Corrective Maintenance using Status Display Pages

16

Contents

Status Display Pages

Status display pages are the principle interface between the technician/operator and the Series II cellular system. They allow the technician to view system status, generate status reports, enter commands, and receive system responses.

Status display pages are graphical displays that represent the hardware and software subsystems of the cell site and also display a nearly real-time status of all the cell sites serving the Executive Cellular Processor (ECP). Fault conditions received by the ECP for any of the cell sites on the network are indicated at the top of the status display page via colors and flashing indicators. The technician may then bring up a visual display of the particular cell site that issued the fault condition.

Status display pages allow the ECP technician to: check the status of cell site hardware units, generate output reports on cell site hardware units, remove (deactivate), restore (activate), and switch cell site hardware units; and inhibit, allow, and run diagnostics on cell site hardware units. The commands entered using the status display page are entered at the command line at the bottom of the status display page.

This section addresses status display pages. In particular, it:

- Identifies and describes the major status display pages
- Gives directions for displaying them on the screen
- Identifies and describes the major indicators on the status display pages

2130 - Cell Site Status Summary Display Page

The 2130 - Cell Site Status Summary page (See Figure 16-1) provides overall summary status for each Cell Site.

2130 - Procedure to Analyze the 2130 - Cell Site Status Summary Page

- Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
- Open the 2130 - Cell Site Status Summary page.
- Analyze the overall status of each Cell Site or a specific Cell Site (See Figure 16-1, and Table 16-1).
- For more information about a specific Cell Site, use the page commands to navigate to the desired cell status display page. For details about other cell status display pages, refer to the appropriate section in this document.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00  mm/dd/yy hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR     IMS    CELL     CDN   CCS7   SYS NORM
 OVERLOAD SYS INH CU CU PERPH      LINK   MSC      DCS   TRUNK   OMP+LK
CMD<                             —— 2130 - Cell Site STATUS SUMMARY ——

                                                     (screen 1 of 3)
CMD       DESCRIPTION
s         SCREEN s OF 3              1-uneq  16-uneq  31-uneq  46-uneq  61-uneq
2131,c    Cell c Equipment Status    2-uneq  17-uneq  32-uneq  47-uneq  62-uneq
2132,c    Cell c Software Status     3-uneq  18-uneq  33-uneq  48-uneq  63-uneq
2133,c    Cell c VRG Status          4-uneq  19-uneq  34-uneq  49-uneq  64-init
SERIES 2 ONLY                        5-uneq  20-uneq  35-uneq  50-uneq  65-uneq
2133,c,sg,ant VR Status              6-uneq  21-uneq  36-uneq  51-uneq  66-uneq
2134,c    Cell c DS-1 Unit Status    7-uneq  22-uneq  37-uneq  52-uneq  67-uneq
2135,c    Cell c LC/SU/BC Status     8-uneq  23-uneq  38-uneq  53-uneq  68-uneq
2136,c    Cell c LAC Status          9-uneq  24-uneq  39-uneq  54-uneq  69-uneq
2137,c    Cell c OTU/LMT Status     10-uneq  25-uneq  40-uneq  55-uneq  70-uneq
2138,c    Cell CDMA Equip Status    11-act   26-uneq  41-uneq  56-uneq  71-uneq
2139,c,n  Cell c CCC n CCU Status   12-act   27-uneq  42-uneq  57-uneq  72-uneq
2235,c    Cell c DCCH Status        13-trbl  28-uneq  43-uneq  58-uneq  73-uneq
                                    14-uneq  29-uneq  44-uneq  59-uneq  74-uneq
401,c     OP:CELL c                 15-uneq  30-uneq  45-uneq  60-uneq  75-uneq
```

LEGEND
ant - PHYSICAL ANTENNA FACE
c - CELL NUMBER
n - CDMA CLUSTER CONTROLLER NUMBER
s - SCREEN NUMBER (REQUEST OTHER SCREENS BY ENTERING NUMBER AT CMD PROMPT). CELL SITES 76-150 ARE DISPLAYED ON SCREEN 2, AND 151-222 ON SCREEN)
sg - SERVER GROUP
VR - VOICE RADIO
VRG - VOICE RADIO GROUP

Figure 16-1. Example of 2130 - Cell Site Status Summary Page

Table 16-1. 2130 - Cell Site Status Summary Page Indicators

Summary State (Note)	Description
`uneq`	Cell Site unequipped in the RC/V `ceqcom2` (Series II) form.
`grow`	Cell is marked as growth in the RC/V `ceqcom2` (Series II) form.
`init`	Cell Site transient clear, stable clear, or boot initialization phase. Whether or not a cell phase is in progress is indicated by the video state of the `init` indicator: White on magenta—Cell phase is in progress Black on magenta—Cell phase is pending (scheduled, but not yet started).
`oos`	Both data links are out-of-service, or both reference generators are alarmed, or call processing has been inhibited.
`cpi`	Call processing is inhibited.
`trbl`	Trouble. At least one of the major cell hardware units is out-of-service, being initialized, or has a major alarm.
`ovld`	Cell experiencing processor overload.
`inh`	Inhibited. At least one Cell Site software controller is in the off-normal state.
<null>	(No state) Equipped, but run-time status is not known.
`arr_active`	Automatic radio reconfiguration (ARR) active for this Cell Site (no off-normal conditions).
`act`	Active Cell Site (no off-normal conditions).

Summary states are listed in order of condition priority from the top of this table (highest or most severe [`uneq`]) to bottom (lowest or least severe [`act`]). (If two or more reportable conditions exist for the same indicator, only the most important or most critical one as defined in this list order will be shown.)

2131 - Cell Equipment Status Display Page

The 2131 - Cell Equipment Status page (See Figure 16-2) provides a status summary of each unit or group of units. It also shows a status indicator for the activation of the CDMA spectrum swap feature.

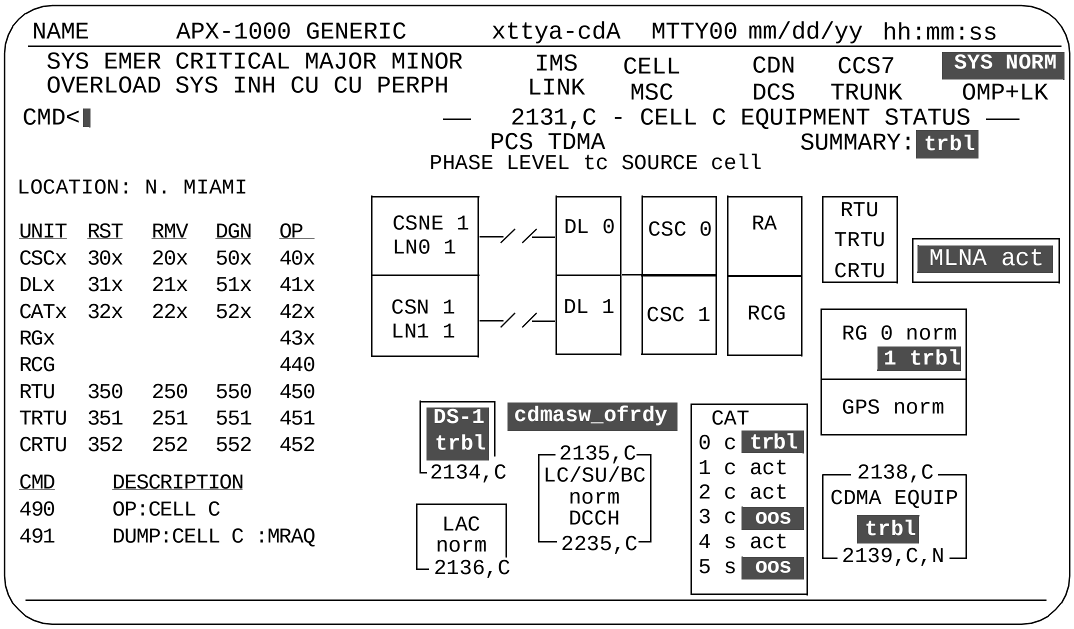
In addition, this page has maintenance commands to:

- Change the cell hardware configuration
- Generate a cell status output message report
- Dump the cell maintenance request administrator queue (MRAQ).

For an explanation of the 2131 - Cell Equipment Status page indicators, (see Table 16-2.

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 CDMA Spectrum SWAP Base Feature (401-613-001*)



NOTE 1: ALL UNITS FOR SERIES II CELL SITES CAN BE DISPLAYED IN THE equip STATE; THIS MEANS THAT THE UNIT IS EQUIPPED BUT ITS STATUS IS NOT YET KNOWN.

LEGEND

C - CELL SITE NUMBER
N - CDMA CLUSTER CONTROLLER NUMBER
x - UNIT NUMBER
LOCATION - DESTINATION ID FOR A PARTICULAR CELL OR DCS (TOWN/CITY)(11 CHARS MAX)

Figure 16-2. Example of 2131 - Series II Cell Site Equipment Status Page

Table 16-2. 2131 - Cell Equipment Status Page Indicators

Indicator	Description
CELL SUMMARY or SUMMARY	Indicates the summary state of the Cell Site. The state indicated will also appear on the 2130 - Cell Site Status Summary page. If any CDMA equipment or indicator is alarmed or troubled, the summary state will be trbl.
PCS TDMA	This indicator is displayed for TDMA PCS cells.
PHASE LEVEL	If present, shows current initialization activity for Cell Site. Possible phase activity: audit (audit invoked due to internal error); spp (single process purge); tc (phase 3, transient clear—all calls in setup, teardown, or handoff stage at Cell Site are released); sc (phase 4, stable clear—all calls at Cell Site are released, Cell Site is fully initialized, and Cell Site translations are updated from ECP copy); boot (phase 5, download to Cell Site RAM from ECP); bootie (phase 6, unconditional download—same as boot except errors are ignored during boot); sc-pb (partial boot following a stable clear); or <none> (no phase).
PHASE SOURCE	If present, indicates source of phase origination.Possible source: cell (Cell Site recovery software); clsi (Cell Site integrity process at ECP); dlrst (data link restore); ecp (ECP recovery software); link (data link maintenance); man (manual request); cpa/i (transient clear caused by manual allow/inhibit of call processing); or <none> (no phase).
CSN/CSNE	State of Cell Site node (CSN) / enhanced Cell Site node (CSNE).
DL 0/DL 1	Shows state of both Cell Site data links (0 and 1), if so equipped. Possible states: act (active); oos (out-of-service); dgn (diagnostic); init (initialized); uneq (unequipped).
CSC 0/CSC 1	State of Cell Site controller (CSC): act; stby (standby); oos; equip; uneq; or ovld (overload).
RG	State of the two RGs (reference generators 0 and 1); act; grow; uneq (for RG 1 in a SIIe, SIIm, or SIImm cell only); equip; stby; alarm.
GPS	State of Global Positioning System (GPS): norm; uneq; minor; major; critical.
CDMA EQUIP	Status of CDMA equipment (CCC, BBA, PP, and PAFs): norm (normal); trbl (if any CDMA equipment is OOS, or if the OOS limit per logical antenna face/carrier is exceeded); or uneq.

Table 16-2. 2131 - Cell Equipment Status Page Indicators (Contd)

Indicator	Description
DS-1	State of DS1 and/or digital facilities interface (DFI) boards: norm (normal—no DS1 or DFI boards are OOS or alarmed); or trbl (one or more DS1 or DFI boards are OOS or alarmed).The DS1 is a plug-in circuit board that supports 24 DS0 channels on a T1 trunk facility. The DFI is a plug-in circuit board that supports either 24 DS0 channels on a T1 trunk facility or 30 DS0 channels on an E1 trunk facility.
RA	State of voice radio (RA): norm (typically, no more than 25% of these units are OOS); alarm (alarmed, more than 25% of these units are OOS). The out-of-service threshold limits above can be changed/set by the service provider.
RTU	State of radio test unit (RTU): act (steady black on green), oos (steady black on red), uneq (steady magenta on black). Status is indicated by the unit's video state alone.
TRTU	State of TDMA radio test unit (TRTU): act (steady black on green), oos (steady black on red), uneq (steady magenta on black). Status is indicated by the unit's video state alone.
CRTU	State of CDMA radio test unit (CRTU): act (steady black on green), oos (steady black on red), uneq (steady magenta on black), grow (steady white on magenta). Status is indicated by the unit's video state alone
RCG	State of receiver calibration generator (RCG): act; uneq (for SIIe, SIIm, or SIImm cell only); or alarm. Valid equipage status for the RCGs is shown in the table.
LC/SU or LC/SU/BC DCCH	State of locate, setup, and/or beacon radios (LC/SU/BC): norm (no locate, setup, beacon, or DCCH radio is OOS); trbl (one or more locate, setup, beacon, or DCCH radios are OOS); arr_active (an automatic radio reconfiguration—ARR is in effect for one or more locate, setup, beacon, or DCCH radios).
MLNA	Displays the alarm summary or the equipped state of six Frame Receive Units (FRUs) and six Masthead Amplifier Units (MAUs). Valid states: uneq, alarm (when one or more FRUs and/or MAUs are out-of-service) and act (when all FRUs and MAUs are normal).

Table 16-2. 2131 - Cell Equipment Status Page Indicators (Contd)

Indicator	Description
CAT	State of clock and tone (CAT) board or CDMA synchronous clock and tone (SCT) board (0 - 5) (a c or an s displayed next to the number indicates a CAT board or an SCT board, respectively). Boards 4 and 5 can only be SCT boards. Possible states: act; stby; oos (if problem with TDM bus clocking); grow; trbl (if problem with CDMA clocking signals); or uneq. SCT boards 4 and 5 cannot be in the grow state; and CAT boards 0 and 1 cannot be in the uneq or grow state.
LAC	State of linear amplifier circuit (LAC): norm (no LAC is alarmed); alarm (one or more LACs are alarmed).
OTU/LMT	State of optical transceiver unit/ lightwave microcell transceiver (OTU/LMT). Red background—At least one OTU, or LMT, or OIF has a critical alarm. Yellow background—At least one OTU, or LMT, or OIF has a major alarm, and none has a critical alarm. Cyan background—At least one OTU, or LMT, or OIF has a minor alarm, and none has a critical or major alarm.
cdmasw	The CDMA swap status indicator summarizes the activation of the CDMA spectrum swap feature. The current status is indicated by its video state and displayed text. The video states and text are: cdmasw off:steady black on white—CDMA spectrum is swapped off. no cdmasw:steady white on black—The cell does not participate in spectrum swap. cdmasw oncmp:blinking black on white—Camp-on phase in progress to CDMA ON. cdmasw onrdy:blinking black on white—Ready to sequence to CDMA ON. cdmasw on:steady black on white—CDMA spectrum is swapped on. cdmasw ofcmp:blinking black on white—Camp-on phase in progress to CDMA OFF. cdmasw ofrdy:blinking black on white—Ready to sequence to CDMA OFF. cdmasw indtm:steady white on black—Indeterminate. cdmasw invld:steady white on black—CDMA spectrum swap invalid.

2131 - Removing Cell Site Units

You can use the 2131 - Cell Equipment Status page (See Figure 16-2) to conditionally remove Cell Site units from service.

The conditional remove maintenance action changes the state of a maintenance unit from active or standby to out-of-service. It schedules an event or process to place the specified maintenance unit to out-of-service assuming that by doing so does not cause calls to be dropped or service denied to a user.

NOTE:
You can use the 2131 - Cell Equipment Status page to *unconditionally* remove Cell Site units from service by typing, **ucl** at the end of the input you type at the CMD< prompt. Be aware that unconditional remove requests may be service affecting.

2131 - Procedure to Remove a Cell Site Unit

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2131 - Cell Equipment Status page by entering command **2131,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To remove the...	enter...
CSC (Cell Site controller)	**20** followed by the CSC number (0-1) and press **RETURN**.
DL (data links) press	**21** followed by the data link number (0-1) and **RETURN**.
CAT or SCT (clock and tone) units	**22** followed by the CAT (or SCT) number (0-5) and press **RETURN**.
RTU (AMPS radio test unit)	**250** and press **RETURN**.
TRTU (TDMA radio test unit)	**251** and press **RETURN**.
CRTU (CDMA radio test unit)	**252** and press **RETURN**.

NOTE:
This ends the procedure for using the 2131 page to conditionally remove Cell Site units from service

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:
RMV:CELL 1 CSC 0, COMPLETED

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX Cellular Telecommunications Systems System 1000 Series II Cell Site Description, Operation, and Maintenance* (401-660-100)

2131 - Restoring Cell Site Units

You can use the 2131 - Cell Equipment Status page (See Figure 16-2) to conditionally restore Cell Site units to service.

Except for a unit that is already out-of-service or in the growth state, the first step in a *conditional restore* maintenance action is the automatic execution of a *conditional remove*. Therefore, all the restrictions associated with a conditional remove are also associated with a conditional restore.

NOTE:
You can use the 2131 - Cell Equipment Status page to *unconditionally* restore Cell Site units from service by typing, **ucl** at the end of the input you type at the CMD< prompt. Be aware that unconditional restore requests may be service affecting.

2131 - Procedure to Restore a Cell Site Unit

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2131 - Cell Equipment Status page by entering command **2131,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To restore the...	enter...
CSC (Cell Site controller)	**30** followed by the CSC number (0-1) and press **RETURN**.
DL (data links) press	**31** followed by the data link number (0-1) and **RETURN**.
CAT or SCT (clock and tone) units	**32** followed by the CAT (or SCT) number (0-5) and press **RETURN**.
RTU (AMPS radio test unit)	**350** and press **RETURN**.

2131 - Diagnosing Cell Equipment

You can use the 2131 - Cell Equipment Status page (See Figure 16-2) to diagnose specific Cell Site units.

The diagnose maintenance action can be applied to a unit in the out-of-service or growth state, to a redundant unit in the standby state, or to a redundant unit in the active state. In the latter case, the cell initiates a switch before executing the diagnose request.

In addition, the diagnose maintenance action can be applied to a CRTU, CCC, or CCU in the active state. The first step in a diagnose maintenance action for an active CCC, CCU, or CRTU is the automatic execution of a *conditional remove*.

NOTE:
For redundant units, if the targeted unit is in the active state but the mate is out-of-service, the diagnose aborts with no action taken.

The following Series II Cell Site units cannot be diagnosed:

- LAC - linear amplifier circuits
- RCG - receiver calibration generator (See Table 16-3)
- RG - reference generators (See Table 16-4)

.

Table 16-3. Valid Equipage Status for Receiver Calibration Generator

Cell Type	Receiver Calibration Generator	
	uneq	**equip**
Series II	No	Yes
SIIm	Yes	No
SIImm	Yes	No
SIIe	Yes	Yes

Table 16-4. Valid Equipage Status for Reference Generators 0 and 1

Cell Type	Reference Generator 0		Reference Generator 1	
	uneq	**equip**	**uneq**	**equip**
Series II	No	Yes	No	Yes
SIIm	No	Yes	Yes	Yes
SIImm	No	Yes	Yes	Yes
SIIe	No	Yes	Yes	Yes

2131 - Procedure to Diagnose Cell Equipment

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2131 - Cell Equipment Status page by entering command **2131,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To diagnose the...	enter...
CSC (Cell Site controller)	**50** followed by the CSC number (0-1) and press **RETURN**.
DL (data links) press	**51** followed by the data link number (0-1) and **RETURN**.
CAT or SCT (clock and tone) units	**52** followed by the CAT (or SCT) number (0-5) and press **RETURN**.
RTU (AMPS radio test unit)	**550** and press **RETURN**.
TRTU (TDMA radio test unit)	**551** and press **RETURN**.
CRTU (CDMA radio test unit)	**552** and press **RETURN**.

NOTE:
This ends the procedure for using the 2131 page to diagnose specific Cell Site units.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 CSC 0, COMPLETED, ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2131 - Generating Cell Equipment Status Reports

You can use the 2131 - Cell Equipment Status page (See Figure 16-2) to generate status output message reports on Cell Sites and Cell Site units.

2131 - Procedure to Generate Cell Equipment Status Reports

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2131 - Cell Equipment Status page by entering command **2131,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

For status on a...	enter...
CSC (Cell Site controller)	**40** followed by the CSC number (0-1) and press **RETURN**.
DL (data links)	**41** followed by the data link number (0-1) and press **RETURN**.
CAT or SCT (clock and tone) units	**42** followed by the CAT (or SCT) number (0-5) and press **RETURN**.
RG (reference generator)	**43** followed by the RG number (0-1) and press **RETURN**.
RCG (receiver calibration generator)	**440** and press **RETURN**.
RTU (AMPS radio test unit)	**450** and press **RETURN**.
TRTU (TDMA radio test unit)	**451** and press **RETURN**.
CRTU (CDMA radio test unit)	**452** and press **RETURN**.
Cell Site	**490** and press **RETURN**.
MRAQ	**491** and press **RETURN**.

NOTE:
This ends the procedure for using the 2131 page to generate status output message reports on Cell Sites and Cell Site units.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

OP:CELL 1 CSC 0, OOS, MANUAL, DGN

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2132 - Cell Software Status Display Page

The 2132 - Cell Software Status page (See Figure 16-3) provides software status indicators and allow/inhibit page commands for the following Cell Site software processes:

- Audits
- Audit/HEH (hardware error handler) output
- Boot (initialization)
- Call processing
- Forward setup channel control
- Routine functional tests
- Interrupts
- Phase monitoring
- Routine diagnostics
- Diversity error imbalance output.

2132 - Allowing/Inhibiting Cell Software Processes

You can use the 2132 - Cell Software Status page to allow/inhibit the following Cell Site software processes (See Figure 16-3):

- Audits
- Audit/HEH (hardware error handler) output
- Boot (initialization)
- Call processing
- Forward setup channel control
- Routine functional tests

- Interrupts
- Phase monitoring
- Routine diagnostics
- Diversity error imbalance output.

In addition, this display page has a command to generate a cell status output message report.

Inhibiting a Cell Site software process causes the affected cell to send an off-normal alarm to the ECP. (A steady black on white CELL status indicator on the status display pages means that at least one Cell Site in the system is in the inh state.) A subsequent allowing of the Cell Site software process causes the affected cell to send an “all clear” message to the ECP, thereby clearing the cell off-normal alarm at the ECP.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR        IMS   CELL  CDN   CCS7    SYS NORM
 OVERLOAD SYS INH  CU  CU PERPH       LINK  MSC   DCS   TRUNK    OMP+LK
CMD<
                                       — 2132,c - CELL c SOFTWARE STATUS —
 ALW               INH                 STATUS     FUNCTION
 701,<audit>       601,<audit>         alw  inh   Audits
 702/708           602/608             alw  inh   Audit/HEH Output
 703               603                 alw  inh   Boot
 704               604                 alw  inh   Call Processing **
 705               605                 alw  inh   Forward Setup Channel Control
 706,<*>           606,<*>             alw  inh   Function Tests
 707,<CSC >        607,<CSC >          alw  inh   Interrupts
 709               609                 alw  inh   Phase Monitor
 710               610                 alw  inh   Routine Diagnostics
 711               611                 alw  inh   DIVERR Output

CMD   DESCRIPTION                 * Functional Tests: lc|su|ant|dcch|oc|tp
490   OP:CELL   c                ** This function is service affecting!
```

