

Emergency Medical Service: LifeLink Model Deployment Initiative Acceptance Test Plan

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Acronym List

ATMS	Advanced Traffic Management System
codec	Coder/Decoder
kbps	Kilo bits per second
L1TC	Level 1 trauma care
LAN	Local Area Network
MDI	Model Deployment Initiative
PC	Personal Computer
SNMP	Simple Network Management Protocol
SwRI	Southwest Research Institute
TOC	TransGuide Operations Center
TxDOT	Texas Department of Transportation
VC	Videoconferencing
WDM	Wave Division Multiplexer
WEB	Wireless Ethernet bridge

1. Scope

This document describes the tests to be performed and the results that are required in order to verify that the *Emergency Medical Service: LifeLink System* is constructed and operates in accordance with the requirements specified in the LifeLink System Design Document (SDD).

1.1 Identification

The tests described in the following sections refer to the LifeLink subsystem of the Model Deployment Initiative (MDI) program in San Antonio, Texas. Tests are generally divided into five sections:

- The ambulance configuration
- The hospital configuration
- The roadside fiber hub configuration
- The TransGuide Operations Center (TOC) configuration
- System functionality

1.2 System Overview

The basic purpose of the LifeLink System is to provide two-way video and audio conferencing and one-way vital statistics data telemetry capabilities between ambulances responding to major accidents and physicians at Level 1 Trauma Care (L1TC) facilities such that early assessment and treatment may be initiated in the field.

The LifeLink System provides a distributed mobile Ethernet Local Area Network (LAN) designed to link San Antonio Fire Department (SAFD) ambulances on or near San Antonio's freeway system with a L1TC provider in the city. The link utilizes the facilities and roadside fiber-optic network of the TransGuide Advanced Traffic Management System (ATMS). The system provides real-time videoconferencing between an ambulance and emergency medical personnel at the L1TC facility. Additionally, the ambulance crew can use optional portable medical data instruments to also send vital statistics data to terminal equipment in the L1TC facility over the LifeLink communications system.

1.3 Goals and Objectives

The LifeLink System offers the opportunity for early intervention by L1TC facility personnel and provides L1TC facilities with additional information about the condition of incoming patients prior to arrival.

The goal of this ATP is to demonstrate the capability of the LifeLink System in its operational environment and to validate that it meets the requirements specified in the design document. The test cases contained in this ATP have been directly derived from the requirements contained in the *LifeLink Model Deployment System Design Document*. This “black box” testing strategy is designed to discover faults of omission by identifying which requirements have and have not been fulfilled.

1.4 Referenced Documents

- Southwest Research Institute, *Proposal for the Model Deployment Initiative System Integration*, SwRI Proposal No. 10-20342, November 1996.
- Texas Department of Transportation, *Request for Offer (RFO) for the Model Deployment Initiative System Integration*, 60115-7-70030, Specification No. TxDOT 795-SAT-01, October 1996.
- Southwest Research Institute, *LifeLink System Design Document*, December 1997.

2. Acceptance Test Methods and Procedures

This section describes the test methods and procedures for executing the LifeLink ATP. The test cases to be completed during execution of this ATP have been designed to demonstrate that the LifeLink System meets the specified requirements. Each of these requirements is further documented in Section 3 in the traceability matrix. For each requirement, the matrix contains traceability information to show the relationship between the requirement and other requirements, design elements, and the ATP.

2.1 Test Identification

The following sections describe specific tests that shall be carried out to demonstrate that the system meets required specifications. The preparation required for each test, the specific requirements to be verified, the test conditions, and the expected results are described.

The specific requirements to be verified are derived from, and cross-referenced to, specific requirements listed in the *LifeLink System Design Document*, December 1997. The tests will be identified with a project unique identifier. This identifier will have the following format:

<System Mnemonic>-<Subsystem Mnemonic>-<Test Number>

System Mnemonic

The system mnemonic uniquely identifies the LifeLink System to distinguish its acceptance tests from the tests of the other MDI systems. The system mnemonic for the LifeLink System is *LL*.

Subsystem Mnemonic

The mnemonic for each set of LifeLink subsystem tests is:

SYST	General and System Requirements
AMBT	Ambulance Subsystem Requirements
FBHT	Roadside Fiber Hub Subsystem Requirements
TOCT	TransGuide Operations Center Subsystem Requirements
HOST	Hospital Subsystem Requirements

Test Number

The tests are numbered sequentially within a given subsystem.

The requirements are discussed in five major sections as follows:

- Section 2.4 – All requirements related to the ambulance subsystem.
- Section 2.5 – All requirements related to the hospital subsystem.
- Section 2.6 – All requirements related to the roadside fiber hub subsystem.
- Section 2.7 – All requirements related to the TransGuide Operations Center subsystem.
- Section 2.8 – All general and system requirements.

2.2 Test Case Design

Test cases will be implemented using one or more of the following qualification methods:

- Inspection. The visual examination of computer code documentation, hardware, etc.
- Demonstration. The operation of the system, or a part of the system, that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis.
- Test. The operation of the system, or a part of the system, using instrumentation or other special test equipment to collect data for later analysis.
- Analysis. The process of accumulating data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results.

2.3 Problem Reporting

Problems detected during execution of the ATP will be classified by category as follows:

- Software problem. The software does not operate according to the specified requirements and the requirements are correct.
- Hardware problem. The hardware does not operate according to the specified requirements and the requirements are correct.
- Documentation problem. The software/hardware does not operate according to the specified requirements but the software/hardware operation is correct.
- Design problem. The software/hardware operates according to the specified requirements but a design deficiency exists. The design deficiency may not always result in a direct observable operational problem but possesses the potential for creating further problems.

Problems detected during execution of the ATP will be classified by priority as follows:

- Priority 1: A problem that prevents the accomplishment of an operational or essential capability.
- Priority 2: A problem that results in user/operator inconvenience or annoyance but does not affect required operational or essential capability.
- Priority 3: Any other effect.

Retesting will consist of repeating a subset of the test cases after changes have been made to correct problems found in previous testing. Retesting will be considered complete if: (a) test cases that revealed problems in the previous testing have been repeated and the results have met acceptance criteria, and (b) test cases that revealed no problems during the previous testing but test functions that are affected by the corrections have been repeated and the results have met acceptance criteria.

2.4 LL-AMBT

This test verifies ambulance subsystem requirements for the MDI LifeLink System.

2.4.1 Hardware Preparation

Hardware installed in operating configuration.

2.4.2 Software Preparation

Software installed in operating configuration.

2.4.3 Other Pre-Test Preparation

None.

