ERICSSON

LBI-38980

Mobile Communications

EDACS™
900 MHz Test Unit

Maintenance Manual

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REFERENCES

LBI-31939 - Maintenance Manual - EDACS Test and Alarm Unit
LBI-38915 - Maintenance Manual - MDX 900 MHz Mobile Radio

INTRODUCTION

The 900 MHz Test Unit is an EDACS (Enhanced Digital Access Communications System) Site Controller option which performs tests, under the direction of the Controller, to identify and report problems with the operation of the Control or Working Channels.

This manual describes the equipment configuration for the currently used 19A149302P9 Controller, a DEC model CT-UXXXF-EK. This model is characterized by the DEC model KDJ11 CPU module and modular RJ11 connectors on the back. Connection to earlier PDP and VAX models, characterized by a separately-mounted, 32-port distribution panel (Emulex or Dilog), requires a different data link cable than is described in this manual.

The 900 MHz Test Unit option requires the presence of an Alarm and Control Unit option, to provide the following items:

- 19D438294G1 shelf
- 19B234961G1 RF attenuator assembly
- Data interface circuit (part of the 19D901365G2 Alarm and Control Unit)
- 19D903880P101 data link cable

Information about these items can be found in the Test and Alarm Unit maintenance manual listed in the References. Note, however, that that manual describes VHF and UHF Test Units, not the 900 MHz Test Unit. The 900 MHz Test Unit uses an entirely different radio, with different power, control, and antenna cables described only in this manual.

Information about the MDX™ radio, used in the 900 MHz Test Unit, can be found in the standard 900 MHz MDX Mobile Radio maintenance manual listed in the References.

DESCRIPTION

The 900 MHz Test Unit option consists of the following equipment to be installed in an EDACS Site Controller cabinet:

- 900 MHz MDX Test Unit radio (including mounting bracket and hardware)
- 19B801358P18 power cable
- 19B803439P1 control cable
- 19B801454P42 coaxial cable

The 900 MHz MDX Test Unit radio is a standard 900 MHz MDX mobile radio that has been specially modified, programmed, and labeled in the factory. The 900 MHz MDX Test Unit radio has been specially modified by adding a jumper to bypass Q903 in the on/off circuit on the System Board, forcing the radio to always come on and stay on as long as it receives dc power. The modification is shown in Figure 1.

