

**OPERATION AND MAINTENANCE
1×N FREQUENCY DIVERSITY
DR 6/11-135A AND 135EC
REPLACEMENT PROCEDURES
RADIO RECEIVER**

	CONTENTS	PAGE
1. GENERAL		1
1.1 UPDATE INFORMATION		1
1.2 ADMONISHMENTS		1
1.3 SERVICE PROTECTION		1
2. RF PREAMPLIFIER		2
3. RECEIVER DOWN-CONVERTER AND MICROWAVE GENERATOR		4
4. LINEAR DELAY EQUALIZER		9
5. IF FILTER AND BASIC EQUALIZER		13
6. IF AGC AMPLIFIER, ADAPTIVE SLOPE EQUALIZER, AND IF COMBINER		15
7. RECEIVER POWER UNIT		16

Figures

1. 6-GHz Receiver Down-Converter	7
2. 11-GHz Receiver Down-Converter	8
3. Linear Delay Equalizer—Frequency Diversity Receiver	10
4. Linear Delay Equalizer—Space Diversity Receiver	11
5. Linear Delay Equalizer With Minicoaxial DADE Cable	12
6. IF Filter and Basic Equalizer	14

Published by
The AT&T Documentation Management Organization

1. GENERAL

This practice is used to replace units in the radio receiver. Any tests, adjustments, or operating requirements necessary after replacement are **not** provided in the replacement procedures. To determine if any action after replacement is required, return to the alarm-clearing procedure that called for the unit to be replaced. When replacing the receiver IF shelf, receiver waveguide assembly units, or backplane pin connections, refer to the Maintenance Support document.

Each procedure lists the recommended test equipment accessories. Each piece of equipment is keyed with an item number (e.g., Item A1) that corresponds to an item number in Table A, B, or C in the TEST EQUIPMENT AND ACCESSORIES tab.

1.1 UPDATE INFORMATION

This practice is reissued to include the 4400-series receiver down-converter. The practice is used in binders 421-102-001, 421-102-001AC, 421-102-002AC, 421-102-003AC, 421-102-004AC, 421-102-080, 421-102-090, 421-102-100, 421-103-001, 421-103-001AC, 421-103-002AC, 421-103-003AC, 421-103-004AC, 421-103-080, 421-103-090, and 421-103-100.

1.2 ADMONISHMENTS

Admonishments are strategically-placed reminders to assure safety of personnel (**DANGER**), to minimize service interruptions (**Caution**), and to prevent equipment damage (**Warning**). The technician should read and become familiar with the admonishments in the MAINTENANCE tab.

1.3 SERVICE PROTECTION

Protect service before starting any of the procedures in this practice. The preface information for each procedure contains the following:

Caution: THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL PROTECTION SWITCHING OPERATION HAS BEEN PERFORMED.

Service must be **manually** protected to avoid a service interruption. Service on a regular channel under repair **must** be manually switched to the protection channel. If the protection channel is under repair, it **must** be manually locked out to prevent a regular channel from switching to it during the procedure.

If necessary, refer to the SERVICE PROTECTION tab and/or the OPERATIONS tab to verify proper service protection.

Warning: To prevent ESD (electrostatic discharge) damage to a plug-in unit, ensure all ESD precautions are followed when removing, replacing, handling, and storing circuit packs.

2. RF PREAMPLIFIER

This procedure is used to replace the RF preamplifier.

The following tools are required for this procedure:

- 1 - Screwdriver (Item C5)
- 1 - SMA connector torque wrench (Item C4)
- 1 - Waveguide U-joint socket wrench (Item C1)
- 1 - 1/4" open-end wrench (Item C2).

For tool specifications and recommendations, see the TEST EQUIPMENT AND ACCESSORIES tab under the TESTS AND ADJUSTMENTS tab.

Caution: *REPLACEMENT OF THIS UNIT CAN CAUSE SYSTEM INTERRUPTION. If this replacement is done on a system carrying live traffic, up to four channels can be affected. If this is not a space diversity receiver, replace defective units at a time of low traffic density to minimize service interruptions. Lock out the affected channel(s) to prevent unnecessary switching during this procedure.*

Note: Read through the entire procedure *before* beginning.

PROCEDURE

1. Obtain a replacement preamplifier with the same unit code. Record gains stamped on unit for later reference.
2. If this is a space diversity receiver, determine which RF preamplifier is to be replaced and disconnect the corresponding IF cable at the input to the IF COMBINER. For example, if a diversity RF preamplifier is to be replaced, disconnect the cable at the input to the DIV IF IN jack on all the IF COMBINERS that are fed by this preamplifier.
3. Use the waveguide wrench and remove the eight waveguide screws connecting the input and the output ports of the preamplifier to the waveguide.
4. As smoothly and quickly as possible, slide the failed unit out and let the air gap provide the transmission path.
5. Transfer the power connector from the failed unit to the replacement unit.
6. Verify that the green indicator lights on the new unit.
7. As smoothly and quickly as possible, slide the replacement unit into place.
8. Use the waveguide wrench to replace the waveguide screws connecting the input and output ports of the preamplifier. Tighten the screws with an open-end wrench.
9. If this is a space diversity receiver, reconnect all IF COMBINER input cables.