2.4.4 Test Description

The following test cases are implemented under this test:

- LL-AMBT-1 Verifies the equipment specifications of the ambulance subsystem.
- LL-AMBT-2 Verifies the user-interface requirements of the ambulance subsystem.
- LL-AMBT-3 Verifies the location/mounting requirements of the ambulance subsystem.
- LL-AMBT-4 Verifies the power-moding requirements of the ambulance subsystem.

2.4.4.1 LL-AMBT-1

This test verifies the equipment specifications of the ambulance subsystem.

2.4.4.1.1 Requirements Addressed

- LL-AMB-001 The ambulance mobile communication link shall utilize a spread spectrum Ethernet bridge radio.
- LL-AMB-002 The ambulance subsystem shall include an industrial computer.
- LL-AMB-003 The ambulance computer shall be able to provide necessary connections and ports for the videoconferencing system.
- LL-AMB-004 The ambulance computer shall be able to provide a connection for the spread spectrum Ethernet bridge radio.
- LL-AMB-005 The ambulance computer shall be able to provide necessary connections and ports for connection to optional vital statistics equipment.
- LL-AMB-006 The ambulance subsystem shall provide a videoconferencing camera and lens capable of providing a video resolution matching or exceeding the capabilities of the videoconferencing codec.
- LL-AMB-008 The ambulance subsystem shall include a headset containing a microphone and speaker which enable voice communications as part of the videoconferencing session.

2.4.4.1.2 Prerequisite Conditions

Hardware and software preparation is complete.

2.4.4.1.3 Test Inputs

Documentation.

2.4.4.1.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.4.4.1.5 Test Procedure

Using applicable documentation verify:

- 1) the WEB RADIO is a spread spectrum Ethernet bridge radio;
- 2) the computer is an industrial computer with the following components:
 - a) 2 PCI ports available for a graphics adapter and codec,
 - b) a 10 Mb Ethernet adapter with an RJ-45 connector,
 - c) a DB-9 serial port available for vital data connection;
- 3) the camera resolution is at least CIF (at least 240 horizontal scan lines);
- 4) the headset has both speakers and a microphone.

2.4.4.1.6 Assumptions and Constraints

None.

2.4.4.1.7 Test Results

Yes	No	
<input type="checkbox"/>	<input type="checkbox"/>	Does the WEB RADIO meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the computer meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the camera meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the headset meet the required specifications?

PASS **FAIL** **SwRI:**_____ **Date:**_____

TxDOT:_____ **Date:**_____

2.4.4.2 LL-AMBT-2

This test verifies the user-interface requirements of the ambulance subsystem.

2.4.4.2.1 Requirements Addressed

LL-AMB-009 User interface to the LifeLink ambulance computer shall limit (to a practical extent) the actions required to originate or terminate a videoconferencing session.

2.4.4.2.2 Prerequisite Conditions

Hardware and software preparation complete.

The ambulance subsystem has ignition power.

The TOC SNMP computer may be used in place of the L1TC facility node since they have functionally the same configuration relative to this test.

2.4.4.2.3 Test Inputs

None.

2.4.4.2.4 Test Results Evaluation

The LifeLink ambulance system is expected to require minimal interaction with the user.

2.4.4.2.5 Test Procedure

1. Power up the ambulance subsystem by pressing one (1) button marked "Power".
2. Initiate the conference by pressing one (1) button marked "Initiate/Terminate".
3. Select a L1TC facility node by entering the two (2) digit code on the keypad or selecting the default node (no buttons pressed).
4. Confirm the selection by pressing one (1) button marked "Enter".
5. Verify the connection successfully completed.
6. Terminate the conference by pressing one (1) button marked "Initiate/Terminate".

2.4.4.2.6 Assumptions and Constraints

The ambulance is in range of a parent WEB RADIO that in turn is connected to a L1TC facility node.

2.4.4.2.7 Test Results

Yes No

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Does the system power up with only one (1) button press? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the conference initiate within two (2) to four (4) button presses? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the conference terminate with only one (1) button press? |

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.4.4.3 LL-AMBT-3

This test verifies the location/mounting requirements of the ambulance subsystem.

2.4.4.3.1 Requirements Addressed

LL-AMB-007 The ambulance subsystem shall provide a videoconferencing camera and lens capable of providing a default field of view directed at the patient under transport.

2.4.4.3.2 Prerequisite Conditions

Hardware and software preparation complete.
LifeLink ambulance subsystem running in operational mode.

2.4.4.3.3 Test Inputs

None.

2.4.4.3.4 Test Results Evaluation

The LifeLink ambulance system is expected to transmit the view directed at the patient under transport.

2.4.4.3.5 Test Procedure

Verify the default local image view contains the view directed at the patient under transport.

2.4.4.3.6 Assumptions and Constraints

The ambulance has ignition power.
The ambulance subsystem has completed conferencing initialization.
The patient under transport is lying on the gurney.

2.4.4.3.7 Test Results

Yes No
 Does the local image provide a default field of view directed at the patient under transport?

PASS FAIL SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.4.4.4 LL-AMBT-4

This test verifies the power-moding requirements of the ambulance subsystem.

2.4.4.4.1 Requirements Addressed

- LL-AMB-010 The ambulance subsystem shall include a power system interface capable of operation during ignition power.
- LL-AMB-011 The ambulance subsystem shall include a power system interface capable of providing momentary power when ignition power is lost.
- LL-AMB-012 The ambulance subsystem shall include a power system interface with an emergency kill switch.
- LL-AMB-013 The ambulance subsystem shall include a power system interface capable of alerting the computer of a loss of ambulance power.

2.4.4.4.2 Prerequisite Conditions

Hardware and software preparation complete.
Ambulance subsystem is not active.

2.4.4.4.3 Test Inputs

None.

2.4.4.4.4 Test Results Evaluation

The LifeLink ambulance system is expected to allow for operation when consistent ignition power is present, perform graceful shutdowns upon the loss of consistent ignition power, and offer an emergency shutdown mechanism.

2.4.4.4.5 Test Procedure

1. Verify the ambulance subsystem can be activated when consistent ignition power is present as follows:
 - Start the ambulance.
 - Press the button labeled “Power On”.
 - Verify the system activates and conferencing initialization completes.
 - Press the button labeled “Power Off”.
 - Verify the system deactivates after approximately three (3) minutes.
2. Verify the ambulance subsystem can perform graceful shutdowns upon the loss of consistent ignition power as follows:
 - Start the ambulance and LifeLink ambulance subsystem.
 - Turn the ambulance off.
 - Verify the system power remains active.