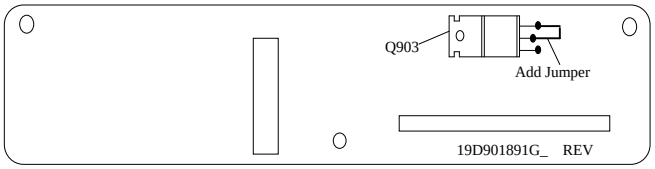


Figure 1 - MDX System Board Modification

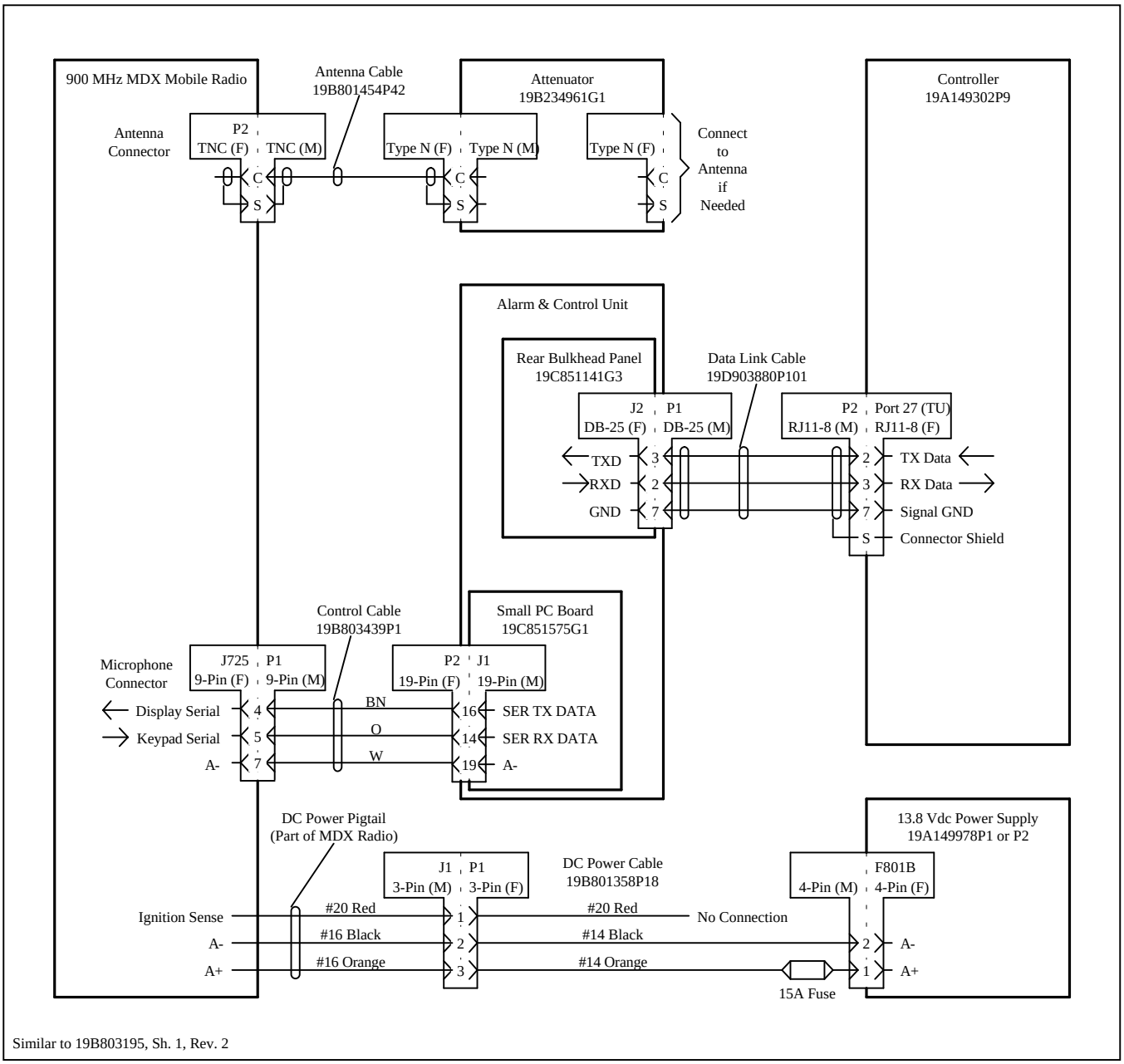
The 900 MHz MDX Test Unit radio has been specially programmed with a Test Unit operating program in place of a standard mobile radio operating program, and specially labeled "COMB: PM92ST". This label, stuck to the left outside cooling fin, also gives the serial number of the Test Unit.

Each MDX Test Unit radio is also programmed with its own Radio-Specific Feature Data. Therefore, a standard MDX mobile radio cannot be used as or converted to an MDX Test Unit radio if it was not sold as a Test Unit radio.

The 900 MHz MDX Test Unit radio performs tests under the direction of the Controller to identify and report problems with the operation of the Control or Working Channels. The data link, between the Test Unit radio and the Controller, passes through the Serial Interface Board in the Alarm and Control Unit. The Serial Interface Board provides level conversion between open-collector or TTL levels used by the Test Unit radio and the RS-232C levels used by the Controller.

The 20-watt RF attenuator is connected between the Test Unit radio's RF output and an antenna (if used), to provide a load for the Test Unit radio and reduce the RF level to the approximate level expected from a typical remote mobile radio transmitting to the site.

Four cables connect the option together and to the EDACS Site Controller as shown in Figure 2.



Similar to 19B803195, Sh. 1, Rev. 2

Figure 2 - Interconnection Diagram

INSTALLATION

Install the 900 MHz Test Unit option in the EDACS Site Controller cabinet as follows:

1. Mount the 900 MHz MDX Test Unit radio in the pull-out shelf at the bottom of the ACU (Alarm and Control Unit) as shown in Figure 4, using the standard MDX radio mounting bracket and hardware supplied.
2. Move the 19B234961G1 RF attenuator assembly to the position shown in Figure 4.
3. Connect the 19B801454P42 coaxial cable from the female TNC connector on the back of the MDX Test Unit radio to the male Type-N connector on the RF attenuator as shown in Figure 4. (An antenna, if used, and connecting coaxial cable are not supplied.)
4. Connect the 19D903880P101 data link cable from the female RJ11 port 27 (TU) on the back of the Controller to the female DB-25 jack J2 on the rear bulkhead panel of the Alarm and Control Unit as shown in Figure 5.
5. Connect the 19B803439P1 control cable from the 9-pin microphone connector on the front of the MDX Test Unit radio to J1 on the 19C851575G1 small printed circuit board on the back of the Alarm and Control Unit as shown in Figures 4 and 5.
6. Connect the 19B801358P18 power cable to the dc power pigtail coming out of the MDX Test Unit radio, and route down to connector F801B on the 13.8 Vdc power supply as shown in Figures 4 and 5. Install the 15A in-line fuse on the orange-colored wire and connect to F801B pin 1 (also marked A+), connect the black-colored wire to F801B pin 2(also marked A-), and do not use the red-colored wire as shown in Figure 3.

