service Code.

SVC. Switched Virtual Circuit.

SVC/PDC. Service/Program Designator Codes.

Synchronization Loss. Test-set condition which indicates loss of synchronization to incoming pattern due to circuit failure or excess bit errors over a specific bit interval.

Synchronous Optical Network (SONET). Bellcore-proposed protocol for fiber networks handling DS-3 transmission with some overhead; likely to become an official ANSI standard (T1X1); will be used by the RBOCs with large fiber trunks.

Synchronous Transmission. Transmission in which data bits are sent at a fixed rate, with the transmitter and receiver synchronized. Synchronized transmission eliminates the need fir start and stop bits.

System Level Verification. This level of verification is usually accomplished at the contractor's facility and will verify that the network configuration and design will meet the system requirements under controlled electrical, mechanical, and environmental conditions.

System. An operational grouping of the Subsystems that compose the Leased System. This grouping may include the use of emulators and test fixtures to simulate the operational configuration of the Leased System equipment.

T Carrier. A time division multiplexed (typically telephone company supplied) digital transmission facility, usually oper-ating at an aggregate data rate of 1.544 Mb/s and above.

T1. AT&T term for a digital carrier facility used to transmit a DS-1 formatted digital signal at 1.544 mb/s.

T-1B. T-1 Bulk.

T-1C. T-1 Channelized.

T3. A T-carrier with an aggregate rate of 44.736 mb/s.

Tariff. The formal process whereby services and rates are established by and for communications common carrier; submitted by carriers for government regulatory approval, reviewed, often amended, and then (usually) approved; the published rate for a specific communications service, equipment or facility that constitutes a contract between the user and the communications supplier or carrier.

TBD. To Be Determined.

TCP. Transmission Control Protocol.

TDM. Time Division Multiplexing.

TEE. Toggle End-to-End.

TELCO. Telephone central office, in most usages, but also a generic abbreviation for telephone company.

TEST. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, and/or services.

TIMS. Transmission Impairment Measurement System.

TM. Test Mode.

Transient. An abrupt change in voltage, of short duration.

Transmission Level Point (TLP). A point in a transmission system at which the ratio, usually expressed in decibels, of the power of a test signal at that point to the power of the test signal at a reference point, is specified. For example, a zero transmission level point (0 TLP) is an arbitrarily established point on a communication line to which all relative levels at other points in the line are referred.

Trunk. A dedicated aggregate telephone line connecting two switch-ing centers, cen-tral office, or data concentration devices.

TSP. Telecommunications Service Priority.

TSS. Technical Support Staff.

Turn Up. Operational verification of a transmission line after cutover.

Two-Wire to Four-Wire Conversion. An arrangement that converts a four-wire transmission path to a two-wire transmission path to allow a four-wire facility to connect to a two-wire entity such as a trunk line or switching system.

TX. Transmit.

UBC. Uniform Building Code.

UDP. User Datagram Protocol.

UPS. Uninterruptable Power System.

UTA. Universal Transmission Analyze.

VAC. Volts Alternating Current.

VAPC (Voice Adaptive Predictive Coding). VAPC uses a block coding process that combines VQ with linear prediction in an adaptive structure. The vector quantizer uses an optimized codebook to code the difference between an input vector and a predicted vector.

VG-Compressed (Voice Grade Compressed). Techniques that allow voice grade analog signals to be carried on a 16kb/s, 9.6kb/s, or 8kb/s digital channel. They may employ LDCELP, VAPC, or VQ compression methods.

Voice Frequency (vf). Describing an analog signal within the range of transmitted speech, typically from 300 to 3400 Hz; any transmission supported by an analog telecommunications line.

Voice Grade (VG). A term used to describe the per-formance characteristics of a channel, line, facility, or service that is suitable for the transmission of speech, digital or analog data, or facsimile, generally with a frequency range of about 300 to 3000 Hz.

Voice-Bandwidth Line. A line with frequency response characteristics to effectively transmit voice-frequency signals. (A frequency range of about 300 to 3000 Hz).

VOX. Voice Activated Switch.

VPN. Virtual Private Network.

VQ (Vector Quantization). VQ uses an optimized code-book of speech samples. It removes the pitch from the incoming voice sample, matches the resultant waveform to the codebook, and sends the codebook index to the decompression resource. The decompression resource uses this information to reconstruct an approximation of the original voice sample.