- Verify the computer is aware of the power loss by observing the shutdown procedure initiating within 3 minutes.
- Verify the computer shutdown procedure completes prior to power deactivation.

3. Verify the ambulance subsystem offers an emergency shutdown mechanism as follows:

- Start the ambulance and LifeLink ambulance subsystem.
- Wait for the completion of the conferencing initialization.
- Activate the emergency kill switch.
- Verify that the system has been deactivated.

2.4.4.4.6 Assumptions and Constraints

Constant ignition power is not guaranteed.
 Graceful system shutdowns decrease maintenance requirements.
 Safety issues may require an emergency shutdown.

2.4.4.4.7 Test Results

Yes	No	
<input type="checkbox"/>	<input type="checkbox"/>	Does the system activate when ignition power is present?
<input type="checkbox"/>	<input type="checkbox"/>	Does the system gracefully shut down?
<input type="checkbox"/>	<input type="checkbox"/>	Does the system shut down when the emergency kill switch is activated?

PASS **FAIL** **SwRI:** _____ **Date:** _____
TxDOT: _____ **Date:** _____

2.5 LL-HOST

This test verifies hospital subsystem requirements for the MDI LifeLink System.

2.5.1 Hardware Preparation

Hardware installed in operating configuration.

2.5.2 Software Preparation

Software installed in operating configuration.

2.5.3 Other Pre-Test Preparation

None.

2.5.4 Test Description

The following test cases are implemented under this test:

- LL-HOST-1 Verifies the equipment specifications of the hospital subsystem.
- LL-HOST-2 Verifies the user-interface requirements of the hospital subsystem.
- LL-HOST-3 Verifies the location/mounting requirements of the hospital subsystem.

2.5.4.1 LL-HOST-1

This test verifies the equipment specifications of the hospital subsystem.

2.5.4.1.1 Requirements Addressed

- LL-HOS-001 The L1TC facility subsystem shall include one PC.
- LL-HOS-002 The L1TC facility PC shall provide necessary connections and ports for connection to fixed location vital statistics monitoring equipment.
- LL-HOS-003 The L1TC facility PC shall support 10BaseT Ethernet connectivity.

2.5.4.1.2 Prerequisite Conditions

Hardware and software preparation complete.

2.5.4.1.3 Test Inputs

Documentation.

2.5.4.1.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.5.4.1.5 Test Procedure

Using applicable documentation verify:

- 1) the computer is a PC with the following components:
 - a) a PCI port available for a codec,
 - b) a 10 Mb Ethernet adapter with an RJ-45 connector,
 - c) a DB-9 serial port available for vital data connection;
- 2) the camera resolution is at least CIF (at least 240 horizontal scan lines);
- 3) the headset has both speakers and a microphone.

2.5.4.1.6 Assumptions and Constraints

None.

2.5.4.1.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Does the computer meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the camera meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the headset meet the required specifications?

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.5.4.2 LL-HOST-2

This test verifies the user-interface requirements of the hospital subsystem.

2.5.4.2.1 Requirements Addressed

- LL-HOS-005 User interface to the LifeLink L1TC facility computer shall limit (to a practical extent) the actions required to answer, transfer, or terminate a videoconferencing session.
- LL-GEN-003 A full-duplex videoconferencing session with an ambulance may be transferred to another L1TC facility.

2.5.4.2.2 Prerequisite Conditions

Hardware and software preparation complete.
LifeLink hospital subsystem running in operational mode.
The hospital subsystem has completed conferencing initialization.
A conference has been initiated by an ambulance node.

2.5.4.2.3 Test Inputs

None.

2.5.4.2.4 Test Results Evaluation

The LifeLink hospital system is expected to require minimal interaction with the user.
The control of the conference is expected to be transferable to another node.

2.5.4.2.5 Test Procedure

1. Acknowledge the incoming conference by pressing one (1) key marked "Enter".
2. Initiate a consulting node by pressing one (1) key marked "F6".
3. Select a L1TC facility node by entering the two (2) digit code on the keyboard or selecting the default node (no buttons pressed).
4. Confirm the selection by pressing one (1) button marked "Enter".
5. Verify the connection successfully completed.
6. Initiate a transfer by pressing one (1) key marked "F5".
7. Select a L1TC facility node by entering the two (2) digit code on the keyboard or selecting the default node (no buttons pressed).
8. Confirm the selection by pressing one (1) button marked "Enter".
9. Verify the transfer is successfully completed and the original node has terminated its connection.
10. Terminate the conference by pressing one (1) button marked "Initiate/Terminate".

2.5.4.2.6 Assumptions and Constraints

The hospital computer is always on with a guaranteed power source.

2.5.4.2.7 Test Results

Yes No

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Does the acknowledgement of an incoming conference require only one (1) key press? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the consulting mode activate within two (2) to four (4) key entries? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the transfer function activate within two (2) to four (4) key entries? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the conference terminate with only one (1) key press? |

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.5.4.3 LL-HOST-3

This test verifies the location requirements of the hospital subsystem.

2.5.4.3.1 Requirements Addressed

LL-HOS-004 The L1TC facility PC shall provide unobstructed access to other L1TC facility equipment or walkways.

2.5.4.3.2 Prerequisite Conditions

Hardware and software preparation complete.

2.5.4.3.3 Test Inputs

None.

2.5.4.3.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.5.4.3.5 Test Procedure

Inspect the location of the LifeLink hospital subsystem to ensure unobstructed access to other L1TC facility equipment or walkways.

2.5.4.3.6 Assumptions and Constraints

None.

2.5.4.3.7 Test Results

Yes No
 Does the LifeLink hospital subsystem location meet the required specification?

PASS **FAIL** **SwRI:** _____ **Date:** _____
TxDOT: _____ **Date:** _____

2.6 LL-FBHT

This test verifies roadside fiber hub subsystem requirements for the MDI LifeLink System.

2.6.1 Hardware Preparation

Hardware installed in operating configuration.

2.6.2 Software Preparation

Software installed in operating configuration.

2.6.3 Other Pre-Test Preparation

None.

2.6.4 Test Description

The following test cases are implemented under this test:

- LL-FBHT-1 Verifies the radio specifications of the roadside fiber hub subsystem.
- LL-FBHT-2 Verifies the installation requirements of the roadside fiber hub system.
- LL-FBHT-3 Verifies the functional requirements of the roadside fiber hub system.

2.6.4.1 LL-FBHT-1

This test verifies the equipment specifications of the roadside fiber hub subsystem.