LEGEND

```
c       -   CELL SITE NUMBER
STATUS  -   SUMMARY (ALW OR INH) OF FUNCTION LISTED AT RIGHT
```

Figure 16-3. Example of 2132 - Series II Cell Site Software Status Page - ECP Release 9.0

2131 Procedure to Allow/Inhibit Cell Software Processes

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2132 - Cell Software Status page by entering command **2132,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To allow/inhibit...	enter...
audits	**701,**followed by the name of the audit to allow, or **601,**followed by the name of the audit to inhibit and press **RETURN**.
audit output	**702** to allow or **602** inhibit audit output and press **RETURN**.
HEH output	**708** to allow or **608** inhibit and press **RETURN**.
boot (initialization)	**703** to allow or **603** to inhibit and press **RETURN**.
call processing	**704** to allow or **604** to inhibit and press **RETURN**.
forward setup channel control	**705** to allow or **605** to inhibit and press **RETURN**.
routine functional tests	**706,** followed by **lc**, **su**, **ant**, **lmt**, **dcch**, **oc**, or **tp** to allow, or **606,** followed by **lc**, **su**, **ant**, **lmt**, **dcch**, **oc**, or **tp** to inhibit and press **RETURN**.
interrupts or	**707,**followed by the CSC number (0-1) to allow, **607,**followed by the CSC number (0-1) to inhibit and press **RETURN**.
phase monitor	**709** to allow or **609** to inhibit and press **RETURN**.
routine diagnostics	**710** to allow or **610** to inhibit and press **RETURN**.
DIVERR output	**711** to allow or **611** to inhibit and press **RETURN**.

NOTE:
For a Cell Site status output message report, enter **400** and press **RETURN**.

NOTE:
This ends the procedure for using the 2132 page to allow/inhibit various Cell Site software processes.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

INH:CELL 1 RTDIAG COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2133 - Cell Voice Radio (VR) Status Display Page

The 2133 - Series II Cell VR Status page (See Figure 16-4, and Table 16-5) displays the summary state of each voice radio (See Table 16-6) at a specified Cell Site. This page also displays the number of the DCS serving the Cell Site, and the Cell Site trunk groups associated with each of the logical antenna faces. Each logical antenna face is identified by server group (SG) and physical antenna face (ANT).

This display page applies to AMPS and TDMA but not CDMA.

In addition, this page has maintenance commands to:

- Conditionally or unconditionally remove and restore radios
- Diagnose radios
- Conditionally or unconditionally remove server group antennas
- Conditionally restore server group antennas
- Diagnose server group antennas
- Generate server group antenna status message output reports.

An AMPS radio (RCU or SBRCU) having a voice radio personality may also have a beacon radio personality. Thus, an RCU or SBRCU can serve two functions concurrently: (1) carry an over-the-air AMPS call and (2) provide signal strength measurements for the TDMA mobile-assisted handoff (MAHO) procedure. Since the RF carrier power level remains fixed for beacon radios, the dual-personality RCU or SBRCU is ineligible for dynamic power control.

A TDMA radio (DRU or EDRU) provides a basic modulation efficiency of three user channels per 30-kHz of bandwidth. A 30-kHz channel is subdivided into six timeslots (1 - 6) for TDMA transmissions. Timeslots 1 and 4 form user channel 1, timeslots 2 and 5 form user channel 2, and timeslots 3 and 6 form user channel 3. A *logical* TDMA radio on the 2133 page is identified by radio and user-channel number separated by a hyphen (radio_number-user_channel_number).

A DRU or EDRU carrying a TDMA digital control channel (DCCH) and/or beacon channel always has its RF carrier turned on and set at a fixed power level A TDMA beacon channel can double as a digital traffic (voice) channel, but the RF carrier power level remains fixed—no dynamic power control is allowed.