10. If only one gain is stamped on the unit, record the value from Step 1 on the RADIO DATA CARD. If more than one gain is stamped, see **Comment**.

Comment: If three gains are given (low, mid, and high), the appropriate preamplifier gain for each receiver must be determined. The manufacturers reference frequencies are 5930 MHz (low), 6175 MHz (mid), and 6420 MHz (high). The preamplifier gain is dependent on the center frequency for each associated receiver and its relative position compared to the high, mid, and low reference frequencies. To establish the gain of the preamplifier, you will need the center frequency and the stamped gains on the preamplifier.

Example: The preamplifier is stamped 8 dB (low), 10 dB (mid), and 12 dB (high), and the center frequency for one particular receiver is 6048 MHz. The frequency is between the low and mid gains and is interpolated to have a value of about 9 dB (frequency plan tables can be found in the Microwave Generator Frequency Check and Adjustment procedure). This procedure should be performed for each receiver fed by the preamplifier.

Record gains on the RADIO DATA CARD.

11. This procedure is complete. Return to the instruction that referenced this procedure.

END OF PROCEDURE

3. RECEIVER DOWN-CONVERTER AND MICROWAVE GENERATOR

This procedure is used to replace the RECEIVER DOWN CONV & MWV GEN unit.

The following tools are required for this procedure:

- 1 - SMA connector torque wrench (Item C4)
- 1 - Screwdriver (Item C5)
- 1 - 1/4" open-end wrench (Item C2).

For tool specifications and recommendations, see the TEST EQUIPMENT AND ACCESSORIES tab under the TESTS AND ADJUSTMENTS tab.

Caution: *THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL SWITCHING OPERATION HAS BEEN PERFORMED.*

Warning 1: *To prevent ESD damage to a plug-in unit, ensure that all ESD precautions are followed.*

Warning 2: *The SMA connectors must be properly torqued to prevent possible damage to the connectors.*

PROCEDURE

Plug-In Unit Removal

1. Verify that service is protected.
2. Obtain a replacement plug-in unit and a replacement microwave generator module with the same unit code as the one being replaced.
3. On the unit faceplate, remove the cable (equipped with locking-type SMB connector) from the IF OUT jack.
4. **Warning:** *There may be connector damage if both SMA connectors of the semirigid cable are not loosened and removed simultaneously.*

Remove the semirigid cable(s) between the RF IN jack (REG RF IN and DIV RF IN jacks if space diversity receiver) and the isolator(s)/transducer(s) in the receiver waveguide assembly.

5. **Connect ESD wrist strap to ESD jack or a bare metal spot on the radio frame.**
6. On the unit to be removed, simultaneously release the latch catch and pull the lever forward. Pull the lever down until the unit is released from the backplane connector.
7. Hold the unit at the top and bottom, slide it out of the shelf, and place it in an ESD protective container.
8. If the replacement unit is an optional 4400-series receiver down-converter, verify that the upper/lower sideband selector jumper pin is in the correct position, according to the assigned radio channel. See Table A and Figures 1 and 2.
9. If the replacement unit already has a microwave generator installed, go to Step 10. If the replacement unit is not equipped with a microwave generator, go to Step 14.

10. Check the unit code on the new microwave generator. If the unit code is the same as the one being replaced, go to Step 19. If the unit code is different, go to Step 11.

MWV GEN Removal

11. Remove the power connector for the microwave generator module from plug P1 on the printed circuit board (Figures 1 and 2).
12. Remove the screws (two) holding the microwave generator module in place.
13. See **Note**. Loosen and remove the SMA connector at the output of the microwave generator module, and set the module aside.

Note: Hold the connector on the cable with a 1/4" wrench to prevent twisting of the cable.

MWV GEN Installation

14. Install the new microwave generator module without inserting the two mounting screws (Figures 1 and 2).
15. Connect the power connector to plug P1 on the printed circuit board.
16. Loosely connect (finger tight) the semirigid cable to the output of the microwave generator module.
17. Tighten both SMA connectors with the torque wrench. Hold the connector on the semirigid cable with a 1/4" wrench while torquing the connector on the microwave generator module end of the cable.
18. Insert and tighten the two mounting screws that hold the microwave generator in place.

Plug-In Unit Installation

19. On the replacement unit, release the latch catch and pull the lever forward.
20. **Warning: Misalignment of the plug-in unit in the shelf guides will cause backplane connector damage.**

Carefully align the replacement unit in the top and bottom shelf guides.