2.6.4.1.1 Requirements Addressed

- LL-FBH-001 The roadside fiber hub terminal subsystem shall include a spread spectrum Ethernet bridge radio located on each camera pole in an environmental box.
- LL-SYS-005 The system shall use a wireless, spread spectrum communications channel for communication between ambulances and roadside fiber hub terminals.
- LL-GEN-004 The system shall use optical fibers in the TransGuide infrastructure as the backbone of the communications system.

2.6.4.1.2 Prerequisite Conditions

Hardware and software preparation complete.

2.6.4.1.3 Test Inputs

Documentation.

2.6.4.1.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.6.4.1.5 Test Procedure

Select a fiber hub at random to be representative of all fiber hubs and perform the following:

- 1) Review mechanical design drawings of the environmental box to verify that the enclosure will house a WEB radio.
- 2) Using applicable documentation, verify:
 - a) the WEB radios utilize spread spectrum technology;
 - b) the WEB radios utilize the Ethernet protocol.
- 3) Verify that the LifeLink System is connected to optical fibers in the TransGuide infrastructure.

2.6.4.1.6 Assumptions and Constraints

Boxes have been assembled to the mechanical design drawing specifications. One LifeLink fiber hub is representative of all LifeLink fiber hubs. (Note: LL-FHBT-3 & LL-TOCT-2 verify functionality of each LifeLink fiber hub individually).

2.6.4.1.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Do the roadside fiber hub subsystem environmental boxes meet the required specification?
<input type="checkbox"/>	<input type="checkbox"/>	Do the roadside fiber hub subsystem WEB radios meet the required specification?
<input type="checkbox"/>	<input type="checkbox"/>	Does the roadside fiber hub subsystem utilize optical fibers in the TransGuide infrastructure?

PASS **FAIL** **SwRI:** _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.6.4.2 LL-FBHT-2

This test verifies the installation requirements of the roadside fiber hub subsystem.

2.6.4.2.1 Requirements Addressed

- LL-FBH-002 The roadside fiber hub terminal subsystem shall provide network continuity between each TransGuide fiber hub and the TOC with WDM devices on the protect fiber pairs.
- LL-FBH-003 The roadside fiber hub terminal subsystem shall use existing TransGuide camera poles and roadside fiber hub terminals.

2.6.4.2.2 Prerequisite Conditions

Hardware and software preparation is complete.

2.6.4.2.3 Test Inputs

None.

2.6.4.2.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.6.4.2.5 Test Procedure

One roadside fiber hub subsystem will be selected at random for inspection to verify:

- 1) installation of WDM devices in an existing roadside fiber hub;
- 2) installation of WDM devices on the protect fibers;
- 3) installation of radio enclosure on an existing TransGuide camera pole.

2.6.4.2.6 Assumptions and Constraints

One LifeLink fiber hub is representative of all LifeLink fiber hubs. (Note: LL-FHBT-3 & LL-TOCT-2 verify functionality of each LifeLink fiber hub individually).

2.6.4.2.7 Test Results

Yes No

Does the roadside fiber hub subsystem use WDM devices?

Does the roadside fiber hub subsystem use existing TransGuide facilities?

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.6.4.3 LL-FBHT-3

This test verifies the functional requirements of the roadside fiber hub subsystem.

2.6.4.3.1 Requirements Addressed

LL-FBH-004 Each roadside fiber hub subsystem shall provide a communications link capable of supporting data transmission between an ambulance radio registered to the roadside fiber hub radio and the TOC.

2.6.4.3.2 Prerequisite Conditions

Hardware and software preparation is complete.

The TOC SNMP computer is configured and ready to receive a videoconference from an ambulance.

The ambulance subsystem is active and ready to initiate a conference.

2.6.4.3.3 Test Inputs

None.

2.6.4.3.4 Test Results Evaluation

Each roadside fiber hub subsystem should serve as an access point into the TOC subsystem communications backbone.

2.6.4.3.5 Test Procedure

Verify the functionality of each roadside fiber hub subsystem by the following:

- 1) Initiate a conference from the ambulance to the TOC SNMP computer.
- 2) Drive the ambulance along the portions of the San Antonio Highway System where LifeLink System radios are installed.
- 3) At the TOC, verify the functionality of each roadside fiber hub subsystem by observing the activity indicator corresponding to each fiber hub turn on for approximately five (5) seconds while the videoconference is in progress.

2.6.4.3.6 Assumptions and Constraints

Since the nature of the system does not ensure the ambulance will communicate with every single roadside fiber hub subsystem, repeated laps or specific positioning of the ambulance may be necessary to verify some of the fiber hub subsystems.

2.6.4.3.7 Test Results

FH001A <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH001B <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH002 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH003 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH004 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH005 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH006 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH008 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH009 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH010 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH0011 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0012 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH013 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH014 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH015 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH016 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0017 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH018 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH019 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH020 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH021 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH022 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH024 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH025 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH026 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH027 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH028 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH029 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH030 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH031 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH032 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH033 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH034 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH035 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH036 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH037 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH038 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH039 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH040 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH041 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH042 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0043 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH045 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH046 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH047 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH048 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH049 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH050 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH051 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	

Yes No

Do **ALL** the roadside fiber hub subsystems support data transfer between the TOC and a registered radio?

PASS

FAIL

SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.7 LL-TOCT

This test verifies TransGuide Operations Center subsystem requirements for the MDI LifeLink System.

2.7.1 Hardware Preparation

Hardware installed in operating configuration.

2.7.2 Software Preparation

Software installed in operating configuration.

2.7.3 Other Pre-Test Preparation

None.

2.7.4 Test Description

The following test cases are implemented under this test:

LL-TOCT-1 Verifies the computer specifications of the TransGuide Operations Center subsystem.

LL-TOCT-2 Verifies the communications specifications of the TransGuide Operations Center subsystem.

2.7.4.1 LL-TOCT-1

This test verifies the computer specifications of the TransGuide Operations Center subsystem.

2.7.4.1.1 Requirements Addressed

LL-TOC-001 The TOC subsystem shall include a computer matching the following specifications:
Provide capability to serve as the SNMP host.

LL-TOC-002 The TOC subsystem shall include a computer matching the following specifications:
Provide capability to serve as a videoconferencing node.

LL-SYS-007 The system shall provide for the use of standard Simple Network Management Protocol (SNMP) techniques for network management of all Ethernet configurable devices including spread spectrum radios from one central control node.

2.7.4.1.2 Prerequisite Conditions

Hardware and software preparation is complete.

2.7.4.1.3 Test Inputs

Documentation.