Table 16-5. 2133 - Series II Cell VR Status Page Radio Maintenance Indicators

Indicator	Description
DCS	Identity of the serving DCS (1 - 16).
SG	Identity of server group (0 or 1).
ANT	Identity of physical antenna face (0 - 6).
PCS TDMA	This indicator is displayed for TDMA PCS cells.
RADIO	Identity of Series II cell voice radio (0 - 191). Logical TDMA radios are identified by radio and user-channel number (radio_number-user_channel_number).
CHNL	Voice radio channel number (1 - 1023). (Also see RADIO description above.)
BLK	Indicates whether the Cell Site has blocked access to this trunk/voice channel: blocked: Indicated by yes. unblocked: No display (normal).
TG	Identity of the trunk group (1 - 2000 for 5ESS-2000 Switch DCS; 18 - 254 for DEFINITY Switch DCS).

Table 16-5. 2133 - Series II Cell VR Status Page Radio Maintenance Indicators (Contd)

Indicator	Description
MEM	Identity of the trunk member (1 - 1951). The summary state for the trunk member is indicated by its video state: grow (white on magenta): Trunk can be tested, but not used for call processing. idle (white on black): Normal state when not handling calls. busy (black on green): Normal state when in use for call processing. tran (white on red): Transient audit state - In the process of changing state, one that cannot be obtained immediately. gard (white on red): Placed on guard timing after an abnormal termination in call processing. After guard timing expires, the trunk is restored to the idle state. aud (white on magenta): Trunk is being audited, or waiting for periodic reset. reset (white on red): Periodic reset - Recovery from suspected hardware trouble. oos (black on red): Removed from service, or maintenance busy. uneq (magenta on black): Unequipped
B	Identifies a radio as a Beacon radio.
b	Identifies the radio as a logical replacement for a failed (automatic radio reconfiguration [ARR]) Beacon radio.
D	Indicates that the DRU or EDRU associated with the voice channel displayed also carries a DCCH.
d	Indicates that the DRU or EDRU associated with the displayed voice channel is replacing a DCCH DRU or EDRU due to ARR. ARR is performed using radios of the same *hardware type*, that is, a DRU will only be replaced by another DRU, and an EDRU will only be replaced by another EDRU.
l	Identifies the radio as a logical replacement for a failed (ARR) analog Locate radio.
s	Identifies the radio as a logical replacement for a failed (ARR) Setup radio.

```
CITY      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy hh:mm:ss ZONE
 SYS EMER CRITICAL MAJOR MINOR    IMS    CELL     CDN    CCS7   SYS NORM
 OVERLOAD SYS INH  CU CU PERPH    LINK   MSC      DCS    TRUNK   OMP+LK
CMD<
                                    — 2133,52,0,5 —      DCS    11  SG   0
                               PCS TDMA (screen s of 20) Cell   52  ANT  5

CMD      DESCRIPTION       RADIO   CHNL BLK  TG  MEM  RADIO   CHNL BLK  TG  MEM
s        SCREEN s of 20    0       396  YES  100 10    15-1   600       184 30
                           1       558  YES  100 21    15-2   600       184 52
200,r    RMV r             2B      432       100 13    15-3   600       184 14
201,r    RMV r; UCL        3       474  YES  100 15    18-1   642       184 36
202      RMV SG ANT        4       516       100 24    18-2   642       184 45
203      RMV SG ANT UCL    5       390       100 35    18-3   642       184 54
300,r    RST r             6       369  YES  100 46    19-1B  584       184 43
301,r    RST r; UCL        7       453       100 17    19-2B  584       184 39
302      RST SG ANT        8-3     537       184 38    19-3B  584       184 58
303      RST TG MEM ALL    9-1D    579       184 60    20-1   621       184 50
402      OP: SG ANG        10-1    590       184 40    20-2   621       184 51
500,r    DGN r             11-2    512       184 11    20-3   621       184 41
502      DGN SG ANT        12-1D   542       184 19    21-1   663       184 56
                           13-2    568       184 22    22-1   669       184 48
                           14-3    594       184 25    23-2   675  YES  184 29
```

NOTE: LOCAL POKE COMMANDS 202, 203,AND 502 WILL NOT FUNCTION FOR TDMA RADIOS ON AN SG AND ANT FACE. HOWEVER, THE CORRESPONDING TI COMMANDS FOR THESE LOCAL POKES WILL WORK ONLY FOR INDIVIDUAL TDMA RADIOS, BUT NOT THE WHOLE SG.

LEGEND

ANT — ANTENNA
B — BEACON RADIO
d, D — DCCH RADIO TYPE
DCS — THE SERVING DCS FOR THIS CELL
r — RADIO NUMBER (SERIES II CELL VOICE/BEACON/DCCH RADIO NUMBER)
s — SCREEN NUMBER (REQUEST OTHER SCREENS BY ENTERING NUMBER AT CMD PROMPT)
SG — SERVER GROUP (SG)

Figure 16-4. Computer Terminal Screen: 2133 - Series II Cell VR Status Page

.

Table 16-6. 2133 - Series II Cell VR Status Page Radio Indicator

Status	Color Terminal	Black & White Terminal
`active`	steady black on green	steady white on black
`out-of-service`	steady black on red	steady black on white
`warning`	black on yellow	black on white
`equipped`	steady white on black	steady white on black
`unequipped`	steady magenta on black	steady white on black
`growth`	steady white on magenta	steady white on black
`unav`	steady black on red	steady black on white
`arr_active`	steady green on black	steady white on black

2133 - Removing/Restoring/Diagnosing Radios & Server Group Antennas

You can use the 2133 - Series II Cell VR Status page (See Figure 16-4, and Table 16-5) to remove restore and diagnose radios and server group antennas.

The 202, 203, and 502 page commands do not work for TDMA radios on a server group and antenna face.

2133 Procedure to Remove/Restore/Diagnose Radios/Server Group Antennas

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2133 - Series II Cell VR Status page by entering command **2133,***c***,***sg***,***ant* or **2133,***c***,***r* (where *c* is the Cell Site number, *sg* is the server group number, *ant* is the physical antenna face number, and *r* is the radio number).
3. At the CMD< line,

To...	enter...
Conditionally remove a radio	**200,** followed by the radio number (0-191) and press **RETURN**.
Unconditionally remove a radio	**201,** followed by the radio number (0-191) and press **RETURN**.

Conditionally remove a server group antenna	**202** and press **RETURN**.
Unconditionally remove an SG antenna	**203** and press **RETURN**.
Conditionally restore a radio	**300,** followed by the radio number (0-191) and press **RETURN**.
Unconditionally restore a radio	**301,** followed by the radio number (0-191) and press **RETURN**.
Conditionally restore a server group antenna	**302** and press **RETURN**.
Generate a server group antenna status output message report	**402** and press **RETURN**.
Diagnose a radio press violate	**500,** followed by the radio number (0-191) and **RETURN** (provided that doing so does not maintenance action rules; for
Diagnose a server group antenna face	**502** and press **RETURN**.

NOTE:
This ends the procedure for using the 2133 page to remove, restore, and diagnose radios and server group antennas.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 RA5UC1 COMPLETED CONDITIONAL ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2134 - Cell DS-1 Unit Status Display Page

The 2134 - Cell DS-1 Unit Status page (See Figure 16-5, and Table 16-7) displays the summary state of the cell DS1 and/or DFI units.

In addition, this page has maintenance commands to:

- Conditionally remove and restore DS1/ DFI units
- Diagnose DS1/ DFI units
- Generate DS1/ DFI status message output reports
- Generate Cell Site status message output report.

The DS1 plug-in circuit board performs serial-to-parallel and parallel-to-serial data conversion between the T1 lines and the time-division multiplexed (TDM) buses that connect the primary RCF to the growth RCFs. The DS1 boards provide the T1 (1544 kbit/s) connectivity to the DCS.

NOTE:
TDM buses are always installed "red stripe up."

The DFI plug-in circuit board performs serial-to-parallel and parallel-to-serial data conversion between the T1 lines and the TDM buses that connect the primary RCF to the growth RCFs. A DFI may reside in any slot reserved for the DS1.

Unlike the DS1, which can terminate only one T1 line, the DFI can terminate up to two T1 lines, although only one termination is currently supported. In addition, the DFI can be configured to terminate E1 (2048 kbit/s) lines.

When equipping a DS1 or DFI board using RC/V, both boards are given a “DS1” logical unit number. DS1 logical unit numbers range from 0 - 13.Mixing of T1 and E1 channels is not allowed. A cell must either have all T1 channels or all E1 channels.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy hh:mm:ss
SYS EMER  CRITICAL MAJOR  MINOR   IMS   CELL CDN       CCS7    SYS NORM
OVERLOAD  SYS INH  CU    CU PERPH LINK  MSC DCS TRUNK          OMP+LK
CMD<                                    — 2134,c - CELL c DS-1 STATUS

UNIT    RST  RMV  DGN  OP          DS-1  STATE   BOARD TYPE  LINE RATE
DS-1xy 3xy 2xy 5xy 4xy              0    act       DS1          T1
                                    1    act       DS1          T1
                                    2    act       DFI          T1
                                    3    oos       DFI          T1
                                    4    act       DFI          T1
CMD     DESCRIPTION                 5    alarm     DFI          T1
2130    CELL Status Summary         6    grow      DFI          T1
2131,c  CELL c Equipment Status     7    grow      DFI          T1
490     OP:CELL c                   8    uneq
                                    9    uneq
                                   10    uneq
                                   11    uneq
                                   12    uneq
                                   13    uneq
```

LEGEND
c - CELL SITE NUMBER
xy - UNIT NUMBER

Figure 16-5. Example of 2134 - Series II Cell Site DS-1 Unit Status Page

Table 16-7. 2134 - Cell DS-1 Unit Status Page Indicators

Indicator	Description
DS-1	Unit numbers.
STATE	The summary state for a DS1 or DFI unit: equip, act, oos, uneq, grow, or alarm state.
BOARD TYPE	The board type used to provide trunks between the cell and the MSC: DS1- Circuit board supports the 24 DS0 channels on a T1 trunk facility. DFI - Circuit board supports either the 24 channels on a T1 trunk facility or 30 DS0 channels on an E1 trunking facility. The DFI is required for CDMA operation.
LINE RATE	The type of facility: T1—Voice/data trunk facility - carries 24 duplex channels via 64-kbps time slices. E1—Voice/data trunk facility - carries 30 duplex channels via 64-kbps time slices.

2134 - Removing/ Restoring/ Diagnosing or Generating a Status Report for DS1/DFI Units

You can use the 2134 - Cell DS-1 Unit Status page (See Figure 16-5, and Table 16-7) to remove, restore, diagnose, or generate a status output message report for DS1/ DFI units.

2134 Procedure to Remove/Restore/Diagnose or Generate a Status Report for DS1 or DFI Unit

1. Select **ECP Control & Display** from the **AUTOPLEX(R)System 1000 ECP Access** menu.
2. Open the 2134 - Cell DS-1 Unit Status page by entering command **2134,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To..	enter...
Conditionally restore a DS1/ DFI unit	**3** followed by the DS1 logical unit number (0-13) and press **RETURN**.
Conditionally remove a DS1/ DFI unit	**2** followed by the DS1 logical unit number (0-13) and press **RETURN**.
Diagnose a DS1/ DFI unit	**5** followed by the DS1 logical unit number (0-13) and press **RETURN**.
Generate a DS1/ DFI unit status output message report	**4** followed by the DS1 logical unit number (0-13) and press **RETURN**.
Generate a cell status output message report	**490** and press **RETURN**.

NOTE:
This ends the procedure for using the 2134 page to remove, restore, diagnose, or generate a status output message report for DS1/ DFI units.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 DS1 13 COMPLETED ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2135 -Cell LC SU / BC Status Display Page

The 2135 - Cell LC/SU/BC Status page (See Figure 16-6, Figure 16-7 and Table 16-8) displays the summary state of the cell locate, setup, and beacon radios. There are two screens: one to show the status of locate and beacon radios, and another to show the status of setup and beacon radios.

The locate radios screen version has commands to:

- Conditionally remove and restore LC radios
- Diagnose LC radios
- Generate LC radios status message output reports.

The setup radios screen version has commands to:

- Conditionally remove and restore SU radios
- Diagnose SU radios
- Generate SU radios status message output reports.

In addition, all screen versions allow you to generate Cell Site status message output reports.

AMPS setup and analog locate radios are simply RCUs or SBRCUs configured to perform setup and analog locate channel functions. Normally, at startup, two setup radios (one active and one standby) and two locate radios (both active) are used.

Setup radios perform the receive and transmit functions required to set up an AMPS or TDMA call,* but not a CDMA call. CDMA uses its own control channels to set up a CDMA call.

Analog locate radios, which receive but do not transmit, assist only in the handoff of an AMPS call. As explanation, a handoff decision for an AMPS call is based on Cell Site measurements of signal strengths received from the mobile station. In contrast, the handoff decision for a TDMA or CDMA call is based on mobile

* Unless the Cell Site has the TDMA digital control channel (DCCH) feature, in which case the DCCH is used to set up calls for IS-136 compliant TDMA/AMPS dual-mode mobiles.

measurements of signal strengths received from radios at neighboring sites. This latter type of handoff is referred to as mobile-assisted handoff (MAHO).

A feature known as the *digital verification color code (DVCC) verification feature* can ensure a high success rate for the TDMA MAHO procedure. For this feature, there is a digital locate radio (L-DRU) available to each physical antenna face, or sector, neighboring the serving face. (An L-DRU can carry one, two, or three digital locate channels.) Both analog and digital locate radios (L-RCUs, L-SBRCUs, L-DRUs) for the cell are displayed on the 2135 page.

Beacon radios (B-DRUs, B-EDRUs), which may also be realized by analog voice radios (V-RCUs, V-SBRCUs), are instrumental in the TDMA MAHO procedure. A beacon radio has its transmitter On all the time and transmits at a fixed power level. Beacon radios may also carry voice (traffic) channels.

For the TDMA MAHO feature, there is one beacon or beacon-like* radio associated with each physical antenna face, or sector, neighboring the serving face. The Cell Site sends a list of MAHO channels associated with the neighboring faces to the TDMA/AMPS dual-mode mobile assigned to a TDMA digital traffic channel. The dual-mode mobile periodically measures the strength of the MAHO channels (as well as the strength and bit error rate of the serving TDMA digital traffic channel) and reports the results to the serving cell. It is from these measurements that the serving cell decides whether a neighboring face can better serve the call.

* AMPS setup radios and TDMA digital control channel (DCCH) radios qualify as beacon-like radios because they have their transmitters On all the time and transmit at fixed power levels. The RF operating frequencies of the beacon and beacon-like radios together constitute the *MAHO channels*.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy  hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR    IMS    CELL     CDN   CCS7   SYS NORM
 OVERLOAD SYS INH  CU CU PERPH    LINK   MSC      DCS   TRUNK  OMP+LK
CMD<
                                 — 2135,c - Cell c LC/SU/BC STATUS —
                                  PCS TDMA
 UNIT      RST  RMV  DGN   OP    Locate Radios
 LCxy      3xy  2xy  5xy   4xy    0   1   2                     7
 LCxy ORIG 6xy       7xy

  CMD   DESCRIPTION                                      25
 s      SCREEN s of 2             30             34  35
 2130   CELL Summary
 2131,c CELL c HW Stat
 490    OP:CELL ???
 Beacon Radios
  0  1                        5
  6
```

