



TECHNICAL NOTE 01-93

MOBILE MAP PLUS, RANS SYSTEMS, RADIO-ALARM-LINK (RAL)

OPERATION INSTRUCTIONS TEST AND EVALUATION KIT

INTRODUCTION

This kit was developed to provide a simple test and evaluation of the performance of EMPACT data radio systems. The equipment in this kit will allow a trained electronics technician to evaluate the overall performance of the major system components and help point to a major component defect if a system malfunction has occurred. This equipment and related information does not replace the knowledge of a trained and qualified radio technician who has field experience with the installation of radio frequency equipment and antenna systems. If you do not have past experience with the installation or maintenance of radio systems or antennas, we recommend you contact someone in your area with this type of experience. There are many installation procedures that can affect the performance of your system, particularly with antenna and antenna cable installation. We have tried to note some of these procedures in this manual. However, there is no substitute for experience.

This manual and the enclosed test equipment should be used in conjunction with the Operation and Installation (O&M) Manual for your system. There are illustrations and installation procedures in the Installation Manual (O&M) that are referred to in this document.

This test kit can be used to:

- *Test the entire for proper operation.*
- *Check the system for a change in output power since installation.*
- *Identify problems associated with major system components.*
- *Identify components that may need factory maintenance.*

Important Note:

The test kit contains quality equipment that will provide accurate measurements when used properly. However, abuse of this equipment will cause component failure and inaccurate testing. You will be charged for repair or replacement if test kit components are missing or damaged. *Do not* use this test kit to test your system unless you are qualified to work on this type of equipment and feel comfortable with the testing procedures. If you have any questions, contact the **CDT** factory immediately.

OVERVIEW OF TEST PROCEDURES

The installation of **CDT's EMPACT Series** radio data-link products are usually simple because there are few components and simple interconnecting cable. Most system problems usually occur with the installation or weathering of antennas, antenna cables, and mounting hardware. This is because these components are exposed directly to the outside environment and their mounting can affect the communications ability of the system components. In general, we recommend proceeding as follows:

1. Gather the installation manuals and as-built drawings for this installation. Review the installation manual and the location of components before proceeding.
2. Perform a visual check of the major components and wiring installation, particularly antennas, antenna masts, and antenna cables.
3. Test the transmitter power output and antenna condition.
4. Test the operation of the encoder.
5. Test the operation of each receiver and/or field display on the test bench.
6. Test the operation of each receiver and/or field display in the vehicle or mounting location.

TEST KIT COMPONENT INVENTORY

This test kit contains the following equipment:

- 1- Bird Model 43 radio frequency power meter, tuned element for the frequency range, and type N male-to-male adapter for testing the transmitter output power and antenna condition.
- 1- Radio Shack portable radio receiver/scanner with "rubber duck" snap-on antenna for verifying the transmission of voice and data information.
- 1- Magnetic mount portable antenna, cable, and connector for testing the antenna installation at each mobile location.
- 1- Portable earphone with cable and connector for verifying the radio reception of each mobile unit.
- 1- Modular power supply with cable and power plug for bench testing each mobile display.
- 2- Alligator clip jumper cables.
- 1- Copy of the Installation and Operation Instructions

Important Note:

Be sure to inventory the equipment when you receive this kit and again before you return it to the factory. Use each piece of equipment carefully. Abuse of the equipment may cause inaccurate readings. Further, you will be charged for damaged or missing equipment.

TEST PROCEDURE

1. Visual Inspection
 - A. Transmitter Antenna and Mast
 1. Refer to O&M Figure 3-1 and Appendix B.
 2. The antenna mast should place the bottom of the antenna at a minimum of 20 feet above the structure. For best results, the antenna should be located on the highest structure and have an unobstructed line-of-sight to the areas where the mobile receivers/displays are to be operated.
 3. The antenna mast should be firmly attached and lightning protected as shown in O&M Appendix B.

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4. The antenna should be firmly attached at the top of the antenna mast. There should be no other vertical structures or other antennas within 20 feet of the antenna.
 5. The antenna should be assembled and have all the parts as shown in O&M Appendix C. The antenna cable connector should be firmly attached to the mating cable and be weatherproofed as shown in O&M Appendix C.
 6. The antenna lead-in cable should have no abrasions that cut through the outer insulation, and should be neatly ty-rapped or taped to the mast. Ty-raps must be the U/V protected type. The ty-raped or taped attachment to the mast should be firm but not so tight as to deform the roundness of the antenna lead-in cable.
 7. The antenna cable must not have sharp bends or crimps. The lead-in cable is a low-loss cable with a heavy (9 gauge) center conductor suspended in a spiral and foam insulation. Sharp bends or crimps can raise the VSWR (lower the amount of signal radiating from the antenna) and greatly reduce the operating range of the system. Cable bends should have a gentle radius of no smaller than 12 inches. Pay particular attention at weather-heads and bulkhead penetrations.
 8. The antenna cable connector should be firmly attached to the transmitter. Verify that the antenna cable connector is properly attached to the antenna lead-in cable.
 9. There should be no coils of excess cable between the antenna and transmitter. A “neatly coiled” section of cable can cause system problems. The cable length from antenna to transmitter should be as short as possible.
- B. Transmitter
 1. The transmitter is manufactured in a separate enclosure from the encoder electronics so it can be mounted as close to the antenna as practically possible. This is important because the shorter the cable distance from the transmitter to the antenna, the more signal reaches the antenna.
 2. The transmitter should be firmly mounted and wiring connected in accordance with O&M, paragraph 3.3.2 and 3.4.2. The space above the transmitter is very important because you will be installing the power meter on the top of the transmitter to test the output and reflected power.
 - C. Encoder
 1. The encoder should be installed and interconnected with the alarm equipment in accordance with O&M, paragraph 3.3 and 3.4.
 2. Pay particular attention to the interconnection with the associated alarm systems. You may wish to review the project as-built drawings and the technical manuals of the equipment connected to the encoder unit.
 - D. Vehicle Antenna and Lead-in Cable.
 1. Each vehicle antenna should have all the components and be mounted as shown in O&M, paragraph 3.3.5 and Appendix D. Please note that this type of antenna is a quarter-wave ground plane type and relies on the vehicle metal surface and a good ground connection for proper operation.
 2. Verify that each antenna is properly mounted and contains all the washers, pads and O-rings.
 3. Verify that the antenna cable is neatly routed with no abrasions that cut the outer insulation.