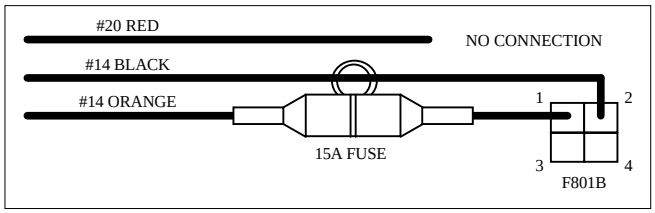


Figure 3 - Power Supply Connections

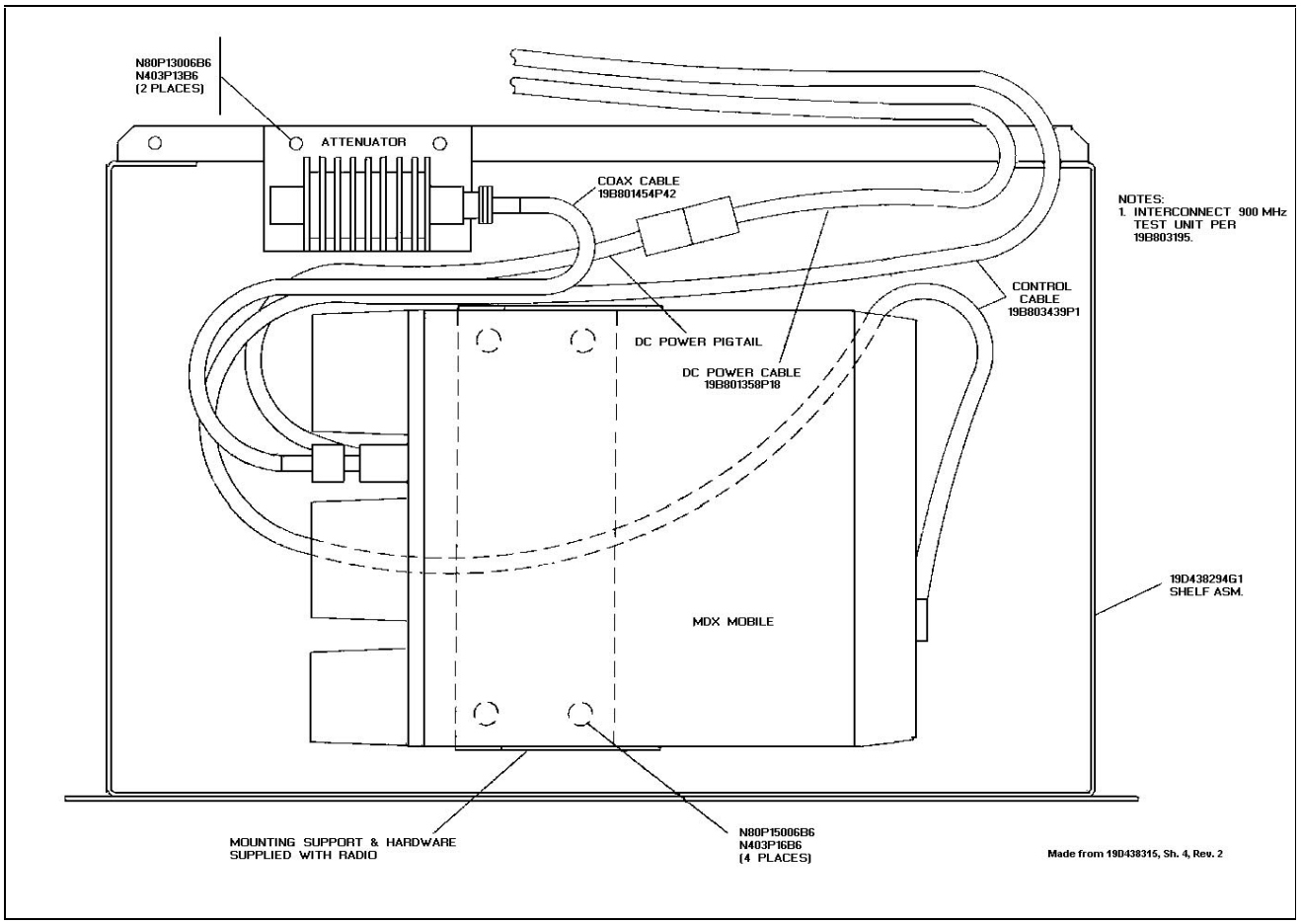


Figure 4 - Shelf Layout (Top View of Shelf)

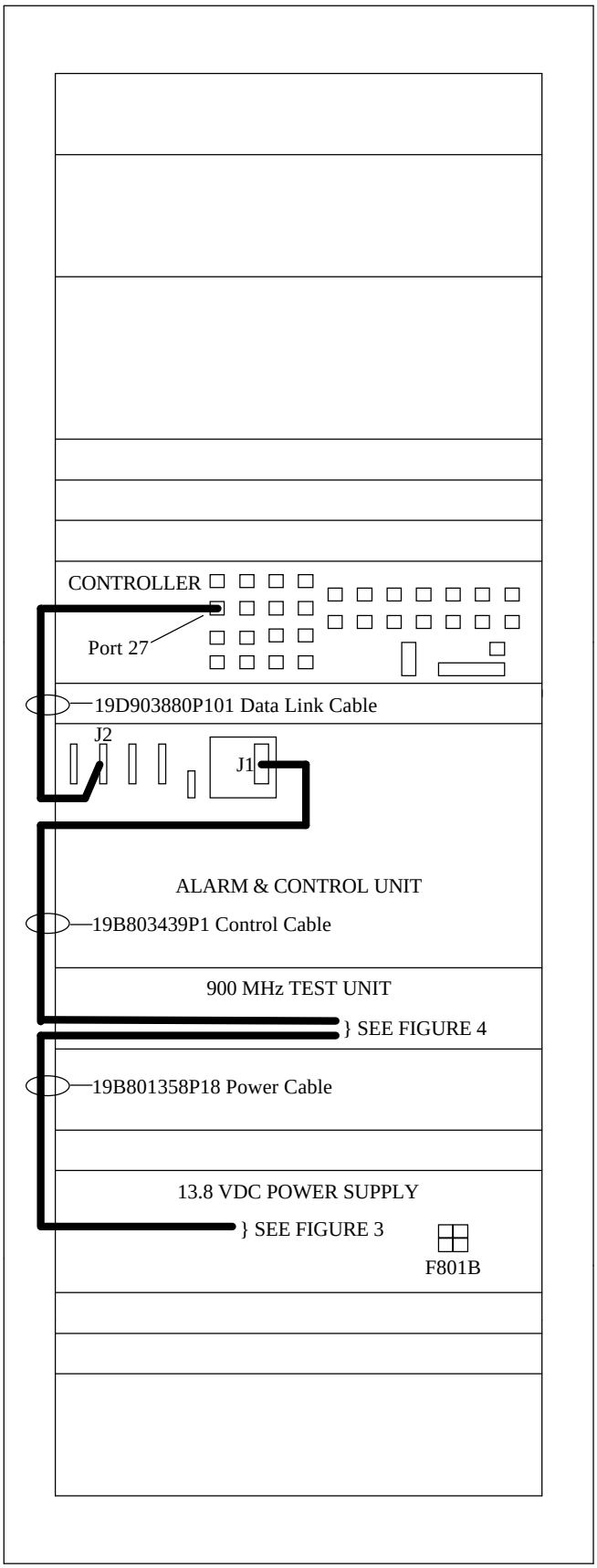


Figure 5 - Test Unit Cable Routing (Rear View of Cabinet)

PROGRAMMING

OVERVIEW

The 900 MHz MDX Test Unit radio will not function correctly without all of the following information stored electronically within the Test Unit radio:

- Test Unit Operating Program
- Personality Data
- Radio-Specific Feature Data
- Radio Serial Number

When the Test Unit radio is operating normally, the display on the front should show "PROGRAM". If, after following the programming procedures listed in this section, the display shows "BFEATURE", contact the factory to obtain programming information.