LEGEND

xy - LOCATE RADIO UNIT NUMBER
c - CELL SITE NUMBER
HW - HARDWARE

Figure 16-6. Example of 2135 - Series II Cell Site LC/SU/BC Status Page (Locate Radio Version)

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy  hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR    IMS    CELL     CDN   CCS7   SYS NORM
 OVERLOAD SYS INH  CU CU PERPH    LINK   MSC      DCS   TRUNK  OMP+LK
CMD<
                                 -- 2135,c - Cell c LC/SU/BC STATUS --
                                  PCS TDMA
 UNIT       RST   RMV  DGN   OP   ┌ Setup Radios ──────────────────────┐
 SUxy       3xy   2xy  5xy   4xy  │ 0   1                 5            │
 SUxy ORIG  6xy        7xy        │                              17  18│
                                  │                                    │
  CMD   DESCRIPTION               │             33  34  35             │
 s      SCREEN s of 2             │                                    │
 2130   CELL Summary              │                                    │
 2131,c CELL c HW Stat            │                                    │
 490    OP:CELL ???               └────────────────────────────────────┘
┌Beacon Radios──────────────┐
│                          5│
│ 0  1                      │
│ 6                         │
│                           │
└───────────────────────────┘
```

LEGEND

xy - SETUP RADIO UNIT NUMBER
c - CELL SITE NUMBER
HW - HARDWARE

Figure 16-7. Example of 2135 - Series II Cell Site LC/SU/BC Status Page Setup Radio Version)

Table 16-8. 2135 - Cell LC/SU/BC Status Page Indicators

Indicator	Description
PCS TDMA	This indicator is displayed for TDMA PCS cells.
`Radio Unit Summary States`	The summary state for each radio type is indicated by its video display (color) state alone. The following is a list of the video summary states for each radio type: Locate Radios — `uneq`, `grow`, `indetmt` (indeterminate), `act`, `oos`, `arr_active`, or `arr_oos` Setup Radios— `uneq`, `grow`, `indetmt`, `act`, `stby`, `oos`, `arr_active`, or `arr_oos` Beacon Radios (see note)— `uneq`, `indetmt`, `warn` (the radio has some problem but beacon transmitter is still operational), `act`, `oos`, `arr_active`, `arr_warning`, or `arr_oos`.
`Video Display States`	Possible video display states for the radio indicators are as follows: `uneq` (blank—only equipped units are displayed on this page) `grow` (white/magenta) `indetmt` (white/black) `act` (black/green) `oos` (black/red) `stby` (white/blue) `warn` (black/yellow) `arr_active` (green/black) `arr_oos` (white/red) `arr_warning` (blue/yellow).
Be aware that because AMPS setup and TDMA DCCH radios have their transmitters On all the time and transmit at fixed power levels, they too may serve as beacon-like radios. However, beacon-like radios will *not* show in the *Beacon Radios* box of the 2135 status display page; only digital beacon radios (B-DRUs, B-EDRUs) or analog voice radios (V-RCUs, V-SBRCUs) configured as beacon radios will appear in that box.	

2135 - Removing/ Restoring/ Diagnosing or Generating a Status Report for Locate or Setup Radios

You can use the 2135 - Cell LC/SU/BC Status page (See Figure 16-6, Figure 16-7 and Table 16-8) to remove, restore, diagnose, or generate a status output message report for locate or setup radios.

2135 Procedure to Remove/Restore/Diagnose or Generate a Status Report for Locate or Setup Radios

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2135 - Cell LC/SU/BC Status page by entering command **2135,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To...	enter...
conditionally restore a locate radio	**3** followed by the locate radio number (0-39) and press **RETURN**.
conditionally remove a locate radio	**2** followed by the locate radio number (0-39) and press **RETURN**.
diagnose a locate radio	**5** followed by the locate radio number (0-39) and press **RETURN**.
generate a locate radio status output message report	**4** followed by the locate radio number (0-39) and press **RETURN**.
conditionally restore a setup radio	**6** followed by the setup radio number (0-7 or 0-35 with directional setup) and press **RETURN**.
conditionally remove a setup radio	**7** followed by the setup radio number (0-7 or 0-35 with directional setup) and press **RETURN**.
diagnose a setup radio	**9** followed by the setup radio number (0-7 or 0-35 with directional setup) and press **RETURN**.
generate a setup radio status output message report	**8** followed by the setup radio number (0-7 or 0-35 with directional setup) and press **RETURN**.
generate a cell status output message report	**490** and press **RETURN**.

NOTE:
This ends the procedure for using the 2135 page to remove, restore, diagnose, or generate a status output message report for locate or setup radios.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 LC 39 COMPLETED ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2136 - Cell LAC Status Display Page

The 2136 - Cell LAC Status page (See Figure 16-8) displays the summary state of all LACs at the cell. There is also a page command (400) for generating a Cell Site status output message report.

A LAC may be in one of four possible summary states: equip, norm, alarm, or uneq.

```
 NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy  hh:mm:ss
  SYS EMER CRITICAL MAJOR MINOR     IMS    CELL     CDN   CCS7   SYS NORM
  OVERLOAD SYS INH  CU CU PERPH     LINK   MSC      DCS   TRUNK  OMP+LK
 CMD<
                                   —— 2136,c - Cell c LAC STATUS ——
 CMD   DESCRIPTION               0-norm    8-norm   16-norm   24-uneq
2130   CELL Status Summary       1-norm    9-norm   17-norm   25-uneq
2131,c CELL c Equipment Status   2-norm   10-norm   18-norm   26-uneq
                                 3-norm   11-alarm  19-norm   27-uneq
400    OP:CELL c                 4-norm   12-norm   20-norm   28-uneq
                                 5-norm   13-norm   21-uneq   29-uneq
                                 6-norm   14-norm   22-uneq   30-uneq
                                 7-norm   14-norm   23-uneq   31-uneq
```

LEGEND

c - CELL SITE NUMBER

Figure 16-8. Example of 2136 - Series II Cell Site LAC Status Display Page

2137 - Cell OTU/LMT Status Display Page

The 2137 - Cell OTU/LMT Status page (See Figure 16-9, and Table 16-9) displays the alarm state of all optical transceiver unit/lightwave microcell transceivers (OTU/LMTs) and the summary state of the optical interface frames (OIFs) at the cell. There is also a page command (400) for generating a Cell Site status output message report.

The OTU and LMT are basic hardware components of the *fiber-link microcell system*, which is a low-power RF system that attaches to a host cell such as the Series II Cell Site (often referred to as a *macrocell*) to provide coverage from perhaps a few hundred feet (60 meters) up to 3,280 feet (1 kilometer) in radius. *The fiber-link microcell system can handle any combination of* AMPS, TDMA, and CDMA radio equipment *simultaneously*.

The LMT consists of a low-power RF radiator device inside a weather-hardened housing. It is intended for remote indoor or outdoor deployment, and may be located up to 7 miles (11.2 km) from the Series II Cell Site.

The optical interface equipment at the host Cell Site provides the electrical-to-optical interface between the host Cell Site and the fiber-link microcell system. There is a single-shelf modular optical interface shelf (OIS) that supports up to four LMTs, or the larger OIF that supports up to 21 LMTs. For each LMT, there must be one installed OTU in the OIS or OIF.

One or more LMTs can function as a sector of a host cell; as many as eight LMTs may be assigned to a sector. LMTs may be assigned to all sectors of an AMPS Series II Cell Site as long as the total number of LMTs does not exceed 21: an AMPS Series II Cell Site is limited to a maximum of 21 LMTs.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR     IMS    CELL    CDN   CCS7    SYS NORM
 OVERLOAD SYS INH  CU CU PERPH     LINK   MSC     DCS   TRUNK   OMP+LK
CMD<
                                     — 2137,c - DCS c,OTU/LMT STATUS —

                                 ID OTU  LMT   TR  ID OTU   LMT   TR
 CMD     DESCRIPTION             No. Stat. Stat. Ant  No. Stat. Stat. Ant
2130     CELL Status Summary
2131,c   Cell c Equipment Status  0  norm  norm   1    11  norm  norm    6
                                  1  noscn batt   1    12  norm  fn/dr   6
400      OP:CELL                  2  opttx avgop  1    13  norm  door    6
                                  3  norm  fan    2    14  uneq  uneq
                                  4  norm  vswr0  2    15  uneq  uneq
                                  5  norm  laser  2    16  uneq  uneq
                                  6  norm  nocom  2    17  uneq  uneq
      OIF Fan Status              7  optrx vswr1  3    18  uneq  uneq
                                  8  norm  oscil  4    19  uneq  uneq
         alarm                    9  oscil lnamp  3    20  uneq  uneq
                                 10  norm  txpwr  6
```

LEGEND

c - CELL SITE NUMBER

Figure 16-9. Example of 2137 - Series II Cell Site OTU/LMT Status Page

Table 16-9. 2137 - Cell OTU/LMT Status Page Indicators

Indicator	Description
`OTU Stat`	OTU alarm state: `uneq`—OTU is unequipped `oscil`—OTU has a local oscillator malfunction `optrx`—OTU has an optical receiver malfunction `opttx`—OTU has an optical transceiver malfunction `noscn`—OTU alarms cannot be scanned (OTU is insane) `norm`—OTU is equipped and functioning.
`LMT Stat`	LMT alarm state: `uneq`—LMT is unequipped `txpwr`—LMT transmitter power is too high `nocom`—The cell cannot communicate with the LMT `lnamp`—LMT's linear amplifier has failed `vswr0`—Diversity antenna 0 has failed `avgop`—The average received optical power has dropped below the threshold `oscil`—The block conversion local oscillator for diversity 1 channels has malfunctioned `laser`—LMT's laser temperature has exceeded 35 degrees Centigrade, or the bias exceeds the threshold `vswr1`—Diversity receive antenna 1 has failed `fan`—One or both LMT fans are malfunctioning `batt`—LMT has lost power and is on battery backup `door`—LMT door is open `drusr`—LMT door is open, or a user alarm has been triggered `norm`—LMT is equipped and functional.
`TR Ant`	Transmit antenna number (as defined in the RC/V `ceqcom2` form).
`OIF Fan Status`	Summary state of OIF fans: `norm` (no OIF fans are alarmed), `minor` (one OIF fan is alarmed), `major` (two OIF fans are alarmed), `critical` (three OIF fans are alarmed).

2138 - Cell CDMA Equipment Status Display Page

The 2138 - Cell CDMA Equipment Status page (See Figure 16-10, Figure 16-7 and Table 16-10) provides status indicators and maintenance commands for the following CDMA units:

- CDMA cluster controller (CCC)
  Provides a control and data interface between the TDM bus and up to seven CDMA channel units (CCUs). A CCC and its CCUs form a CDMA cluster; there may be up to two CDMA clusters on a shelf. Each CCC terminates the dedicated packet pipe (PP) associated with its CDMA cluster.

  Each CCU contains two channel elements (CEs); thus, a fully loaded

CDMA cluster contains 14 CEs, and a fully loaded CDMA radio shelf contains 28 CEs.

A CE contains the necessary circuitry to support one CDMA channel. It can be configured as an overhead channel (pilot/sync/access or page) *or* a traffic (voice) channel.