21. Slide the replacement unit into the shelf until the bottom of the lever clears the front of the shelf.
22. Seat the plug-in unit by pushing up on the lever and simultaneously applying light pressure to the top of the unit. Ensure that the latch catch has engaged the lever.
23. On the unit faceplate, reconnect the normal cable to the IF OUT jack (REG IF OUT and DIV IF OUT jacks if space diversity receiver).
24. **Warning: There may be connector damage if both SMA connectors of the semirigid cable are not connected and tightened simultaneously.**

Reconnect the semirigid cable(s) between the isolator(s)/transducer(s) in the receiver waveguide assembly and the RF IN jack (REG RF IN and DIV RF IN jacks if space diversity receiver). Tighten all SMA connectors with the torque wrench.

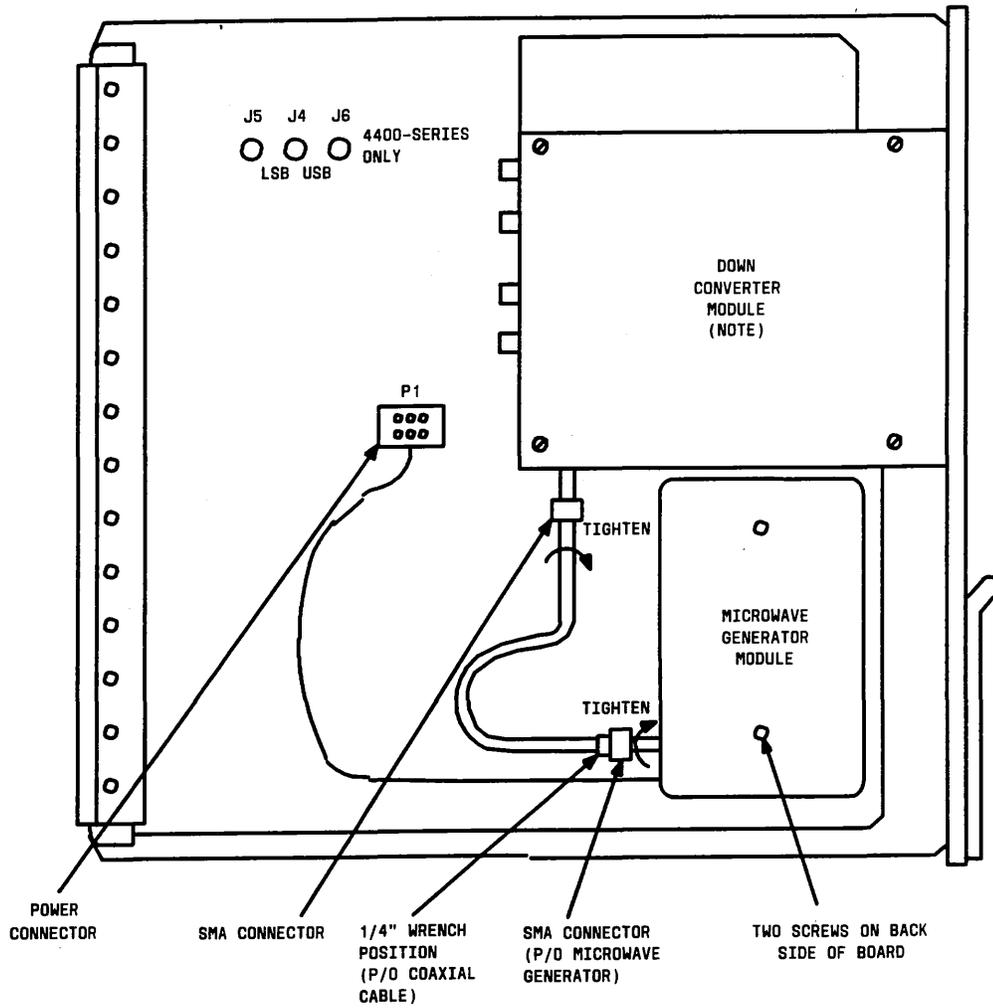
25. Apply the correct latch label to the unit latch if a new microwave generator module was installed.

Note: Allow a 60-minute warm-up period for the microwave generator to stabilize before making a final frequency adjustment.