2.7.4.1.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.7.4.1.5 Test Procedure

Using applicable documentation and physical inspection verify:

- 1) the computer is a PC with the following components:
 - a) a PCI port available for a codec,
 - b) a 10 Mb Ethernet adapter with an RJ-45 connector,
 - c) a DB-9 serial port available for vital data connection;
- 2) the camera resolution is at least CIF (at least 240 horizontal scan lines);
- 3) the headset has both speakers and a microphone;
- 4) the computer meets the requirements defined in the SNMP manual.

2.7.4.1.6 Assumptions and Constraints

None.

2.7.4.1.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Does the computer meet the required conferencing specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the camera meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the headset meet the required specifications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the computer meet the required SNMP specifications?

PASS **FAIL** **SwRI:** _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.7.4.2 LL-TOCT-2

This test verifies the communications specifications of the TransGuide Operations Center subsystem.

2.7.4.2.1 Requirements Addressed

LL-TOC-003 The TOC subsystem shall provide a communications system capable of supporting the required Ethernet connectivity between the TOC and the respective LITC facilities.

2.7.4.2.2 Prerequisite Conditions

Hardware and software preparation is complete.

2.7.4.2.3 Test Inputs

Documentation.

2.7.4.2.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.7.4.2.5 Test Procedure

Using applicable documentation verify:

- 1) the fiber optic transceivers support 10 Mb Full-Duplex Ethernet;
- 2) the Ethernet switches support 10 Mb Full-Duplex Ethernet;
- 3) the Ethernet switches total 59 ports available for fiber hub connections;
- 4) the Ethernet switches have a port available for connection to University Hospital;
- 5) the Ethernet switches are interconnected.

Using the SNMP computer:

- 1) initiate a ping to each of the 59 radios;
- 2) verify a response from each radio;
- 3) initiate a ping to University Hospital;
- 4) verify a response from the hospital node.

2.7.4.2.6 Assumptions and Constraints

None.

2.7.4.2.7 Test Results

FH001A <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH001B <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH002 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH003 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH004 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH005 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH006 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH008 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH009 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH010 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH0011 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0012 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH013 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH014 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH015 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH016 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0017 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH018 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH019 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH020 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH021 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH022 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH024 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH025 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH026 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH027 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH028 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH029 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH030 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH031 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH032 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH033 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH034 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH035 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH036 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH037 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH038 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH039 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH040 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH041 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH042 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH0043 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH045 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH046 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH047 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>
FH048 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH049 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH050 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	FH051 <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>	Univ. Hospital <u>Pass Fail</u> <input type="checkbox"/> <input type="checkbox"/>

Yes No

Does the communications equipment meet the required specification?

Does connectivity exist between the SNMP node, hospital node, and radios?

PASS

FAIL

SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.8 LL-SYST

This test verifies system requirements for the MDI LifeLink program.

2.8.1 Hardware Preparation

Hardware installed in operating configuration.

2.8.2 Software Preparation

Software installed in operating configuration.

2.8.3 Other Pre-Test Preparation

None.

2.8.4 Test Description

The following test cases are implemented under this test:

- LL-SYST-1 Verifies the configuration of the system.
- LL-SYST-2 Verifies the operation of the system.
- LL-SYST-3 Verifies the vital data transfer of the system.
- LL-SYST-4 Verifies the mobile operation of the system.
- LL-SYST-5 Verifies the call-busy/call-waiting of the system.
- LL-SYST-6 Verifies the call-transfer/call-consult of the system.

2.8.4.1 LL-SYST-1

This test verifies the configuration of the system.

2.8.4.1.1 Requirements Addressed

- LL-SYS-001 Each end of the videoconference shall provide a full-screen view of the received video with a smaller view containing the local image that is being transmitted.
- LL-SYS-003 The computer at each end of the videoconference shall be configured to perform automatic operating system startup and application startup.
- LL-SYS-006 The system shall provide voice contact between the controlling physician and the ambulance LifeLink system operator via a single headset provided at each end of the videoconference.
- LL-SYS-008 The videoconference shall provide :
 - A minimum resolution of CIF (352x240 pixels),
 - Scalability to full screen,
 - Display of the transmitted image,
 - Operation within the radio bandwidth.

2.8.4.1.2 Prerequisite Conditions

Hardware and software preparation is complete.
Both systems are in the “off” state.

2.8.4.1.3 Test Inputs

Documentation.

2.8.4.1.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.8.4.1.5 Test Procedure

- 1) At the Ambulance:
 - a) Activate the system by pressing the button labeled “Power On”.
 - b) Verify the system startup progresses without user intervention until the system is ready to initiate a conference.
- 2) At the LITC facility:
 - a) Activate the system by pressing the computer power button.
 - b) Verify the system startup progresses without user intervention until the system is ready to receive a conference.
- 3) At the Ambulance
 - a) Initiate the conference.
 - b) Verify the remote image is scaled to full screen.
 - c) Verify the local image appears on the local-image monitor.
 - d) Verify the minimum resolution by toggling the size to CIF.
 - e) Verify bandwidth usage with radio bandwidth by inspecting the “Bite Rate” setting.
 - f) Verify the presence of a headset for audio connectivity.
- 4) At the LITC facility:
 - a) Acknowledge the conference.
 - b) Verify the remote image is scaled to full screen.
 - c) Verify the local image appears in a Picture-in-Picture display.
 - d) Verify the minimum resolution by toggling the size to CIF.
 - e) Verify bandwidth usage with radio bandwidth by inspecting the “Bite Rate” setting.
 - f) Verify the presence of a headset for audio connectivity.

2.8.4.1.6 Assumptions and Constraints

None.

2.8.4.1.7 Test Results

Yes No

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Do the computers automatically progress to a ready state upon startup? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the videoconference meet the required specifications? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the system display a full screen view of the received image? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the system display a smaller local view of the transmitted image? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the system contain headsets as specified? |

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.8.4.2 LL-SYST-2

This test verifies the operation of the system.

2.8.4.2.1 Requirements Addressed

LL-GEN-001 The system shall provide an Ethernet communications network, two way audio and videoconferencing, and one way vital data telemetry from an ambulance to a LITC facility node.

LL-SYS-002 Each end of the videoconference shall provide a status window indicating the identity of the remote node.

2.8.4.2.2 Prerequisite Conditions

Hardware and software preparation is complete.

2.8.4.2.3 Test Inputs

None.

2.8.4.2.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

(Note: One way vital data telemetry is tested in LL-SYST-3.)