- BCR-BIU-ACU (BBA)
  A baseband combiner and radio (BCR) and its associated bus interface unit (BIU) and analog conversion unit (ACU) form a CDMA radio set—the BBA (for BCR-BIU-ACU). Because the BBA is a single point failure for a sector, redundant BBAs—one active and the other in standby mode—may be installed for increased reliability. (A BBA pair is redundant.) For OA&M purposes, the BBA is treated as a single maintenance unit.

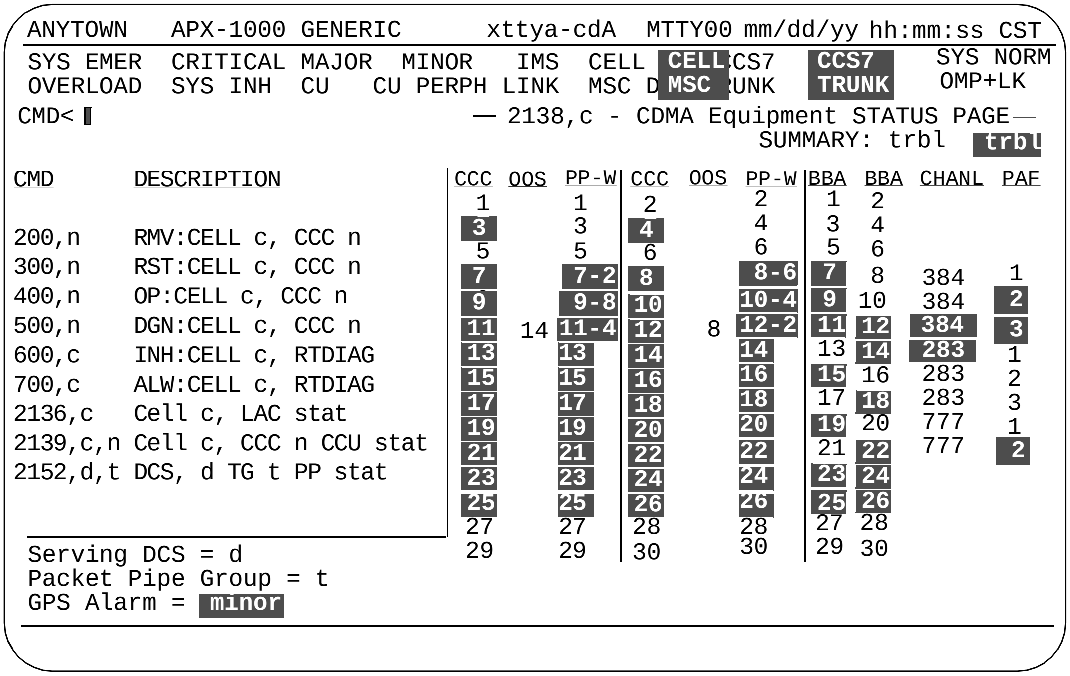
The 2138 page shows the following information for each CCC:

- Number of channel elements (CEs) out-of-service
- Associated packet pipe (PP) trunk group member.

The 2138 page shows the following information for each BBA pair:

- Assigned CDMA channel (carrier) number
- Associated physical antenna face (PAF).

In addition, the 2138 page shows the identity of the serving DCS, packet pipe trunk group, and the Global Positioning System (GPS) alarms status.



LEGEND
c - CELL SITE NUMBER (1-222)
d - DCS NUMBER
n - CDMA CLUSTER CONTROLLER NUMBER (1-30)
t - TRUNK GROUP NUMBER

Figure 16-10. Example of 2138 - Series II Cell Site CDMA Equipment Status Page

NOTE:
If your system does not have the CDMA feature turned on, the message NG:CDMA FEATURE IS NOT TURNED ON appears when you try to access the 2138 - Cell CDMA Equipment Status page.

Table 16-10. 2138 - Cell CDMA Equipment Status Page Indicators

Indicator	Description
CCC	Identity of CDMA cluster controller (1-30). When the CCC and/or packet pipe (PP) trunk group is removed from service and calls are still active, the status of CCC will be displayed as camp_on so that no new calls are allowed. Once the removal is complete, the status will change to oos. The status of the CCC is indicated by the video state of the CCC number alone: uneq (magenta on black) grow (white on magenta) act (black on green) oos (black on red) camp_on (red on green).
OOS	Number of equipped channel elements (CEs) that are out-of-service (maximum = 14 for this particular CCC for CDMA Release 1.0, 2.0, 3.0 and 4.0).
PP-W	Identity of packet pipe trunk group member (1-30). The PP number always matches the CCC number. W represents the size (width) of the DS0. The status of PP is indicated by the video state of the member number alone: uneq (magenta on black) grow (white on magenta) act (black on green): PP summary state will be active when PP is equipped and is not blocked. oos (black on red): PP summary state will be OOS when diagnostics are run, or when the bfm (blocked from MSC) bit is set. blk (blue on yellow): PP summary state will be blocked when any bfd (blocked from DCS) or bfc (blocked from cell) bits are set. Possible reasons for bfd are as follows: ECP/DCS data link down, or *5ESS*-2000 Switch DCS switching module is isolated. Possible reasons for bfc are as follows: PP protocol error, CCC OOS (manual or fault), DS1 OOS, trunk error, or PP acquiring in process (hand shake between DCS and cell). Also see the 2152 - DCS Cell TRKGRP Status page.

Table 16-10. 2138 - Cell CDMA Equipment Status Page Indicators (Contd)

Indicator	Description
BBA	Identity of BBA (combination of BCR-BIU-ACU [baseband combiner/radio, bus interface unit, and analog conversion unit]) unit (1-30). The status of the BBA is indicated by the video state of the unit number alone: uneq (magenta on black) grow (white on magenta) act (black on green) oos (black on red) stby (white on blue) camp_on (black on yellow) BBA has been used for CDMA spectrum swap (black on yellow). If BBA is active and there is either a LAC alarm or an OTU alarm, lac (black numbers on yellow background) is displayed or otu (black numbers on yellow background) is displayed (for microcells only), respectively.
CHANL	Channel number (1 - 1024). Channel number that corresponds to the center of the CDMA frequency, which corresponds to the carrier number assigned to the BBA in Cell Site translations. For channels assigned to personal communication services (PCS) CDMA at 2GHz, the channel number is displayed with black text on white background.
PAF	Identity of physical antenna face (0-6). The status of the PAF (in order of priority) is indicated as follows: no_psa (white numbers on flashing red background): No pilot/sync/access channels (highest priority) no_page (black numbers on yellow background): No page oos_ex (black numbers on steady red background): OOS limit exceeded norm (white numbers on steady black background) (lowest priority). (Status states are listed in order of condition priority, from the top or highest [no_psa] to the bottom or lowest [norm]. If two or more reportable conditions exist for the PAF indicator, only the most important or most critical one as defined in this list order will be shown.)
GPS Alarm	Status of Global Positioning System: norm, uneq, minor, major, or critical. This summary state is also shown on the 2131 - Cell Equipment Status page.
SUMMARY	This indicator shows trbl if any CDMA equipment is OOS, the GPS Alarm indicator is major or critical, there is no_psa, no_page, or the PAF OOS limit is exceeded. Otherwise, this indicator shows norm.

2138 - Remove/Restore/Diagnose CCCs or Generating a Status Report for CCCs

You can use the 2138 - Cell CDMA Equipment Status page (See Figure 16-10, and Table 16-10) to remove, restore, diagnose, or generate a status output message report for a CCC. In addition, you can use the page to inhibit or allow routine Cell Site diagnostics for CDMA units.

A remove action on a CCC also removes each associated CCU. Any CCU in the CDMA cluster that was in the active state just prior to the removal of the CCC is tagged OOS-POS (out-of-service because parent is out-of-service).

A restore actpCUs. Whether the CCC passes or fails the diagnostic test, all units in the CDMA cluster are left in the out-of-service state.

NOTE:
Use the 2139 - Cell CCC CCU Status page to remove, restore, or diagnose individual CCUs.

2138 Procedure to Remove/Restore/Diagnose or Generate a Status Report for a CCC, or Inhibit/Allow Routine Cell Diagnostics

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2138 - Cell CDMA Equipment Status page by entering command **2138,***c* (where *c* is the Cell Site number).
3. At the CMD< line,

To...	enter...
Conditionally remove a CCC	**200,** followed by the cell number (1-222), the CCC number (1-30) and press **RETURN**.

For example: **200,14,7** and **RETURN** conditionally removes Cell Site 14’s CCC 7.

To...	enter...
Conditionally restore a CCC	**300,** followed by the cell number (1-222), the CCC number (1-30) and press **RETURN**.
Generate a status message output report	**400,** followed by the cell number (1-222), the CCC number (1-30) and press **RETURN**.

For example: **400,14,7** and **RETURN.**

To...	enter...
Diagnose a CCC	**500,** followed by the cell number (1-222), the CCC number (1-30) and press **RETURN** (provided that doing so does not violate maintenance action rules; for example, units are out-of-service or not in the active state).

For example: **500,14,7** and **RETURN.**

Inhibit automatic execution of cell routine diagnostics	**600,** followed by the cell number (1-222) and press **RETURN**.
Allow automatic execution of cell routine diagnostics	**700,** followed by the cell number (1-222) and press **RETURN**.

CAUTION:
This option may permit faulty operational or test equipment to remain in service.

NOTE:
This ends the procedure for using the 2138 page to remove, restore, diagnose, or generate a status output message report for a CCC.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 8 CCC 7 COMPLETED ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2139 - Cell CCC CCU Status Display Page

The 2139 - Cell CCC CCU Status page (See Figure 16-11, and Table 16-11) displays the summary status and maintenance commands for the following CDMA feature components associated with a user-specified CDMA cluster controller (CCC):

- CDMA channel unit (CCU)
- Channel element (CE)
- Special purpose channel
- Packet pipe (PP) trunk group member.

A CCC and up to seven CCUs form a CDMA cluster. Each CCC terminates the dedicated packet pipe (PP) associated with its CDMA cluster.

Each CCU contains two channel elements (CEs); thus, a fully loaded CDMA cluster contains 14 CEs, and a fully loaded CDMA radio shelf contains 28 CEs.

A CE contains the necessary circuitry to support one CDMA channel. It can be configured as an overhead channel (pilot/sync/access or page), a traffic (voice) channel, or—for testing purposes—an orthogonal-channel noise simulator (OCNS) channel. OCNS-configured CEs are used to generate radio signals that simulate the effect of multiple users operating in a specified sector on a specified CDMA carrier, so that CDMA system capacity can be estimated in the presence of actual electrical noise from the environment.

The 2139 page shows the following information for each CCU and CE:

- Mode (personality of CE)
- Associated physical antenna face (PAF)
- Associated CDMA carrier number
- Blocking (if any) of the CDMA cluster/ packet pipe.

```
 CITY      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy  hh:mm:ss
  SYS EMER CRITICAL MAJOR MINOR    IMS    CELL     CDN    CCS7    SYS NORM
  OVERLOAD SYS INH  CU CU PERPH    LINK    MSC     DCS    TRUNK   OMP+LK
CMD<
                                     — 2139 - Cell c, CCC n CCU STATUS —
 RMV                   CCU 1   CCU 2   CCU 3   CCU 4   CCU 5   CCU 6   CCU 7
200,x    CCU x                              SRC=cell
201,x      UCL                              RSN=rmv
RST              CE STAT PAF STAT PAF STAT PAF STAT PAF STAT PAF STAT PAF STAT PAF
300,x    CCU x    0 psa  1   page 3   idle     oos      psa  3   grow     uneq
301,x      UCL    1 busy 3   idle     psa  2   oos      busy 2   grow     uneq
OP                2 idle     busy 1   idle     oos      idle     grow     uneq
400,x    CCU x    3 idle     page 1   idle     oos      idle     grow     uneq
DGN               4 idle     idle     idle     oos      idle     grow     uneq
500,x    CCU x    5 busy 2   idle     busy 2   oos      idle     grow     uneq
CELL STATUS       6 idle     idle     idle     oos      idle     grow     uneq
2138,c   Cell c   7 idle     idle     idle     oos      page 2   grow     uneq
SECT BLK RSN      8 idle     idle     idle     oos      idle     grow     uneq
  0     LAC       9 idle     idle     idle     oos      idle     grow     uneq

                  CDMA Carrier No. = 7   PP TG Member No. = 12   bfc  bfd  bfm
```

LEGEND

```
c   - CELL SITE NUMBER
bfc - BLOCKED FROM CELL BIT
bfd - BLOCKED FROM DCS BIT
bfm - BLOCKED FROM MSC BIT
n   - CDMA CLUSTER CONTROLLER (CCC) NUMBER
PP  - PACKET PIPE
TG  - TRUNK GROUP
x   - CDMA CHANNEL UNIT (CCU) NUMBER
```

Figure 16-11. Example of 2139 - Series II Cell Site CCC CCU Status Page

NOTE:
If your system does not have the CDMA feature turned on, the message NG:CDMA FEATURE IS NOT TURNED ON appears when you try to access the 2139 - Cell CCC CCU Status page.