26. This procedure is complete. Return to the instruction that referenced this procedure.

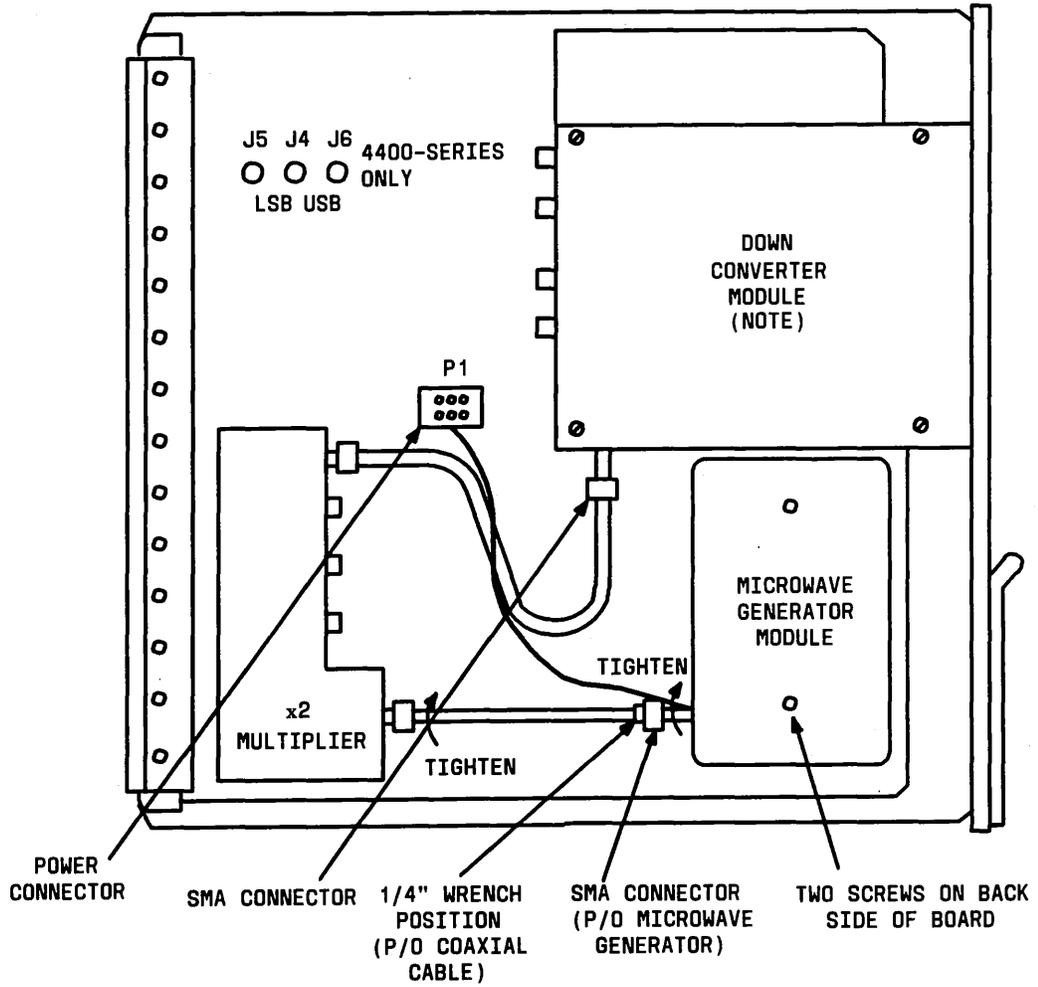
END OF PROCEDURE

TABLE A	
4400 Series Down-Converter Optional Sideband Selection	
APPLICATION	MINIPLUG POSITION
Upper Sideband	J5 to J4
Lower Sideband	J4 to J6



NOTE:
WITH SPACE/ANGLE DIVERSITY SYSTEMS, THE PLUG-IN UNIT
WILL BE EQUIPPED WITH TWO DOWN-CONVERTER MODULES.

Figure 1-6-GHz Receiver Down-Converter



NOTE:
WITH SPACE DIVERSITY SYSTEMS, THE PLUG-IN UNIT
WILL BE EQUIPPED WITH TWO DOWN-CONVERTER MODULES.

Figure 2-11-GHz Receiver Down-Converter

4. LINEAR DELAY EQUALIZER

This procedure is used to replace the equalizer modules that are located in the LINEAR DELAY EQUALIZER plug-in unit.

The following tools are required for this procedure:

- 1 - Extractor tool (Item C10)
- 1 - Screwdriver (Item C5).

For tool specifications and recommendations, see the TEST EQUIPMENT AND ACCESSORIES tab under the TESTS AND ADJUSTMENTS tab.

Caution: *THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL SWITCHING OPERATION HAS BEEN PERFORMED.*

PROCEDURE

1. Verify that service is protected.
2. Obtain replacement equalizers EQL 1 and EQL 2 and/or EQL 3 and EQL 4 (if space diversity receiver) with the same unit codes. The equalizers needed are marked on the front panel of the LINEAR DELAY EQUALIZER plug-in unit.

Note: If no equalizers are specified, none are installed. The trouble could be a faulty cable or connector.