VQ. Voice Quality.

WAN. Wide Area Network

WC. Work Center.

Zero Transmission Level Point (0,0 TLP). Indicates that there are two reference points on a line between which there will be no overall change in signal power. Establishes unity gain (no loss or gain) between these points of reference.

Federal Aviation Administration

Memorandum

Date:

To: Manager, Oklahoma Communication Engineering Team

From:

Subject: INFORMATION: Suggested improvements to Order JO 6000.200, Maintenance of FAA Telecommunications Infrastructure (FTI) Services

Problems with present handbook:

Recommended improvements:

RECORD OF CHANGES

DIRECTIVE NO. JO 6000.200

CHANGE TO BASIC	SUPPLEMENT			OPTIONAL	CHANGE TO BASIC	SUPPLEMENT			OPTIONAL

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Air Traffic Organization Policy

ORDER
JO 6000.200
CHANGE 1

Effective Date:
11/24/2008

SUBJ: Maintenance of FAA Telecommunications Infrastructure (FTI) Services

1. Purpose. This change transmits revised pages to Order JO 6000.200, Maintenance of FAA Telecommunications Infrastructure (FTI) Services.

2. Who This Change Affects. This document requires actions by the Airway Transportation System Specialist (ATSS) at operational facilities with Facility, Service, and Equipment Profile (FSEP) equipment: DIST and DISTG.

a. The ATSS and all administrative personnel must subscribe to the Auto-Notifications Services for electronic library release notifications at http://technet.faa.gov/. Administrative offices can print these documents for local use as required.

b. For electronic copies, use the Technical Library website at http://nas.amc.faa.gov.

c. The ATSS must keep accurate FSEP records and Logistics Inventory System (LIS) addresses to receive printed copies. Printed copies are mailed to the ATSS at operational facilities with an accurate FSEP record using the LIS mailing address per Orders 6000.5D, Facility, Service, and Equipment Profile (FSEP) and Order 1720.30C, Distribution of Airway Facilities Technical Directives.

d. To update LIS, contact the LIS point of contact for your service area. To update FSEP information, visit this link: https://intranet.faa.gov/faaemployees/org/linebusiness/ato/operations/technical_operations/ajw162/fsep/contacts/.

3. Explanation of Changes. This change revises the initial tolerance/limit for attenuation distortion of all FTI Voice Grade (VG) services. This change updates this Order to reflect modifications to FAA Telecommunications Services Description (FTSD) and adds Technical Performance Records (TPR) for all FTI services.

4. Disposition of Transmittal. Keep this change.

PAGE CONTROL CHART

Remove Pages	Dated	Insert Pages	Dated
i thru v (and vi)	08/07/2006	i thru v (and vi)	11/24/2008

Distribution: PA00, PB00 **Initiated By:** AJW-178

PAGE CONTROL CHART (CONTINUED)

Remove Pages	Dated	Insert Pages	Dated
2-1 thru 2-4	08/07/2006	2-1	11/24/2008
		2-2	08/07/2006
		2-3 thru 2-3B	11/24/2008
		2-4	08/07/2006
2-9 and 2-10	08/07/2006	2-9	08/07/2006
		2-10	11/24/2008
2-11 and 2-12	08/07/2006	2-11	11/24/2008
		2-12	08/07/2006
2-15 thru 2-18	08/07/2006	2-15	11/24/2008
		2-16	08/07/2006
		2-17 and 2-18	11/24/2008
3-1 thru 3-7 (and 3-8)	08/07/2006	3-1 and 3-2	11/24/2008
		3-3	11/24/2008
		3-4	08/07/2006
		3-5	08/07/2006
		3-6	11/24/2008
		3-7 (and 3-8)	11/24/2008
4-1 and 4-2	08/07/2006	4-1 and 4-2	11/24/2008
5-1 thru 5-10	08/07/2006	5-1 thru 5-4	11/24/2008
		5-5	08/07/2006
		5-6	11/24/2008
		5-7	08/07/2006
		5-8	11/24/2008
		5-9	08/07/2006
		5-10	11/24/2008
		5-11 thru 5-13 (and 5-14)	11/24/2008



for Vaughn A. Turner
Director, Safety and Operations Support