Table 16-11. 2139 - Cell CCC CCU Status Page Indicators

Indicator	Description
CCU	Identity of CDMA channel unit (1 - 7) for user-specified CCC.
SRC	Source of the reported state of the CE(s): man or cell.
RSN	Reason for the reported state of the CCU(s): campon, dgn (diagnostics), stop (a request [dgn, rmv, etc.] is already in process and another request has been initiated on the same unit), flt (fault), dnp (downstream neighbor problem), fe (family equipment), or ta (trouble analysis).
CE	Identity of channel element (CE) (0 - 9) for CCU.
STAT	Status or mode of CE(s). The status of CE(s) is indicated as follows (text and color): uneq (magenta on black): If the CCU is unequipped, then both CEs are uneq grow (white on magenta) act (black on green): For non-traffic special purpose channels (pilot, sync, access, and page), the status of the CE is act if the CE is not OOS oos (black on red): If the CCU is OOS, then both CEs are oos busy (black on green): Status will be busy if the mode is traffic and call(s) are up idle (white on black): Status will be idle if the mode is traffic and no calls are up. The mode of CE(s) is indicated by: busy (implies traffic), idle (implies traffic), page, p/s/a (pilot/sync/access), or ocns (orthogonal channel noise source).
PAF	Identity of the physical antenna face(s) (0 - 6) that a call is on, or the PAF the special purpose channel is serving.
CDMA Carrier No.	Identity of CDMA Carrier (1 -10).

Table 16-11. 2139 - Cell CCC CCU Status Page Indicators (Contd)

Indicator	Description
PP TG Member No.	Identity of packet pipe trunk group member (1-30). The PP number always matches the CCC number. The individual blocking bits (bfc, bfd, bfm) are highlighted when set: oos (black on red): PP summary state is oos when the bfm (blocked from MSC) bit is set. blk (blue on yellow): PP summary state is blocked when any bfd (blocked from DCS) or bfc (blocked from cell) bits are set. Possible reasons for bfd are as follows: ECP/DCS data link down, or *5ESS*-2000 Switch DCS switching module is isolated. Possible reasons for bfc are as follows: PP protocol error, CCC OOS (manual or fault), DS1 oos, trunk error, or PP acquiring in process (hand shake between DCS and cell).
SECT	Sector number (0 - 6).
BLK_RSN	When any blocked from sector (bfs) bit is set, the reason (BBA, LAC, OTU, or CDMA SWP) is displayed here.

2139 - Removing/Restoring/ Diagnosing, or Generating a Status Report for CCUs

You can use the 2139 - Cell CCC CCU Status page (See Figure 16-11, and Table 16-11) to remove, restore, diagnose, or generate a status output message report for a CCU.

The transmit bus for a CDMA cluster is daisy-chained through each of the seven CCU slots, starting with CCU 7 and ending with CCU 1. The transmit bus can bypass a slot in which a CCU is either not present or has been removed from service, but it cannot bypass two (or more) adjacent slots.

Be aware that the removal of any two adjacent CCUs will break the transmit bus path, thereby disrupting the transmit data upstream from the break. As an example, removing CCUs 2 and 3 will also remove CCUs 4 through 7. For a conditional remove request, MRA will not permit the removal of two adjacent CCUs if the removal would result in exceeding the traffic CE out-of-service threshold limit. For an unconditional remove request, MRA will allow the removal of two adjacent CCUs with no regard for the traffic CE out-of-service threshold limit.

2139 Procedure to Remove/Restore/Diagnose or Generate a Status Report for CCUs

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.

2. Open the 2139 - Cell CCC CCU Status page by entering command **2139,*c*,*n*** (where *c* is the Cell Site number and *n* is the CDMA cluster controller number).
3. At the CMD< line,

To...	enter...
Conditionally remove a CCU	**200,** followed by the CCU number (1-7) and press **RETURN**.

For example: **200,1** and a **RETURN** conditionally removes CCU 1.

Unconditionally remove a CCU	**201,** followed by the CCU number (1-7) and press **RETURN**.
Conditionally restore a CCU	**300,** followed by the CCU number (1-7) and press **RETURN**.unconditionally restore a CCU**301,** followed by the CCU number (1-7) and press **RETURN**.
Generate a status message output report for a CCU	**400,** followed by the CCU number (1-7) and press **RETURN**.
Diagnose a CCU	**500,** followed by the CCU number (1-7) and press **RETURN** (provided that doing so does not violate maintenance action rules; for example, units are out-of-service or not in the active state).

NOTE:
This ends the procedure for using the 2139 page to remove, restore, diagnose, or generate a status output message report for a CCU.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 8 CCC 7, CCU 1 COMPLETED ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

2235 - Cell DCCH Status Display Page

The 2235 - Cell DCCH Status page (See Figure 16-12, and Table 16-12)displays the summary state of the TDMA digital control channel (DCCH) radios. Maintenance commands are also available on this display page.

IS-54 TDMA is enhanced by implementing the DCCH feature as described in the IS-136 standard. The DCCH performs the setup function for mobile subscribers using IS-136 compliant TDMA/AMPS dual-mode mobiles.

The DCCH is used in place of the analog control channel (ACC). The DCCH is carried by a TDMA radio (DRU, EDRU) configured as a DCCH radio, and the ACC is carried by an AMPS radio (RCU, SBRCU) configured as a setup radio.

For the TDMA radio (DRU, EDRU), there is one non-volatile memory (NVM) image file for the DCCH radio, digital voice radio, and digital beacon radio. The RCC downloads the personality type and other specific parameter values to each TDMA radio at initialization. Since a TDMA radio provides a basic modulation efficiency of three user channels (1 - 3) per 30-kHz of bandwidth, the DCCH radio may also carry digital traffic and beacon channels. The DCCH is carried on user channel 1.

Typically, there is one DCCH per physical antenna face, or sector, in a TDMA system. Up to three DCCHs are allowed per sector.

```
NAME      APX-1000 GENERIC      xttya-cdA  MTTY00 mm/dd/yy  hh:mm:ss
 SYS EMER CRITICAL MAJOR MINOR     IMS    CELL      CDN    CCS7    SYS NORM
 OVERLOAD SYS INH  CU CU PERPH     LINK    MSC      DCS    TRUNK    OMP+LK
CMD<                                       — 2235,c — CELL DCCH STATUS
                                             PCS TDMA
 CMD      DESCRIPTION          | RADIO    PF RADIO   PF RADIO  PF  RADIO  PF
2133,c,r SII VR                |    0 -1  1   150 -1 6
2135,c   LC/SU/BC              |    2 -1  1   162 -1 6
                               |    5 -1  1
300,r    RST r                 |    8 -1  2
301,r    RST r; UCL            |   10 -1  2
400      OP:CELL c DCCH        |   15 -1  2
500,r    DGN r                 |   25 -1  3
                               |   32 -1  3
                               |   40 -1  3
                               |   70 -1  4
                               |   85 -1  4
                               |   90 -1  4
                               |  101 -1  5
                               |  102 -1  6
                               |  104 -1  5
```

LEGEND

c - CELL SITE NUMBER
r - DCCH RADIO NUMBER

Figure 16-12. Example of 2235 - Series II Cell Site DCCH Status Page

Table 16-12. 2235 - Series II Cell Site DCCH Status Page

Indicator	Description
PCS TDMA	This indicator is displayed for TDMA PCS cells.
`RADIO`	Identity of DCCH radio (range 0 - 191; the maximum number of DCCH radios that can be assigned is currently 21—three per sector). Radios are identified as follows: radio_number-user_channel_number. The status of the radio is indicated by its video state alone: `equip` (white on black) `uneq` (magenta on black) `grow` (white on magenta) `act` (black on green) `oos` (black on red) `indt` (black on yellow): indeterminate `arr_oos` (white on red) `arr_act` (green on black).
PF	Identity of physical antenna face (0 - 6).

2235 - Restoring/ Diagnosing or Generating Status Reports for DCCH Radios

You can use the 2235 - Cell DCCH Status page (See Figure 16-12, and Table 16-12) to restore, diagnose, or generate a status output message report for DCCH radios.

1. Procedure to Restore/Diagnose or Generate Status Reports for DCCH Radio Procedures
2. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
3. Open the 2235 - Cell DCCH Status page by entering command **2235,***c* (where *c* is the Cell Site number).
4. At the CMD< line,

To...	enter...
Restore a DCCH radio	**300,** followed by the DCCH radio number (0-191) and press **RETURN**.
Unconditionally restore a DCCH radio	**301,** followed by the DCCH radio number (0-191) and press **RETURN**.
Generate a cell DCCH radio status output message report	**400** and press **RETURN**.
Diagnose a DCCH radio	**500,** followed by the DCCH radio number (0-191) and press **RETURN** (provided that doing

so does not violate maintenance action rules; for example, units are out-of-service or not in the active state).

NOTE:
This ends the procedure for using the 2235 page to restore, diagnose, or generate a status output message report for DCCH radios.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 DCCH RA 20 COMPLETED ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

Dual Server Group Out-Of-Service (OOS) Limits

For a Series II Dual Server Group cell, configured as either a 3-sector or 6-sector cell, Voice Radio Out-Of-Service (OOS) limits can now be set on a per Logical Antenna Face (LAF) level, rather than on a per-cell level. Previously, the OOS could only be defined, or set, on a per-cell level. Because the software that performed the OOS checking for conditional OA&M commands, checked on a per LAF basis, it was possible for the per-cell OSS limits to block the testing of radios on a specific LAF. This is no longer a problem. The ability to set OOS limits on a per LAF basis allows the service-provider to set the voice radio OSS limits at the same level at which the Cell Site software performs the OOS checking for conditional OA&M commands; that is, at the per LAF level.

New RC/V Translation Parameters

This feature adds 4 new AMPS and TDMA Voice Radio OOS limit translations to the ceqface form, as below:

1. AMPS Voice Radio OOS Limit Server Group 0. This parameter defines the AMPS Voice Radio Out of Service Limit for Server Group 0.
2. AMPS Voice Radio OOS Limit Server Group 1. This parameter defines the AMPS Voice Radio Out of Service Limit for Server Group 1.

3. TDMA Voice Radio OOS Limit Server Group 0. This parameter defines the TDMA Voice Radio Out of Service Limit for Server Group 0.
4. TDMA Voice Radio OOS Limit Server Group 1 This parameter defines the TDMA Voice Radio Out of Service Limit for Server Group.

For all 4 translations, the following apply:

- The view is Per Logical Face.
- The Allowable Values are 1 to 100% or Blank.
- The Default is Blank.
- The Restriction is that, if no value is entered (i.e., Blank), the value defaults to the Per Cell Voice.
- Radio Out of Service Limit.
- Update is allowable.

Corrective Maintenance using ECP Craft Interface

17

Contents

ECP Craft Shell

The ECP Craft Shell is another one of several software interfaces between the technician and the ECP. The same commands that are entered via status display pages may also be entered at the ECP Craft Shell. This section will describe customized commands that can be entered at either the ECP Craft Shell or at the command line at the bottom of a status display page.

This section describes entering customized commands at the ECP Craft Shell prompt or at the command line at the bottom of a status display page.

Generating Cell Site Units/Radios/Alarms Status Reports

You can generate status output message reports on Cell Site units or on radios currently having their non-volatile memory (NVM) updated. You can also generate status output message reports that list outstanding external and environmental alarms for a Cell Site.

Procedure to Generate a Cell Site Unit/Radios/Alarms Status Report

- Select **ECP Craft Shell** from the AUTOPLEX(R) System 1000 ECP Access menu.

1. When the connection is established, enter one of the following command formats:

   Command format:

   Format 1 To generate a cell equipment status output report:

   OP:CELL *a*[,*b*][CLASS *c*]

   Format 2: To generate a status output report on radios currently being NVM updated:

   OP:CELL *a*,RUNVM

   Format 3: To generate a list of outstanding external and environmental alarms for a Cell Site:

   OP:CELL *a*,EXTERN

   where

   a. Indicates the Cell Site number.

   b. Indicates the Cell Site unit.

c. Indicates message class override.

RUNVMGenerates the status on all radio units currently undergoing NVM updating.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

OP:CELL 1 SU 7, ACTIVE, FORCED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX Cellular Telecommunications Systems System 1000 User Defined Cell Site Alarms* (401-612-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004)

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Series II Cell Site Description, Operation, and Maintenance* (401-660-100).

Removing Cell Site Units

You can remove specific Cell Site units from service, all busy voice radios with a specified camp-on time, or all radios with a non-volatile memory (NVM) that is incompatible with the Cell Site controller (CSC).

The *conditional remove* maintenance action changes the state of a maintenance unit from active or standby to out-of-service. It schedules an event or process to place the specified maintenance unit to out-of-service assuming that by doing so does *not* cause calls to be dropped or service denied to a user.

The *unconditional remove* maintenance action changes the state of a maintenance unit from active or standby to out-of-service with little concern to whether calls are dropped or service denied to a user during the course of command execution.

Unconditionally removing test radios (RTU, TRTU, CRTU) aborts any currently running maintenance activity requiring the use of that test equipment.

A warning message is sent to the terminal where the remove request originated if any of the following conditions occur:

- An emergency call was already killed as a result of the remove command.
- A specific sector/carrier has no CDMA page and/or pilot/sync/access channel because the migration of the overhead channel to another CCU failed or there is no other active CCU available to receive the overhead channel.

The following is an example of the warning message:

RMV:CELL 10 BBA 6 IN PROGRESS
EMERGENCY CALL IN PROGRESS

Procedure to Remove Cell Site Units

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter one of the following command formats:

Command format:

Format 1 To remove a Cell Site unit:

RMV:CELL *a*,*b*[;UCL][CLASS *c*]

Format 2: To remove all busy radios or radios with incompatible NVM:

RMV : CELL *a*,{ALLBUSYRA *d*|INCOMPNVM}[CLASS *c*]

where

a. Indicates the Cell Site number.

b. Indicates the Cell Site unit.

UCL Indicates unconditional execution.

c. Indicates message class override.

d. Indicates to remove all busy radios with a specific camp-on time *d* (between 0-30 minutes). Only valid for a single Cell Site.