3. On the unit faceplate, remove the cables (equipped with locking-type SMB connectors) from the IF IN jack (REG and DIV IF IN and DADE IF OUT jacks if space diversity receiver) and IF OUT jack (REG and DIV IF OUT if space diversity receiver).
4. Using a screwdriver, unlock the plug-in unit by pushing in and turning the locking screw counterclockwise; then use the extractor tool to remove the unit from the shelf.
5. Remove the screws holding the equalizer or equalizers suspected as being faulty (see Figure 3 if frequency diversity receiver or Figure 4 if space diversity receiver; see **Notes**).

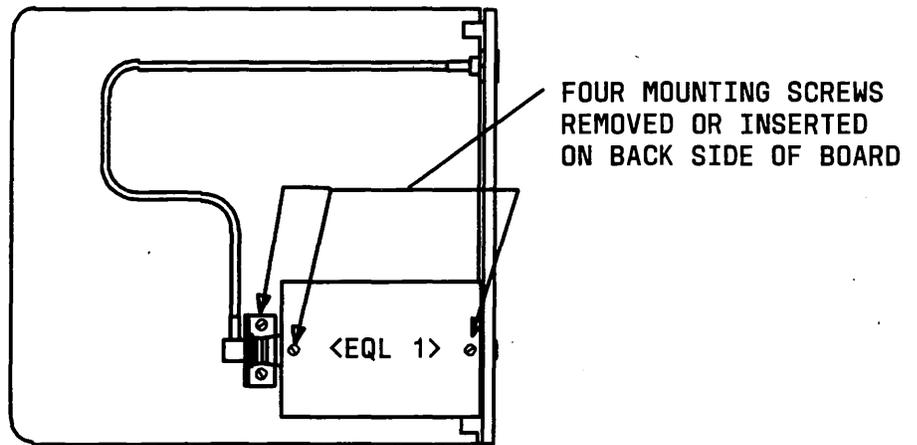
Note 1: If in doubt, use substitution method during tests to determine faulty equalizer.

Note 2: If the equalizer is equipped with minicoaxial DADE (differential absolute delay equalization) cable (Figure 5), it may be necessary to temporarily remove cable ties and stick downs to replace the defective equalizer unit.

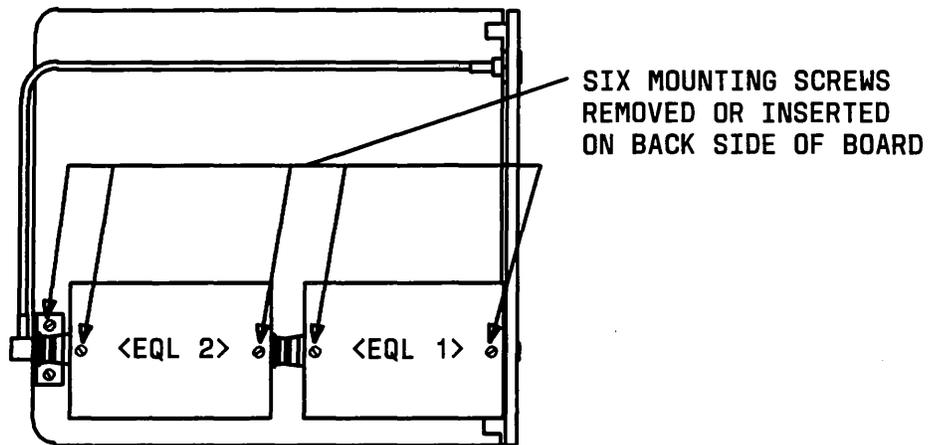
6. Install the replacement equalizer or equalizers using the screws just removed.
Note: If an equalizer is being added for the first time, it will be necessary to remove the nut that holds the connector to the angle bracket. Turn the angle bracket around and reinstall the nut. A pair of pliers or an adjustable wrench is required.
7. Reinstall replacement plug-in unit into shelf. Lock the plug-in by pushing in and turning the screw clockwise.

8. Reconnect the normal cables to the IF IN jack (REG and DIV IF IN and DADE IF OUT jacks if space diversity receiver) and IF OUT jack (REG and DIV IF OUT if space diversity receiver).
9. This procedure is complete. Return to the instruction that referenced this procedure.