NOTE
A standard 900 MHz MDX mobile radio cannot be used as or converted to an MDX Test Unit radio if it was not sold as a Test Unit radio.

OPERATING PROGRAM

The 900 MHz MDX Test Unit radio has been specially programmed in the factory with a Test Unit Operating Program in place of a standard mobile radio operating program. The Test Unit Operating Program is stored in U703 on the Audio/Logic board. If U703 ever needs to be replaced, it can be flash programmed in the Test Unit radio using the standard PC programming equipment listed in this section, and the flash programming procedure described in LBI-38972.

PERSONALITY DATA

The 900 MHz MDX Test Unit radio is tested in the factory using a generic factory Personality Data. Before the Test Unit can be used at a site, its Personality Data must be reconfigured specifically for that site. The Personality Data is stored in U802 on the Audio/Logic board.

To program the 900 MHZ MDX Test Unit radio with the Personality Data for a site, use the standard PC programming equipment listed in this section, and the personality programming procedure described in TQ-3373. The Test Unit radio is programmed with the same Personality Data as any mobile radio using that site. When the Personality Data is to be programmed into the Test Unit radio, "TEST UNIT" must be selected for the Unit Type field in the Program Radio window of the Current Personalities screen.

RADIO-SPECIFIC FEATURE DATA

Each 900 MHz MDX Test Unit radio is loaded with Radio-Specific Feature Data at the factory. This data, unique to each Test Unit radio's Serial Number ROM, is stored in the Personality Data EEPROM, U802, with the Personality Data. At the time the installer configures the Personality Data, the Radio-Specific Feature Data can be read and should be written down and identified with that specific Test Unit radio for future use. If U802 is ever replaced, the Test Unit radio must be reloaded with this same Radio-Specific Feature Data, in addition to the Personality Data.

SERIAL NUMBER ROM

Each 900 MHz MDX Test Unit radio contains a Serial Number ROM, U706, on the Audio/Logic board. Each Serial Number ROM contains a unique serial number which cannot be changed and does not match the serial number on the nameplate of the radio. If the Audio/Logic board ever needs to be changed, transfer the Serial Number ROM along with the Radio-Specific Feature Data to the new board. If the Serial Number ROM ever needs to be replaced, the new Serial Number ROM will contain a different serial number and you must contact the factory to get new Radio-Specific Feature Data.

PROGRAMMING EQUIPMENT

The following PC programming equipment or equivalent is required to program the 900 MHz MDX Test Unit radio:

- 12 Vdc Power Supply (for MDX Radio)
- IBM-Compatible Personal Computer
- TQ-3372 (19B801417P10) MDX Programming Cable (MDX to Data Interface)
- TQ-3365 EDACS 900 MHz Radio Software Kit which includes the following:
  - TQ-3373 EDACS 2 Software Version 3.0
  - LBI-38808 EDACS Utility Programming Maintenance Manual
  - TQ-3370 Serial Programming Kit which includes the following:
    - 19D438367G2 Data Interface
    - 19B235027P1 RS-232 Data Cable (PC to Data Interface)
    - 19B800850P2 12 Vdc Power Supply (for Flash Programming)
    - LBI-38858 Serial Programming Kit TQ-3370 Maintenance Manual

Where only 220 Vac is available, use TQ-3365-220 which includes TQ-3370-220, which includes a 19B800888P1 12 Vdc Power Supply (flash programming) - all else is the same.