INCOMPNVM Indicates to remove all radios with an NVM version that is incompatible with the CSC.Only valid for a single Cell Site.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

RMV CELL 1 SU 7, COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Restoring Cell Site Units

You can restore specific Cell Site units to service.

The *restore* maintenance action can be applied to units that are in the out-of-service, active, or standby state. Except for a unit that is already out-of-service or in the growth state, the first step in a *conditional restore* maintenance action is the automatic execution of a *conditional remove*. Therefore, all the restrictions associated with a conditional remove are also associated with a conditional restore.

Similarly, except for a unit that is already out-of-service or in the growth state, the first step in an *unconditional restore* maintenance action is the automatic execution of an *unconditional remove*. Therefore, the lack of restrictions associated with an unconditional remove—unconditional remove requests may be service affecting—are also associated with an unconditional restore.

A warning message is sent to the terminal where the restore request originated if any of the following conditions occur:

- An emergency call was already killed as a result of the remove command being generated as part of the restore process.
- A specific sector/carrier has no CDMA page and/or pilot/sync/access channel because the migration of the overhead channel to another CCU failed or there is no other active CCU available to receive the overhead channel.

The following is an example of the warning message:

RST:CELL 10 BBA 6, IN PROGRESS
EMERGENCY CALL IN PROGRESS

Procedure to Restore Cell Site Units

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   RST:CELL *a*,*b* [;UCL][:{STBY|ACT}][CLASS *c*]

   where

   a. Indicates the Cell Site number.

   b. Indicates the Cell Site unit.

   ACT Indicates the active state (default value).

   STBY Indicates the standby state.

   UCL Indicates unconditional execution.

   c. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

RST:CELL 1 SU 7, COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)
- Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004)

Diagnosing Cell Site Units

You can run diagnostics on specific Cell Site units.

The *diagnose* maintenance action can be applied to a unit in the out-of-service or growth state, to a redundant unit in the standby state, or to a redundant unit in the active state. In the latter case, MRA initiates a *switch* before executing the diagnose request.

For redundant units, if the targeted unit is in the active state but the mate is out-of-service, the diagnose aborts with no action taken.

In addition, the diagnose maintenance action can be applied to a CCC, CCU, or CRTU in the active state. The first step in a diagnose maintenance action for an active CCC, CCU, or CRTU is the automatic execution of a *conditional remove*.

Procedure to Run Cell Site Unit Diagnostics

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.

2. When the connection is established, enter the following command:

   DGN:CELL *a*,*b*[;[RPT *c*][,RAW][,UCL]]
   [:[PH *d*][,TLP][,CHANL *e*]][CLASS *f*]

   where

   a. Indicates the Cell Site number.

   b. Indicates the Cell Site unit.

   c. Indicates the number of times you want the diagnostic to run. The default value is 1.

   RAW Indicates printing the diagnostic results of every phase. The default is the first five failures of each failing phase.

   UCL Indicates unconditional execution of diagnostic and prints all failures. Normal mode stops on first failure.

   d. Indicates execution of particular phase numbers. Numbers are in decimal and may be a single number or a range of numbers:

   TLP Indicates executing trouble locating procedure (TLP) at the conclusion of the diagnostic. TLP generates a list of suspected faulty equipment.

   e. Indicates the channel number (1-1023) used to diagnose the locate radio, setup radio, or the test generator test unit; indicates the channel number (1-2047) used to diagnose only the TDMA PCS mini-cells. If the channel is not available at the Cell Site, the diagnostic request is denied.

   f. Indicates message class override.

References:

See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 SU 7, COMPLETED, ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Stopping Cell Site Unit Diagnostics

You can stop diagnostics on specific Cell Site units.

The *stop* maintenance action stops a diagnostic test on a maintenance unit. If the diagnostic test request is still in the job queue, the request is removed from the queue. If the diagnostic test is running, the test is aborted.

The unit is left in the out-of-service or growth state *unless the unit is a CCC, CCU, BBA, or CRTU*. Upon terminating a diagnostic test for one of those units, the unit is returned to the state it was in just prior to the diagnostic request (out-of-service, growth, or active).

Procedure to Stop Cell Site Unit Diagnostics

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   STOP:DGN;CELL *a*,*b* [CLASS *c*]

   where

   a. Indicates the Cell Site number.

   b. Indicates the Cell Site unit.

   c. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

STOP:DGN:CELL 1 SU 7, COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004)

Moving Cell Site Radios

You can move the functionality of a setup, analog locate, beacon, or DCCH radio to a voice radio. The Cell Site software will select another radio of similar technology serving the same logical antenna face (sector) as the one you want to move. The selected radio will then take over the functionality (setup, analog locate, beacon, DCCH) of the radio you specify in the command.

The move command works only for Series II Cell Sites using the automatic radio reconfiguration (ARR) feature.

AUTOPLEX System 1000 Automatic Radio Reconfiguration Optional Feature (401-601-027).

Procedure to Move Cell Site Radios

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   MOVE:CELL *a*,*b*[;UCL][CLASS [*c*]

where

a. Indicates a single Cell Site number.

b. Indicates the radio whose functionality you want to move to another radio on the same logical antenna face.

UCL Indicates unconditional execution.

c. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

```
REPT:CELL 6, AUTOMATIC RADIO RECONFIGURATION, ACTIVATION
COMPLETED
                          FRAME    SHELF    SLOT
FAILED RADIO  DCCH RA 8      0        5        4
```

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Automatic Radio Reconfiguration Optional Feature* (401-601-027)

Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Moving CDMA Calls to a Specified Channel Element

You can force a semisoft handoff on an active CDMA call in a particular cell and channel element (CE) to a specific CE within the same cell sector. This allows you to free a CE or move a call to a specific CE.

This command is known as the basic craft forced handoff (BCFHO).

The CE you specify must be connectable to the same sector as the traffic-serving CE. For a successful handoff:

- The CDMA call must be in a stable talking state.
- The destination CE must be connectable to the same sector as the serving CE.
- The destination CE must be idle.
- The CDMA call must *not* be in a 3-way soft handoff.

Procedure to Move a CDMA Call to a Specified CE

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   MOVE:DN ”*a*”;CELL *b*, CCC *c*,CCU *d*,CE *e*

   which

   a. Indicates the directory number (10 digits).
   b. Indicates the CDMA Cell Site number.
   c. Indicates the CDMA cluster controller (CCC) number.
   d. Indicates the CDMA channel unit (CCU) number.
   e. Indicates the CDMA channel element (CE) number.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

```
REPT:MOVE:DN 0123456789 CELL 6 CCC 27 CCU 5 CE 0
   From CCC 15 CCU 3 CE 1
   SUCCESS
```

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

Swapping CDMA Spectrum to/from AMPS/TDMA

You can switch the use of a range of frequencies by the system between either the CDMA technology or analog/TDMA technology. When CDMA is introduced into a service area, the CDMA frequency band must be cleared of analog/TDMA activity, both within the cells that are supporting CDMA and within a guard zone surrounding the CDMA service area. The guard zone is necessary to ensure that CDMA activity does not impact service in the remaining analog/TDMA service area.

The spectrum swap capability is used when CDMA is being installed and you need to activate and test CDMA without affecting the system during high traffic periods. You can turn CDMA on during low traffic periods for testing, then turn CDMA off and restore analog/TDMA.

Up to 150 cells can be swapped between CDMA and analog/TDMA with a 30 minute period. Larger numbers of cells can be swapped but the swap may not complete within 30 minutes. Stable calls in the technology being swapped are camped on for five to 15 minutes (adjustable via RC/V) and are then dropped.

Using the following procedure is service affecting. Calls in the area undergoing the swap will be dropped when the camp-on period expires. (Five to 15 minutes—15 minutes is the default value.)

Procedure to Swap CDMA Spectrum to/from AMPS/TDMA

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access menu**.
2. When the connection is established, enter the following command:

   SW:SPECTRUM CDMA *a*[;UCL]

   where

a.	Indicates whether to turn on or off CDMA.
UCL	Indicates unconditional execution of the command.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

SW:SPECTRUM SWAP CDMA ON, FINISHED
ALL CELLS FINISHED SWAP

NOTE:
Suppose you have just entered the following command to swap the spectrum back to the non-CDMA technology: **SW:SPECTRUM CDMA OFF**

Suppose further that after entering the above command, the following output message report appears: SW:SPECTRUM CELL *a*, CDMA EMERGENCY CALLS PRESENT

To preserve the existing emergency calls on CDMA and undo the spectrum swap, you would enter **SW:SPECTRUM CDMA ON;UCL**.

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX Cellular Telecommunications Systems System 1000 CDMA Spectrum Swap* (401-613-001).

Generating Status Reports of Spectrum Swap of CDMA to/from AMPS/TDMA

You can generate a status output message report on Cell Site spectrum swaps.

Procedure to Generate Spectrum Swap Status Reports

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access menu**.
2. When the connection is established, enter the following command:

   OP:SPECTRUM SWAP

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

SW:SPECTRUM SWAP CDMA ON, FINISHED
ALL CELLS FINISHED SWAP

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX Cellular Telecommunications Systems System 1000 CDMA Spectrum Swap* (401-613-001).

Running Cell Site Audits

You can request audits on one or more Cell Sites.

Procedure to Audit Cell Sites

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   AUD:CELL *a*,NAME *b* [CLASS *c*]

   where

   a. A single Cell Site, a range or cells (maximum 32), or a list of cells.

   b. Indicates the audit you want to run.

   c. Indicates output message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example a of successful output message report.

Example:

AUD:CELL 10 NAME ARCCC,COMPLETED, ERROR COUNT 4

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *Cell Site Audits* (401-610-078)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Diagnosing Cell Site Data Links

You can diagnose Cell Site data links, and, using the loopback option, test the associated transmission facility.

Procedure to Diagnose Cell Site Data Links

1. Select **ECP Control & Display** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. Open the 2131 - Cell Equipment Status page by entering command **2131,***c* (where *c* is the Cell Site number).

NOTE:
For a customized restore using a manually entered command, skip Step 3 and go to Step 4.

3. At the CMD< line, enter **51,** followed by the cell number (1-222) and press **RETURN**.

NOTE:
This ends the procedure for using the status display page command. See Result and Example.

4. Press the **F3** (**CMD/MSG**) key to position the cursor at the bottom of the page and enter the following command:

   DGN:CELL *a*,DL *b*;*c*   [;ERR][,RPT *d*][,UCL][CLASS *e*]

where

a. Indicates the Cell Site number.

b. Data link number.

c. Indicates the diagnostic test type.

ERR Dumps the protocol error registers at the conclusion of the loopback test.

d. Indicates the number of times you want the test repeated.

UCL Indicates an unconditional execution of the diagnostic with no early termination and printing all failures (conditional stops on first failure).

e. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

DGN:CELL 1 DL 0, COMPLETED, ALL TESTS PASSED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Stopping Cell Site Data Link Diagnostics

You can stop diagnostics on Cell Site data links.

Procedure to Stop Cell Site Data Link Diagnostics

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   STOP:DGN;CELL *a*,DL *b* [CLASS *c*]

   where

   a. Indicates the Cell Site number.

   b. Indicates the Cell Site data link number.

   c. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

STOP:DGN:CELL 1 DL 0, COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Diagnosing Cell Site Trunks Associated with a Server Group and Antenna Face (Non-CDMA)

You can diagnose Cell Site trunks that are associated with a cell, server group, and antenna face.

Procedure to Diagnose a Cell Site Trunk Server Group and Antenna Face

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   DGN:CELL *a*,SG *b*,ANT *c* [,ALL]

   where

   a. Indicates the Cell Site number.

   b. Indicates the server group number.

   c. Indicates the antenna face number.

   ALL Indicates all measurement data, regardless of whether the diagnostic passes or fail.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file.

NOTE:
The output message report you receive depends on the type of Cell Site. The following is for a Series II cell.

Example:

DGN:CELL 1 SG 0 ANT 6, COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

Stopping Diagnostics on Cell Site Trunks Associated with a Server Group and Antenna Face

You can stop Cell Site trunk diagnostics associated with a specific cell, server group, and antenna face.

Procedure to Stop Diagnostics on a Cell Site Trunk Server Group and Antenna Face

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   STOP:DGN;CELL *a*,SG *b*,ANT *c*

   where

   a. Indicates the Cell Site number.

   b. Indicates the server group number.

   c. Indicates the antenna face number.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

STOP:DGN;CELL 1 SG 0 ANT 6 COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)

Requesting Cell Site Data Link NVM Updates

You can request a non-volatile memory (NVM) update for Cell Site data link optioning fields.

NOTE:
The download command works only with an off-line Cell Site controller (CSC).

Procedure to Update Cell Site NVM

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   DNLD:CELL *a*,DLOPTS *b c d e f g h*

   where

   a. Indicates the Cell Site number.
   b. Indicates the DS1/DL configuration.
   c. Indicates the data rate.
   d. Indicates the framing mode.
   e. Indicates the zero suppression.
   f. Indicates the line length compensation (T1 signaling only).
   g. Indicates the type of signaling.
   h. Indicates the type of Cell Site.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file.The following is an example of a successful output message report.

Example:

DNLD:CELL 2 DLOPTS COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057).

Requesting Cell Site Hardware Unit NVM Updates

You can request a non-volatile memory (NVM) update for Cell Site units.