END OF PROCEDURE

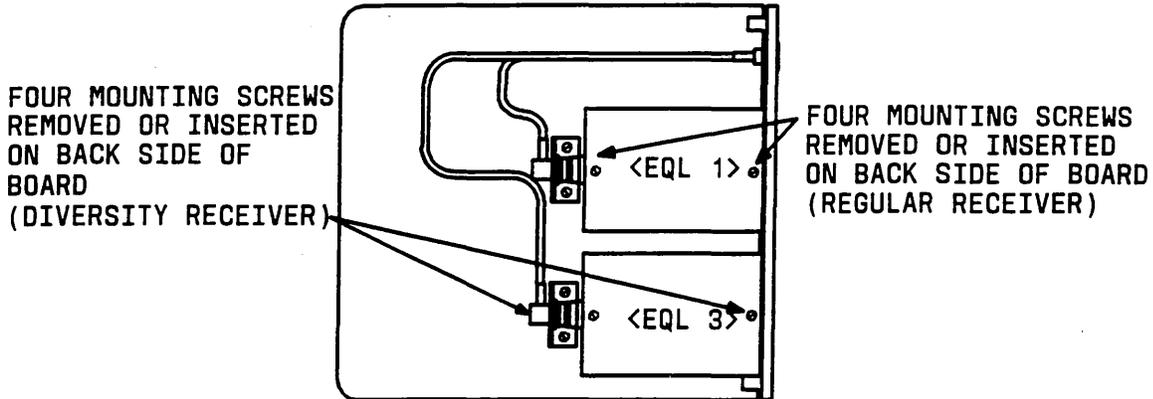


A. ONE EQUALIZER EQUIPPED

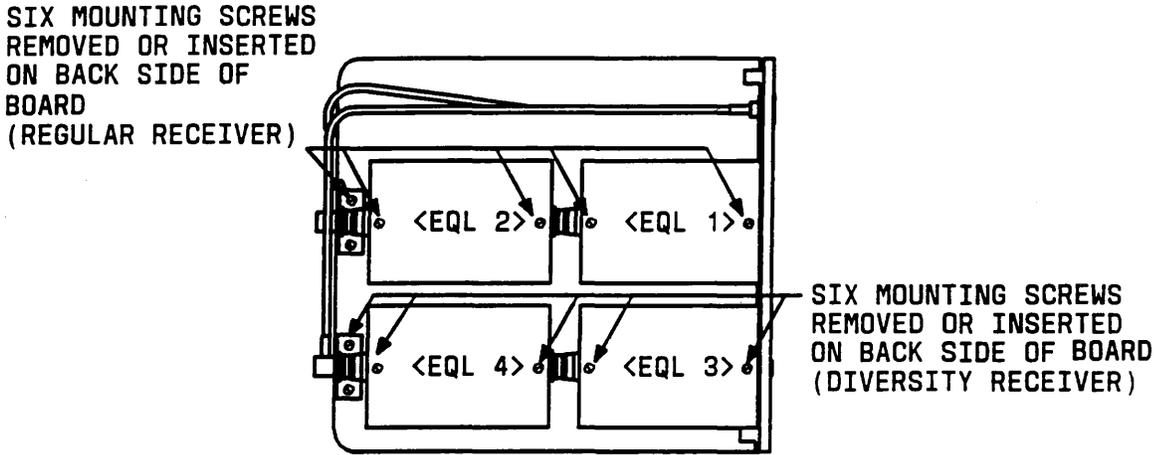


B. TWO EQUALIZERS EQUIPPED

Figure 3—Linear Delay Equalizer—Frequency Diversity Receiver



A. ONE EQUALIZER PER RECEIVER



B. TWO EQUALIZERS PER RECEIVER

Figure 4—Linear Delay Equalizer—Space Diversity Receiver

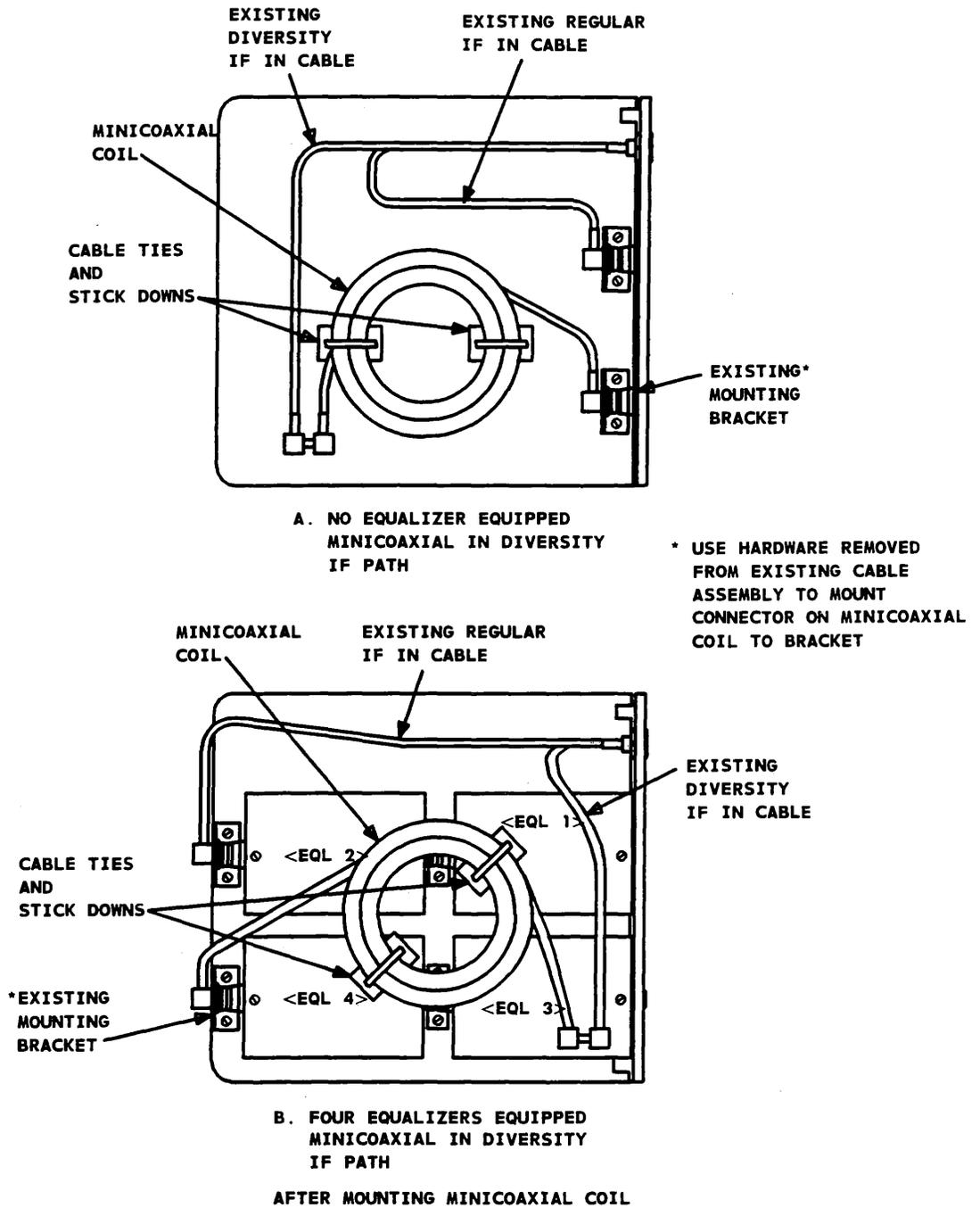


Figure 5-Linear Delay Equalizer With Minicoaxial DADE Cable

5. IF FILTER AND BASIC EQUALIZER

This procedure is used to replace the IF filter or the basic equalizer that is located in the IF FILTER AND BASIC EQUALIZER unit.

The following tools are required for this procedure:

- 1 - Extractor tool (Item C10)
- 1 - Screwdriver (Item C5).

For tool specifications and recommendations, see the TEST EQUIPMENT AND ACCESSORIES tab under the TESTS AND ADJUSTMENTS tab.

Caution: *THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL SWITCHING OPERATION HAS BEEN PERFORMED.*

PROCEDURE

1. Verify that service is protected.
2. Obtain a replacement module with the same unit code.
3. On the unit faceplate, remove the cables from the IF IN and IF OUT jacks.
4. Using a screwdriver, unlock the plug-in unit by pushing in and turning the locking screw counterclockwise, and then use the extractor tool to remove the unit from the shelf.
5. Within the unit, remove the cable between the IF filter output (P2) and the basic equalizer input (P1) (Figure 6).
6. Remove the screws holding the IF filter or basic equalizer module in place, and remove the module (Figure 6).
7. Install the replacement module using the screws just removed.
8. Reconnect the cable between the IF filter output (P2) and the basic equalizer input (P1).
9. Reinstall the plug-in unit into the shelf. Lock the plug-in by pushing in and turning the screw clockwise.
10. Reconnect the normal cables to the IF IN and IF OUT jacks.
11. This procedure is complete. Return to the instruction that referenced this procedure.