2.8.4.2.5 Test Procedure

- 1) At the Ambulance:
 - a) Activate the system by pressing the button labeled “Power On”.
 - b) Verify the system startup progresses without user intervention until the system is ready to initiate a conference.
 - c) Initiate the conference.
 - d) Verify the remote node identity is displayed in the status bar.
 - e) Verify audio connectivity to the LITC facility.
 - f) Verify video connectivity to the LITC facility.
- 2) At the LITC facility:
 - a) Acknowledge the conference.
 - b) Verify the remote node identity is displayed in the status bar.
 - c) Verify audio connectivity to the Ambulance.
 - d) Verify video connectivity to the Ambulance.

2.8.4.2.6 Assumptions and Constraints

None.

2.8.4.2.7 Test Results

Yes	No	
<input type="checkbox"/>	<input type="checkbox"/>	Does the LifeLink System provide two way audio and video communications?
<input type="checkbox"/>	<input type="checkbox"/>	Does the system display status message indicating the remote node?

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.8.4.3 LL-SYST-3

This test verifies the vital data telemetry of the system.

2.8.4.3.1 Requirements Addressed

- LL-GEN-001 The system shall provide an Ethernet communications network, two way audio and videoconferencing, and one way vital data telemetry from an ambulance to a L1TC facility node.
- LL-GEN-005 The system shall support vital data telemetry at a RS-232 serial link with a rate of 38.4 kbps between the ambulance and L1TC facility involved in the conference simultaneously with a videoconferencing session.

2.8.4.3.2 Prerequisite Conditions

Hardware and software preparation complete.

The TOC SNMP computer may be used in place of the L1TC facility node, since they have functionally the same configuration relative to this test.

Vital data telemetry equipment is connected at both the ambulance and the L1TC facility node or TOC SNMP computer node. (Note: Vital data telemetry equipment is not provided by the LifeLink system.)

2.8.4.3.3 Test Inputs

None.

2.8.4.3.4 Test Results Evaluation

Test results will comply fully with referenced requirements.

2.8.4.3.5 Test Procedure

- 1) At the Ambulance:
 - a) Verify the LifeLink application is set to 38.4 kbps for vital data transfer.
 - b) Activate the system and initiate the conference.
- 2) At the L1TC facility:
 - a) Verify the LifeLink application is set to 38.4 kbps for vital data transfer.
 - b) Acknowledge the conference.
- 3) Verify vital data connectivity with the LifePak unit by the following:
 - a) Connect the LifePak vital data equipment to each end of the system.
 - b) Activate the LifePak vital data equipment at each end.
 - c) Simulate patient vitals on the LifePak in the ambulance.
 - d) Record a twenty (20) second segment of simulated vitals.
 - e) Transmit the segment from the Ambulance to the L1TC facility through the LifeLink System.
 - f) Verify that the L1TC facility LifePak equipment displays the received vital data.

- g) Verify that the conference was unaffected by the transfer.
- h) Disconnect the LifePak vital data equipment from each end of the system.
- 4) Verify vital data connectivity with the ProPak unit by the following:
 - a) Connect the ProPak vital data equipment to each end of the system.
 - b) Activate the ProPak vital data equipment at each end.
 - c) Simulate patient vitals on the ProPak in the ambulance.
 - d) Verify that the LITC facility ProPak equipment displays the received vital data.
 - e) Verify that the conference is unaffected by the transfer.

2.8.4.3.6 Assumptions and Constraints

None.

2.8.4.3.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Does the vital data transfer work with the LifePak unit?
<input type="checkbox"/>	<input type="checkbox"/>	Does the vital data transfer using the LifePak occur simultaneously with video and audio?
<input type="checkbox"/>	<input type="checkbox"/>	Does the vital data transfer work with the ProPak unit?
<input type="checkbox"/>	<input type="checkbox"/>	Does yhe vital data transfer using the ProPak occur simultaneously with video and audio?

PASS **FAIL** **SwRI:** _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.8.4.4 LL-SYST-4

This test verifies the operation of the system.

2.8.4.4.1 Requirements Addressed

- LL-SYS-004 In the event of a temporary loss of communications, the system shall present a "frozen" image of the last good video presented to viewers which will prevail until the transient blockage is removed.
- LL-SYS-009 If an ambulance initiates a conference while out of range of the radio communications network, the conference will automatically establish when the ambulance enters radio contact.
- LL-SYS-010 If an ambulance drives out of radio contact during a conference and re-enters radio contact within the timeout period, the conference will resume without ambulance system operator intervention.
- LL-SYS-011 If an ambulance drives out of radio contact during a conference and remains without radio contact for a time exceeding the timeout period, the conference will terminate without ambulance system operator intervention.

2.8.4.4.2 Prerequisite Conditions

Hardware and software preparation is complete.

The TOC SNMP computer may be used in place of the LITC facility node since they have functionally the same configuration relative to this test.

2.8.4.4.3 Test Inputs

None.

2.8.4.4.4 Test Results Evaluation

The system should gracefully handle ambulance movement into and out of radio coverage.

2.8.4.4.5 Test Procedure

- 1) Verify the ability of the system to tolerate movement in and out of system radio coverage by the following:
 - a) Position the ambulance outside of the radio coverage of the system.
 - b) Verify the Link indicator indicates no link.
 - c) Initiate a conference from the ambulance to the LITC facility.
 - d) Verify the system provides feedback that the ambulance is not in range.
 - e) Verify the system displays a message offering the option to cancel the connection request.
 - f) Drive into range of the system.
 - g) Verify the Link indicator indicates a link.
 - h) Verify the conference establishes without additional action in the ambulance.
 - i) Acknowledge the conference at the LITC facility node.

- j) Drive out of range of the system.
- k) Re-enter range of the system with 5 minutes.
- l) Verify the conference re-establishes without additional action in the ambulance.
- m) Drive out of range of the system.
- n) Wait for approximately 5 minutes.
- o) Verify the conference automatically terminates.

2.8.4.4.6 Assumptions and Constraints

None.

2.8.4.4.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Does the LifeLink System maintain a still image during temporary outages?
<input type="checkbox"/>	<input type="checkbox"/>	Does the LifeLink System complete a previously initiated conference upon entering radio range?
<input type="checkbox"/>	<input type="checkbox"/>	Does the LifeLink System resume a conference without ambulance system operator intervention if the link is reestablished within the timeout period?
<input type="checkbox"/>	<input type="checkbox"/>	Does the LifeLink System terminate a conference if the ambulance does not have a radio link for longer than the timeout period?

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.8.4.5 LL-SYST-5

This test verifies the call-waiting/busy-signal of the system.