OPERATION

OVERVIEW

The Test Unit receives all its instructions from and reports the status of the channel tests to the Controller through the Serial Interface Board in the Alarm and Control Unit and a serial data link to the Controller. During normal operation, the Test Unit operates in one of the following states:

- Power-Up
- Initialization
- Set-Up
- Monitor
- Test Call

POWER-UP

The Test Unit enters the Power-Up state when power is first applied or after receiving the Reset message from the Controller. In the Power-Up state it sets all switching circuits to a predetermined known state and performs self-diagnostic checks. When these checks are completed, it sends a Status Response message to the Controller and waits for a Status Request message in return. If a Status Request message is not received within 10 seconds, it again sends a Status Response message and again waits for a Status Request message in return. This continues until a Status Request message is returned.

INITIALIZATION

The Test Unit enters the Initialization state after it has received the first Status Request message from the Controller. Upon entering this state, it sends another Status Response message to the Controller and proceeds to the Set-Up state.

SET-UP

The Test Unit enters the Set-Up state after sending any of the following messages to the Controller:

- Status Response (while in the Initialization state)
- CC Fail
- Call Results

MONITOR

The Test Unit enters the Monitor state when it receives the Monitor Control Channel message from the Controller.

Upon entering this state, it sets its receiver to the frequency of the current Control Channel number (given in the Monitor Control Channel message) and begins monitoring the outbound Control Channel.

Monitoring the Control Channel is the primary function of the Test Unit. Control Channel monitoring consists of the following tasks:

1. Obtaining synchronization with the outbound Control Channel data frames.
2. Decoding the outbound Control Channel data.
3. Verifying the site ID from the outbound Control Channel data.

When the Test Unit is unable to do any one or more of these tasks, it sends the CC Fail message to the Controller and returns to the Set-Up state. When the Controller receives the CC Fail message, it logs the failure and sends a CC Monitor message with a new Control Channel number to the Test Unit. When the Test Unit receives the new CC Monitor message, it returns to the Monitor state and begins monitoring the new Control Channel.

TEST CALL

The Test Unit enters the Test Call state when it receives the Testcall State message from the Controller. Upon entering this state, it initiates a channel-request sequence. A normal (successful) sequence contains the following steps (a failure at any step in the sequence causes a jump to step 13):

1. The Test Unit receives the Testcall State message from the Controller.
2. The Test Unit sets itself to the frequency of the Control Channel and obtains synchronization with the outbound Control Channel data frames.
3. The Test Unit sends a request for an individual call and waits to receive a Working Channel assignment. (For call requests, the TU uses a Logical ID of 0 for both the caller and callee.)
4. The Test Unit receives the Working Channel assignment and sets itself to the frequency of the assigned Working Channel.
5. The Test Unit receives the high-speed-data channel confirmation from the Working Channel.
6. The Test Unit sends the high-speed-data key message followed by low-speed data to the Working Channel.
7. The Working Channel detects the high-speed-data key message and low-speed data from the Test Unit.
8. The Test Unit stops sending low-speed data to the Working Channel.
9. When the Working Channel stops receiving the low-speed data from the Test Unit, it starts a 2-second hang time interval. During this interval, the Working Channel transmits pre-drop alert dotting for the first 0.7 second, followed by low-speed data for the remaining 1.3 second. (Note that wide-band Working Channels, used in lower frequency systems, only transmit low-speed data during this interval.)
10. The Test Unit detects and checks the pre-drop alert dotting only. (Note that checking pre-drop alert dotting - alternating 1s and 0s - does not notice data inversion, if present.)
11. Approximately 2 seconds after the Working Channel stops receiving the low-speed data from the Test Unit, the Working Channel transmits the drop-channel message.
12. The Test Unit receives the drop-channel message.
13. The Test Unit sends the Call Results message to the Controller, and returns to the Set-Up state to wait for further instructions.

MAINTENANCE

OVERVIEW

Maintenance for the Serial Interface Board in the Alarm and Control Unit is described in the Test and Alarm Unit maintenance manual (see References following the Table of Contents). Maintenance for the 900 MHz MDX Test Unit radio is described in the 900 MHz MDX mobile radio maintenance manual (see References following the Table of Contents).

The 900 MHz MDX Test Unit radio can be forced into the Test-Mode state for a limited number of tests without removing it from the EDACS Site Controller cabinet. This is different from the standard MDX Test-Mode state as described in the 900 MHz MDX mobile radio maintenance manual. (To perform tests in the standard MDX Test-Mode state, the radio must be reprogrammed with the standard operating program.)

The Test Unit Operating Program can be checked by simulating commands from the Controller and reading the response messages from the Test Unit.