END OF PROCEDURE

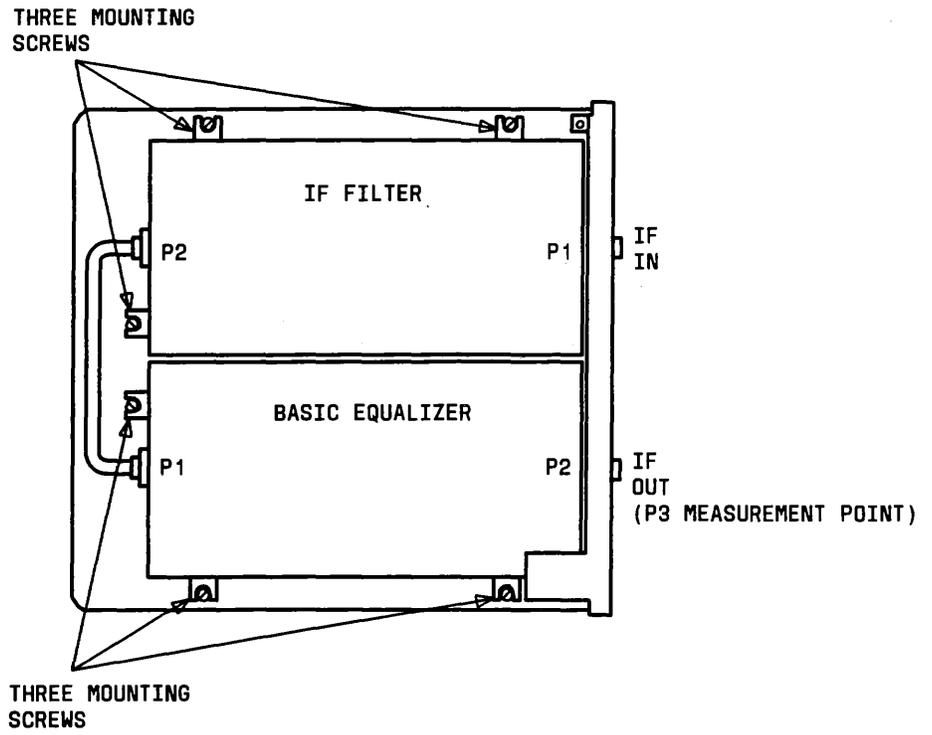


Figure 6-IF Filter and Basic Equalizer

6. IF AGC AMPLIFIER, ADAPTIVE SLOPE EQUALIZER, AND IF COMBINER

This procedure is used to replace the IF AGC AMPL unit, the ADAPTIVE SLOPE EQL unit, or the IF COMBINER unit.

The following tools are required for this procedure:

- 1 - Extractor tool (Item C10)
- 1 - Screwdriver (Item C7).

For tool recommendations and specifications, see the TEST EQUIPMENT AND ACCESSORIES tab under the TESTS AND ADJUSTMENTS tab.

Caution: *THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL SWITCHING OPERATION HAS BEEN PERFORMED.*

Warning: *To prevent ESD damage to a plug-in unit, ensure that all ESD precautions are followed.*

PROCEDURE

1. Verify that service is protected.
2. Obtain a replacement unit with the same code.
3. **Connect the ESD wrist strap to the ESD jack or a bare metal spot on the radio frame.**
4. On the unit faceplate, remove the cables from the IF IN (REG and DIV on the IF COMBINER) and IF OUT jacks.
5. Using a screwdriver, unlock the plug-in by pushing in and turning the screw counterclockwise. Use the extractor tool to remove the unit from the shelf. Place the unit in an ESD protective container.
6. **Warning: Misalignment of the plug-in unit in the shelf guides will cause backplane connector damage.**
Carefully align the replacement unit in the top and bottom shelf guides.
7. Slide the unit into the shelf and seat by applying pressure to the top and bottom of the unit. Lock the plug-in by pushing in and turning the screw clockwise.
8. Reconnect the cables to the IF IN (REG and DIV on the IF COMBINER) and IF OUT jacks.
9. On the unit, set the MAN/AUTO pushbutton to the AUTO (in) position.
10. This procedure is complete. Return to the instruction that referenced this procedure.

END OF PROCEDURE

7. RECEIVER POWER UNIT

This procedure is used to replace the RCVR PWR unit.

No test equipment or special tools are required for this procedure.

Caution: *THIS PROCEDURE WILL AFFECT SERVICE UNLESS THE PROPER MANUAL SWITCHING OPERATION HAS BEEN PERFORMED.*

Warning: *To prevent ESD damage to a plug-in unit, ensure that all ESD precautions are followed.*

PROCEDURE

1. Verify that service is protected.
2. Obtain a replacement unit with the same unit code.
3. **Connect the ESD wrist strap to the ESD jack or a bare metal spot on the radio frame.**
4. On the unit faceplate, operate the pushbutton switch to the STBY (out) position.
5. On the unit to be removed, simultaneously release the latch catch and pull the lever forward. Pull the lever down until the unit is released from the backplane connector.
6. Hold the unit at the top and bottom, and slide it out of the shelf. Place the unit in an ESD protective container.
7. On the replacement unit faceplate, verify that the pushbutton is in the STBY (out) position.
8. On the replacement unit, release the latch catch and pull the lever forward.
9. **Warning: Misalignment of the plug-in unit in the shelf guides will cause backplane connector damage.**
Carefully align the replacement unit in the top and bottom shelf guides.
10. Slide the replacement unit into the shelf until the bottom of lever clears the front of the shelf.
11. Seat the plug-in unit by simultaneously pushing up on the lever and applying light pressure to the top of the unit. Ensure that the latch catch has engaged the lever.
12. On the unit faceplate, operate the pushbutton switch to the RCVR ON (in) position.
Note: The green LED on the power unit should light.
13. This procedure is complete. Return to the instruction that referenced this procedure.

END OF PROCEDURE