2.8.4.5.1 Requirements Addressed

- LL-GEN-002 One controlling L1TC facility node can conference with one ambulance at a time.
- LL-SYS-012 If a second ambulance attempts to initiate a videoconference with a L1TC facility node which is already in a conference session, the system will notify both the L1TC facility and the second ambulance. The second ambulance will continue to attempt connection, and a new videoconference session will start when the L1TC facility terminates the existing videoconference.

2.8.4.5.2 Prerequisite Conditions

Hardware and software preparation complete.

2.8.4.5.3 Test Inputs

None.

2.8.4.5.4 Test Results Evaluation

The system should gracefully handle requests from more than one ambulance to participate in a conference.

2.8.4.5.5 Test Procedure

Verify the ability of the system to indicate the unavailability of a node due to a prior connection by the following:

- a) Position the ambulance within the radio coverage of the system.
- b) Verify the Link indicator indicates a link.
- c) Initiate a conference between the TOC node and the L1TC facility.
- d) Attempt to initiate a conference between the ambulance and the L1TC facility.
- e) Verify the display of a message indicating a conference is already in progress in the ambulance.
- f) Verify the display of a message indicating an attempted connection by the ambulance.
- g) Terminate the existing TOC to L1TC facility conference.
- h) Verify the automatic completion of the ambulance initiated conference.

2.8.4.5.6 Assumptions and Constraints

None.

2.8.4.5.7 Test Results

- | <u>Yes</u> | <u>No</u> | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Does the ambulance display a message indicating a conference is already in progress? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the L1TC facility display a message an attempted connection by the ambulance? |
| <input type="checkbox"/> | <input type="checkbox"/> | Does the new conference automatically complete upon termination of the existing conference? |

PASS

FAIL

SwRI: _____ **Date:** _____

TxDOT: _____ **Date:** _____

2.8.4.6 LL-SYST-6

This test verifies the call-transfer/call-consult of the system.

2.8.4.6.1 Requirements Addressed

- LL-GEN-003 A full-duplex videoconferencing session with an ambulance may be transferred to another L1TC facility.
- LL-GEN-006 Additional L1TC facility nodes may consult in a conference where the controlling L1TC facility node directs the consult node to receive the audio and video from the ambulance.

2.8.4.6.2 Prerequisite Conditions

Hardware and software preparation complete.

2.8.4.6.3 Test Inputs

None.

2.8.4.6.4 Test Results Evaluation

At the discretion of the controlling L1TC facility node, the conference should be transferable to a different L1TC facility node.

2.8.4.6.5 Test Procedure

- 1) At the Ambulance:
 - a) Activate the system and initiate the conference.
- 2) At the L1TC facility:
 - a) Acknowledge the conference.
- 3) Verify the ability to transfer a call by the following at the controlling L1TC facility node:
 - a) Select a L1TC facility node by entering the two (2) digit code on the keyboard or selecting the default node (no buttons pressed).
 - b) Confirm the selection by pressing one (1) button marked "Enter".
 - c) Verify the connection is no longer displayed on the original controlling node.
 - d) Verify the connection exists on the new controlling node.
 - e) Verify no intervention was required by the ambulance system operator.
- 4) Verify the ability to consult a call by the following at the controlling L1TC facility node:

- a) Initiate a consulting node by pressing one (1) key marked “F6”.
- b) Select a L1TC facility node by entering the two (2) digit code on the keyboard or selecting the default node (no buttons pressed).
- c) Confirm the selection by pressing one (1) button marked “Enter”.
- d) Verify the connection is successfully completed.

2.8.4.6.6 Assumptions and Constraints

None.

2.8.4.6.7 Test Results

<u>Yes</u>	<u>No</u>	
<input type="checkbox"/>	<input type="checkbox"/>	Does the conference successfully transfer to a new control node?
<input type="checkbox"/>	<input type="checkbox"/>	Does the conference successfully consult to an additional node?

PASS **FAIL** **SwRI:** _____ **Date:** _____

TxDOT: _____ **Date:** _____

3. REQUIREMENTS TRACEABILITY

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-GEN-001	The system shall provide an Ethernet communications network, two way audio and videoconferencing, and one way vital data telemetry from an ambulance to a LITC facility node.	P-2.5.1	LL-SYST-2 LL-SYST-3	Demonstration Inspection
LL-GEN-002	One controlling LITC facility node can conference with one ambulance at a time.	P-2.5.1 (Derived)	LL-SYST-6	Demonstration Inspection
LL-GEN-003	A full-duplex videoconferencing session with an ambulance may be transferred to another LITC facility.	P-2.5.1	LL-HOST-2 LL-SYST-6	Demonstration Inspection
LL-GEN-004	The system shall use optical fibers in the TransGuide infrastructure as the backbone of the communications system.	P-2.5.1 P-2.5.2.6.1 P-2.5.2.6.4	LL-FBHT-1	Demonstration Inspection
LL-GEN-005	The system shall support vital data telemetry at a RS-232 serial link with a rate of 38.4 kbps between the ambulance and LITC facility involved in the conference simultaneously with a videoconferencing session.	P-2.5.1 P-2.5.2.6.5 (Derived)	LL-SYST-3	Demonstration Inspection
LL-GEN-006	Additional LITC facility nodes may consult in a conference where the controlling LITC facility node directs the consult node to receive the audio and video from the ambulance.	(Derived)	LL-SYST-6	Demonstration
LL-SYS-001	Each end of the videoconference shall provide a full-screen view of the received video with a smaller view containing the local image that is being transmitted.	P-2.5.1 (ref. change order)	LL-SYST-1	Demonstration Inspection
LL-SYS-002	Each end of the videoconference shall provide a status window indicating the identity of the remote node.	P-2.5.1	LL-SYST-2	Demonstration Inspection

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-SYS-003	The computer at each end of the videoconference shall be configured to perform automatic operating system startup and application startup.	P-2.5.2.4.1 (Derived)	LL-SYST-1	Demonstration Inspection
LL-SYS-004	In the event of a temporary loss of communications, the system shall present a "frozen" image of the last good video presented to viewers which will prevail until the transient blockage is removed.	P-2.5.1 P-2.5.2.5	LL-SYST-4	Demonstration
LL-SYS-005	The system shall use a wireless, spread spectrum communications channel for communication between ambulances and roadside fiber hub terminals.	P-2.5.1	LL-FBHT-1	Demonstration Inspection
LL-SYS-006	The system shall provide voice contact between the controlling physician and the ambulance LifeLink system operator via a single headset provided at each end of the videoconference.	P-2.5.1 P-2.5.2.6.3 P-2.5.2.6.5	LL-SYST-1	Demonstration Inspection
LL-SYS-007	The system shall provide for use of standard Simple Network Management Protocol (SNMP) techniques for network management of all Ethernet configurable devices including spread spectrum radios from one central control node.	P-2.5.1	LL-TOCT-1	Demonstration Inspection
LL-SYS-008	The videoconference shall provide: A minimum resolution of CIF (352x240 pixels), Scalability to full screen, Display of the transmitted image, Operation within the radio bandwidth.	(derived)	LL-SYST-1	Demonstration Inspection
LL-SYS-009	If an ambulance initiates a conference while out of range of the radio communications network, the conference will automatically establish when the ambulance enters radio contact.	(derived)	LL-SYST-4	Demonstration