TEST-MODE STATE

To force the 900 MHz Test Unit radio into the Test-Mode state, temporarily remove dc power (remember that the on/off circuit has been modified so that the PWR key

does not remove dc power). Connect a standard MDX microphone to the front of the MDX radio in place of the control cable. Then press the Home/Emergency key (marked with a triangle) while simultaneously reconnecting the dc power to the Test Unit radio. The Test Unit radio should now be in the Test-Mode state. The following rules apply specifically to the 900 MHz MDX Test Unit radio operating program in the Test-Mode state:

- The PTT switch on the microphone controls whether the radio is transmitting or receiving.
- When the PTT switch is released, the audio path is always open. (No test is made for Channel Guard or carrier presence.)
- The Test Unit radio can transmit low-speed data and voice, or transmit high-speed dotting. The group up/down buttons (marked "+" and "-") toggle between these two transmit modes.
- The Test Unit radio transmits and receives on the frequencies assigned to channel 1 of the conventional frequency set named in the Test Set field of the Radio Options window of the Radio Personality screen of the Personality Data. If a Test Set is not named in this field, the message "NO FREQS" is displayed.
- To exit the Test-Mode state and return to normal Test Unit operation, temporarily disconnect and reconnect dc power to the Test Unit radio. Then remove the microphone and reconnect the control cable.

TEST UNIT OPERATING PROGRAM

Communications Protocol

The 900 MHz MDX Test Unit radio communicates with the Controller through the Serial Interface Board in the Alarm and Control Unit, and a 19.2 kilobaud RS-232C serial data link to the Controller. Message bytes are made up of 8 data bits, 1 stop bit, and no parity bit.

Test Equipment Required

The following equipment (or equivalent) is required to bench test the 900 MHz MDX Test Unit radio:

- 19A149978P1 MASTR II Station Power Supply
- Triplett VOM, Model 630-PL, Type 5
- HP 4953A or HP 4951C Protocol Analyzer or computer with software to allow generation and reception of hexadecimal command strings

Test Setup

Before the 900 MHz MDX Test Unit radio can be bench tested, it must have all the correct software installed (see the section on programming), and must be completely functional (refer to the 900 MHz MDX mobile radio maintenance manual).

1. Connect the MDX mobile radio to the station power supply using a 19B801358P18 dc power cable. The black wire goes to negative and the orange wire goes to positive. The dc power cable should be fused with a 15A fast-blowing fuse.
2. Connect an antenna to the MDX mobile radio.
3. Check to make sure that S1, on the Serial Interface Board of the Test and Alarm Unit, is in the NORM (open) position.
4. Connect the protocol analyzer, or equivalent, to J2 on the rear bulkhead panel of the Test and Alarm Unit as follows:

   TXD of analyzer to J2-3
   RXD of analyzer to J2-2
   GND of analyzer to J2-7

5. Connect the Test and Alarm Unit to the station power supply using J5 on the rear bulkhead panel of the Test and Alarm Unit. J5-1 goes to negative and J5-2 goes to positive.

Test Procedure

Power-Up

Turn on the power supply and verify that the voltage is 13.2 +/- 0.6 Vdc.

Have the analyzer send a Reset message <AA FD 02> and verify that the Test Unit responds with a Status Response message <AA 91 80 00 EE>.

Initialization

Have the analyzer send a Status Request message <AA 07 F8> and verify that the Test Unit responds with a Status Response message <AA 91 81 00 EF>.

Set-Up

Have the analyzer send a Status Request message <AA 07 F8> again and verify that the Test Unit responds with a Status Response message <AA 91 82 00 EC>.

Monitor

Have the analyzer send a CC Monitor message <AA 08 01 01 00 00 00 00 00 F7> and verify that the Test Unit responds with a CC Fail message <AA 94 ff 01 pb> (where ff is 20 or 40 or 80 and pb is the Parity byte).

Test Call

Testing the operation of the Test Unit in the Test Call state is not possible with this test setup. However, the Controller keeps track of Test Call results during the normal operation of the Test Unit in the system. If the Test Unit fails too many channels and the number of failed channels, as a percentage of the total channels at the site, reaches the number specified in the Controller's personality (default is 50 %), the Controller sets the Test Unit failure alarm and stops sending test call requests.

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