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4. Verify that the BNC cable connector (connecting to the Mobile Map Display) is firmly and properly installed on the cable. This connector is field installed and has been the source of past problems.
 - E. Mobile Map Display Unit.
 1. Each unit should be installed and connected in accordance with O&M, paragraphs 3.3.4 and 3.4.3.
 2. If the unit is installed in a fixed location, such as an observation tower, verify that the proper fixed location antenna and lead-in cable has been installed.
 2. Testing Transmitter Power Output and Antenna Condition
 - A. The procedures in the following paragraphs rely on the procedures contained in the O&M manual, Section 4, Initial Setup and Adjustment.
 - B. Power down the transmitter and connect the RF wattmeter as indicated in paragraph 4.3.7 and Figure 3-6. The power meter has already been provided with the correct adapters and power range as long as sufficient space has been provided above the transmitter unit for the power meter.
 - C. Power up the transmitter and perform the transmitter testing as detailed in paragraph 4.5. The forward power should read near the value recorded on the performance record attached to the inside of the transmitter door. A power much higher or lower can indicate a transmitter failure or a problem with the antenna or antenna cable.
 - D. The reverse (reflected) power is the indication of the amount of power that is NOT being absorbed by the antenna and therefore reflected back to the transmitter. A higher reflected power than the value recorded on the performance record usually indicates a problem with the antenna, antenna cable, or the common connector.
 - E. If either of these readings are abnormal (i.e., greatly different than that shown on the performance record) discontinue testing and research the source of the problem. Contact the factory if necessary.
 - F. You may wish to turn on the receiver/scanner to “listen” to the transmitter output. The receiver, channel 1, should already be tuned by the factory to the frequency of your system. If not, tune the receiver using the enclosed instructions.
 3. Encoder Testing
 - A. Continue testing by following the procedures of paragraph 4.6. If you encounter unusual problems, contact the factory.
 - B. Later you will return to the encoder to test individual zones transmitted to the remote displays.
 4. Radio-Graphic Display Testing
 - A. The testing of each radio-graphic display can take place either at the service bench or at the installed location. However, if problems with receiving alarms has occurred, it is recommended that the radio-graphic displays be initially tested at a bench location within close proximity of the transmitter antenna location to establish a base for further tests.
 - B. Remove one or more displays to the service bench location. Power the individual unit using the test set modular power supply with the connector that mates to the display. This small power supply provides sufficient power for one mobile display. Attach the portable antenna included in the test kit.
 - C. Attach the portable earphone to the rear panel connector and use it to monitor the reception of alarm signals in a similar way to using the receiver/scanner. The earphone audio signal should be clear (without hiss or static) during the alarm transmission. A weak signal indicates a

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- transmitter problem or defective receiver module in the display. The earphone should only hiss when no alarm signal is present. If ANY OTHER radio traffic is heard, you have possible outside radio interference. Use the receiver/scanner to identify the source of the interference signal.
- D. Power up the display and perform the testing as outlined in paragraph 4.7. If the bench area you are using is near the encoder location, you can perform all tests rapidly.
 - E. Using the jumper leads included with the test kit, activate individual alarm zones as detailed in paragraphs 4.4.7 through 4.4.10 and Figure 4-2.
 - F. If the bench tests are satisfactory, proceed by reinstalling the mobile display in its previous location and repeat the testing indicated above.
 - G. It is recommended that you begin the testing at the installed location using the portable antenna provided with the test kit. If the system works properly with the test antenna and not with the installed antenna, the installed antenna should be evaluated further.
 - H. If the display is installed in a vehicle, begin the testing with the vehicle located near and within sight of the transmitter antenna. If the tests are successful at this location, perform the tests at other normal operating locations within and/or around the facility.
5. Adjustments and Retesting
 - A. If during testing, problems do occur, refer to the troubleshooting guidelines contained on the O&M manual, Section 7. If you have any questions, contact the factory.
 - B. There are two adjustments located in the encoder and each radio-graphic display that can be adjusted in the field if the proper equipment is available. The adjustments involve setting the FSK center frequency and the digital signal data rate. Contact the factory before attempting these adjustments. The adjustment procedure is contained in the O&M Manual Special Supplement, Appendix G.
 6. Packaging and Shipment
 - A. When your testing is complete, carefully repack all equipment into the case. Be sure all equipment and manuals are included. See the inventory listing on page 3.
 - B. Lock the equipment case using a ty-rap through the two holes marked. Additional ty-raps and preaddressed mailing labels are contained in the test kit behind the foam in the lid.
 - C. Call or fax the **CDT** office to inform us of how and when you are shipping the test kit to us. Call (619) 478-2600 or fax (619) 478-2555. If you have any questions, please contact prior to shipment. Thank you for your cooperation.