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-SYS-010	If an ambulance drives out of radio contact during a conference and re-enters radio contact within the timeout period, the conference will resume without ambulance system operator intervention.	(derived)	LL-SYST-4	Demonstration
LL-SYS-011	If an ambulance drives out of radio contact during a conference and remains without radio contact for a time exceeding the timeout period, the conference will terminate without ambulance system operator intervention.	(derived)	LL-SYST-4	Demonstration
LL-SYS-012	If a second ambulance attempts to initiate a videoconference with a L1TC facility node which is already in a conference session, the system will notify both the L1TC facility and the second ambulance. The second ambulance will continue to attempt connection, and a new videoconference session will start when the L1TC facility terminates the existing videoconference.	(derived)	LL-SYST-5	Demonstration
LL-AMB-001	The ambulance mobile communication link shall utilize a spread spectrum Ethernet bridge radio.	P-2.5.1 P-2.5.2.6.1 P-2.5.2.6.2	LL-AMBT-1	Demonstration Inspection
LL-AMB-002	The ambulance subsystem shall include an industrial computer.	P-2.5.2.6.2 (ref. change order)	LL-AMBT-1	Demonstration Inspection
LL-AMB-003	The ambulance computer shall be able to provide necessary connections and ports for the videoconferencing system.	P-2.5.2.6.2	LL-AMBT-1	Demonstration Inspection
LL-AMB-004	The ambulance computer shall be able to provide a connection for the spread spectrum Ethernet bridge radio.	P-2.5.2.6.2	LL-AMBT-1	Demonstration Inspection

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-AMB-005	The ambulance computer shall be able to provide necessary connections and ports for connection to optional vital statistics equipment.	P-2.5.2.6.2	LL-AMBT-1	Demonstration Inspection
LL-AMB-006	The ambulance subsystem shall provide a videoconferencing camera and lens capable of providing a video resolution matching or exceeding the capabilities of the videoconferencing codec.	P-2.5.2.6.2 (Derived)	LL-AMBT-1	Demonstration Inspection
LL-AMB-007	The ambulance subsystem shall provide a videoconferencing camera and lens able to provide a default field of view directed at the patient under transport.	P-2.5.2.6.2 (Derived)	LL-AMBT-3	Demonstration Inspection
LL-AMB-008	The ambulance subsystem shall include a headset containing a microphone and speaker which enable voice communications as part of the videoconferencing session.	P-2.5.2.6.2	LL-AMBT-1	Demonstration Inspection
LL-AMB-009	User interface to the LifeLink ambulance computer shall limit (to a practical extent) the actions required to originate or terminate a videoconferencing session.	P-2.5.1 P-2.5.2.6.2 (Derived)	LL-AMBT-2	Demonstration
LL-AMB-010	The ambulance subsystem shall include a power system interface capable of operation during ignition power.	(Derived)	LL-AMBT-4	Demonstration
LL-AMB-011	The ambulance subsystem shall include a power system interface capable of providing momentary power when ignition power is lost.	(Derived)	LL-AMBT-4	Demonstration
LL-AMB-012	The ambulance subsystem shall include a power system interface with an emergency kill switch.	(Derived)	LL-AMBT-4	Demonstration
LL-AMB-013	The ambulance subsystem shall include a power system interface capable of alerting the computer of a loss of ambulance ignition power.	(Derived)	LL-AMBT-4	Demonstration

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-FBH-001	The roadside fiber hub terminal subsystem shall include a spread spectrum Ethernet bridge radio located on each camera pole in an environmental box.	P-2.5.2.6.1.3	LL-FBHT-1	Demonstration Inspection
LL-FBH-002	The roadside fiber hub terminal subsystem shall provide network continuity between each TransGuide Fiber Hub and the TOC with WDM devices on the protect fiber pairs.	P-2.5.2.6.1.2	LL-FBHT-2	Demonstration Inspection
LL-FBH-003	The roadside fiber hub terminal subsystem shall use existing TransGuide camera poles and roadside fiber hub terminals.	P-2.5.2.6.1.3	LL-FBHT-2	Demonstration Inspection
LL-FBH-004	The roadside fiber hub subsystem shall provide a communications system capable of supporting data transmission between a radio registered to the subsystem radio and the TOC.	(Derived)	LL-FBHT-3	Demonstration Inspection
LL-TOC-001	The TOC subsystem shall include a computer matching the following specifications: Provide capability to serve as the SNMP host.	P-2.5.1 P-2.5.2.6.1.4 (Derived)	LL-TOCT-1	Demonstration Inspection
LL-TOC-002	The TOC subsystem shall include a computer matching the following specifications: Provide capability to serve as a videoconferencing node.	P-2.5.1 P-2.5.2.6.1.4 (Derived)	LL-TOCT-1	Demonstration Inspection
LL-TOC-003	The TOC subsystem shall provide a communications system capable of supporting the required Ethernet connectivity between the TOC and the respective LITC facilities.	P-2.5.2.6.1.4	LL-TOCT-2	Demonstration Inspection
LL-HOS-001	The LITC facility subsystem shall include one PC.	P-2.5.2.6.5	LL-HOST-1	Demonstration Inspection
LL-HOS-002	The LITC facility PC shall provide necessary connections and ports for connection to fixed location vital statistics monitoring equipment.	P-2.5.2.6.5	LL-HOST-1	Demonstration Inspection
LL-HOS-003	The LITC facility PC shall support 10BaseT Ethernet connectivity.	P-2.5.2.6.5	LL-HOST-1	Demonstration Inspection

Requirement Number	Requirement	Source	Test Case(s)	Verification Method
LL-HOS-004	The L1TC facility PC shall provide unobstructed access to other L1TC facility equipment or walkways.	P-2.5.2.6.5	LL-HOST-3	Demonstration Inspection
LL-HOS-005	User interface to the LifeLink L1TC facility computer shall limit (to a practical extent) the actions required to answer, transfer, or terminate a videoconferencing session.	P-2.5.1 (Derived)	LL-HOST-2	Demonstration