Procedure to Request Cell Cite Hardware Unit NVM Updates

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter the following command:

   DNLD:CELL *a*,*b* [;*c*][CLASS *d*]

   where

   a. Indicates the Cell Site number.

   b. Indicates the downloadable Cell Site unit.

   c. **ALLALT** - Updates a CCC and all its associated CCU/CEs with the alternate firmware version.

   d. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

REPT:CELL 2, NVM UPDATE AMPS MAIN CONTROLLER COMPLETED

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Initializing Cell Sites

You can initialize Series II Cell Sites at a phase level or a cell memory level.

NOTE:
See *AUTOPLEX Cellular Telecommunications Systems System 1000 System Recovery* (401-610-079) before using the following command.

Procedure to Initialize Cell Sites

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu.
2. When the connection is established, enter one of the following command formats:

Command Format:

Format 1: To request a system process purge at a specific Cell Site:

INIT:CELL *a*:SPP *b*[CLASS *c*]

Format 2: To request a specific Cell Site phase:

INIT:CELL *a*:{TC|SC}[CLASS *c*]

Format 3: To request a Cell Site memory boot:

INIT:CELL *a*:BOOT[IE][CLASS *c*]

Format 4: To request a Cell Site memory boot and controller switch:

INIT:CELL *a*:BOOT[IE];SW

NOTE:
This command format switches the standby (STBY) radio control complex to the active (ACT) controller after the boot. The non-active controller can be in the STBY or OOS state before you request the switch.

where

a. Indicates the Cell Site number.

b. Indicates the system process you want to purge (SPP).

TC Indicates a transient clear, phase 3. This option calls in the origination, termination, handoff, or disconnect processes and releases calls. All diagnostics are aborted but the out-of-service (OOS) equipment lists are saved.

SC Indicates a stable clear, phase 4. The Cell Site is fully initialized and translation data is updated from the ECP copy.

BOOT Indicates phase 5. A full cell memory update and a stable clear phase are executed.

BOOTIE Indicates a phase 6. Errors are ignored during the boot.

SW The currently standby controller will become the active controller after the boot.

c. Indicates message class override.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

RCVRY:CELL 10 PHASE COMPLETE, CP ALW, PH LVL TC, PH SRC CELL PROGRESS TYPE

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057)
- *AUTOPLEX Cellular Telecommunications Systems System 1000 System Recovery* (401-610-079)
- *AUTOPLEX System 1000 Virtual System Output Message Routing Optional Feature* (401-612-021)

NOTE:
Feature documents are contained in *AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features* (401-900-004).

Initializing, Setting Up, and Using OCNS at CDMA Cell Sites

You can request orthogonal-channel noise simulation (OCNS) setup at Series II Cell Sites with CDMA equipment.

OCNS is a CDMA-specific feature in which a special software personality is loaded into one or more CDMA channel elements (CEs) at the Cell Site. OCNS-configured CEs are used to generate radio signals that simulate the effect of multiple users operating in a specified sector on a specified CDMA carrier, so that CDMA system capacity can be estimated in the presence of actual electrical noise from the environment.

The following command formats are divided into initial and secondary command requests. Command format 1 is an initial OCNS request. Command formats 2, 3, and 4 are secondary command requests. Use command format 1 before making any secondary requests.

You can make as many secondary command requests as you want after making the initial OCNS request.

NOTE:
After a secondary command request is made, you cannot make another initial command request until command format 3 is used to stop OCNS or the STOP:OCNS;CELL *a* command is used.

CAUTION:
OCNS reduces the amount of available resources for, and interferes with, CDMA traffic.

Procedure to Initialize, Set Up, or Use OCNS at a CDMA Cell Site

1. Select **ECP Craft Shell** from the **AUTOPLEX(R) System 1000 ECP Access** menu
2. When the connection is established, enter one of the following command formats:

Command Format:

Format 1: To initialize an OCNS session at a Cell Site:

OCNS:CELL *a*;START

Format 2: To set the OCNS session parameters:

OCNS:CELL *a*,SECTOR *b*,CARRIER *c*;USERS *d*[,DGAIN *e*]

Format 3: To end an OCNS session:

OCNS:CELL *a*,SECTOR *b*,CARRIER *c*;STOP

You can also use the **STOP:OCNS;CELL** *a* command to terminate a session. This stops the OCNS supervisor and releases resources for traffic.

Format 4: To change the OCNS reporting interval:

OCNS:CELL *a*,REPORT *f*

where

a. Indicates the Cell Site number.

START Starts the OCNS supervisor at the Cell Site.

b. Indicates the sector of the OCNS session.

c. Indicates the CDMA carrier number of the OCNS session.

d. Indicates the number of simulated users for the OCNS session.

e. Indicates the digital gain at the Cell Site for the OCNS session.

STOP Stops OCNS activity for the specified session.

f. Indicates the interval number of 30 second increments for periodic clipping of OCNS reports from the cell.

NOTE:
See the *AUTOPLEX Cellular Telecommunications Systems System 1000 Input Messages* (401-610-055) for more information about message parameters.

Result:

After the system processes the command, an output message report scrolls up from the bottom of the window. In addition, the output message report is sent to a log file. The following is an example of a successful output message report.

Example:

```
OCNS:CELL 1,REPORT INTERVAL SET FOR SOME CCCs
CCC 8,PERIODIC CLIPPING REPORT
Sector  Carrier  CCU  CE  Clipping  Users
  0       7       4   1     1.6%      6
Sector 0 Carrier 7 - currently 40 at 7 digital gain.
```

References:

See the following documents for additional information:

- *AUTOPLEX Cellular Telecommunications Systems System 1000 Output Messages* (401-610-057

Expansion of Maintenance Request Administrator (MRA) and Technician Interface Information Fields (MRAINFO/ TIINFO), Feature IDentification (FID) #3461.0

Lucent's Maintenance Strategy

This chapter covers the "Expansion of Maintenance Request Administrator (MRA) and Technician Interface Information Fields (MRAINFO/TIINFO)" feature, which has Feature IDentification (FID) #3461. Fundamental to Lucent's long term Operations, Administration, and Maintenance (OA&M) strategy is to allow technicians, using information provided to the Executive Cellular Processor (ECP) by the cell sites, to be able to isolate any fault down to an individual piece of equipment. In general, this has involved giving the Executive Cellular Processor (ECP) the ability to correlate different types of error messages and alarms received from the cell sites. In order to support this diagnostic strategy, the Maintenance Request Administrator/Technician Interface (MRA/TI) error messages from the cell are designed to contain and convey as much detail as possible to the Executive Cellular Processor (ECP).

The Maintenance request Administrator Info (MRAINFO) & Technician Interface Info (TIINFO) Fields

The Maintenance Request Administrator (MRA) and other Radio Cluster Server (RCS) maintenance software, use a field called MRAINFO to specify reason codes and to pass them to other processes within the Radio Control Cluster (RCS) and external to it. In particular, to the Technician Interface (TI), within which the field is defined as TIINFO by the Executive Cellular Processor (ECP). The MRAINFO/TIINFO output message structure is defined as a UCHAR, making it only 8 bits long and able to hold no more than 256 values. The continuing evolution of systems and equipment means that many more error messages have to be accommodated if our maintenance strategy continues to be that of helping the technician isolate a fault down to an individual piece of equipment. Therefore, beginning with R13.0, the MRAINFO/TIINFO field has been redefined as a USHORT, making it 16 bits long, so that it can represent many more error conditions and continue to uniquely identify each one.

Increased Length and Values Supported by MRAINFO and TIINFO Fields

To handle the pre-R13 MRAINFO/TIINFO messages, two functions have been be written and built into the software library so that the entire Executive Cellular Processor (ECP) can have access to them. One function translates the incoming MRAINFO/TIINFO messages into the new 16-bit format, and the other translates the outgoing MRAINFO/TIINFO messages into the new 16-bit format. This feature supports all cell generics and types at the Executive Cellular Processor (ECP). It handles pre-R13.0 compatible cells differently than R13.0 compatible cells, but the logic used will be transparent in future releases.

Alarm Collection and Reporting

18

Contents

Introduction

The alarm and FITS interface (AFI) units (See Figure 18-1), which are part of the RCC (shelf 0) in the primary RCF, monitor both equipment and user-defined alarms. Equipment alarms are gathered from alarm sensors within the AIFs, LAFs, primary RCF, and growth RCFs, while user-defined alarms are gathered from alarm sensors external to the Cell Site equipment. The alarm inputs to the two AFIs are connected in parallel through the backplane of the RCC.

The AFI provides an interface for the following alarms:*

- One receiver calibration generator (RCG) alarm
- Two receive preamplifier alarms
- Two reference generator alarms
- Six power converter unit (PCU) alarms associated with the primary RCF (18 PCU alarms if both growth RCFs are connected)
- Six cooling fan alarms associated with the primary RCF (18 fan alarms if both growth RCFs are connected)
- Seven linear amplifier circuit (LAC) alarms via an EIA-422 data link
- Eighteen user-defined alarms.

NOTE:
LAC Maintenance is covered in another section that is entirely dedicated to that subject. It is called, obviously, "LAC Maintenance."

The AFI also provides an interface (See Figure 18-2) for the reference frequency generator (RFG) REF0/REF1 selected status, which indicates which of the two oscillators—reference generator 0 or 1—is active.

On each RCF shelf, the alarm signals from the pair of PCUs are wire ORed together to form a single input to the AFI. (For example, the alarm signals from the two PCUs on the RCC shelf are wire ORed together to form the single input PROCPWRL.) All other alarms have individual inputs to the AFI.

Except for PROCPWRL, which is internal to the RCC backplane, and the alarm signals from the second growth RCF—RCF2, all alarm signals connect to the RCC backplane via an AYD5 paddleboard connector (See Figure 18-1). The

* With ECP Release 7.0 *and assuming that the User-Defined Cell Site Alarms (UDA) optional feature is activated*, the AFI provides an interface for an additional 12 user-defined alarms and 12 equipment alarms.

alarm signals route through the backplane to both the active and standby AFIs, but only the alarms monitored by the active AFI are scanned for alarm conditions.

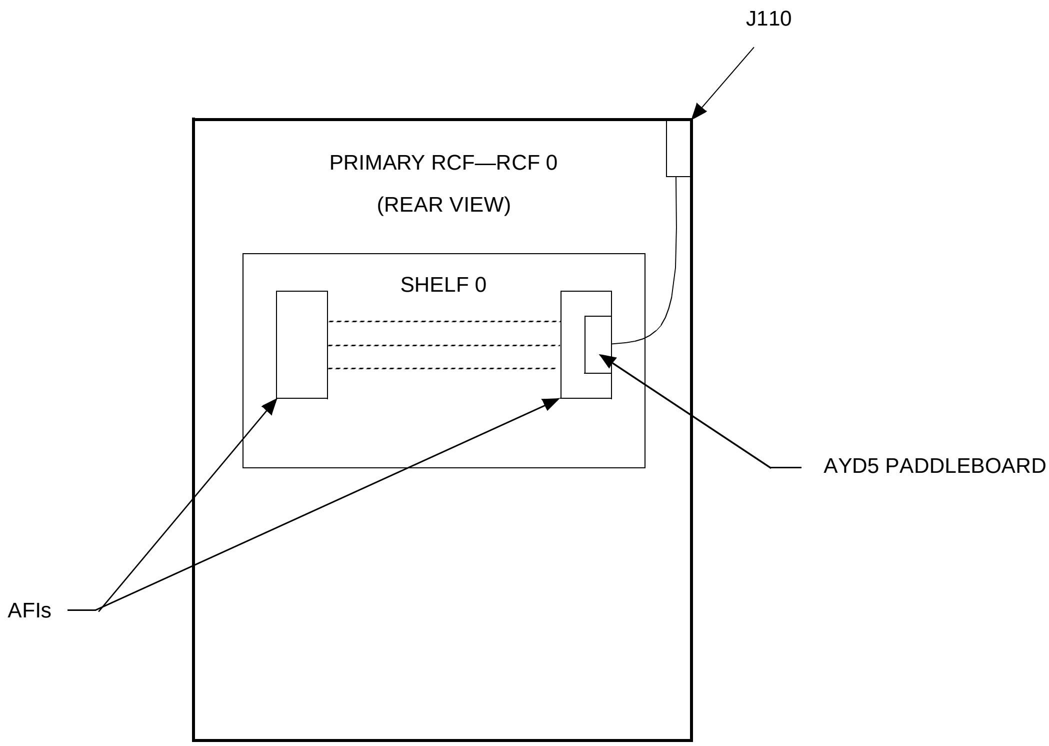


Figure 18-1. Alarm Cabling in the Primary RCF

Equipment Alarms

There is one alarm associated with the RCG (See Figure 18-2), two alarms associated with the receive preamplifiers (part of the receive filter panels), and two alarms associated with the RFG. As with user-defined alarms, each of these alarms connects to an opto-isolator within the AFI.

The “no alarm” state for an RCG or RFG alarm (See Figure 18-3) is with current flowing, while the “no alarm” state for a receive preamplifier alarm is with no current flowing. Unlike user-defined alarms, the polarity for an RCG, RFG, or receive preamplifier alarm is not configurable: each polarity bit is set by on-board firmware to 0 (for no inversion of the alarm signal) or 1 (for inversion of the alarm signal) to achieve the alarm state of logic 0.

There is also a REF0/REF1 selected status associated with the RFG. The “REF0 selected” state is with no current flowing, while the “REF1 selected” state is with current flowing. The polarity of the REF0/REF1 select status is not configurable: the polarity bit is set by on-board firmware to 0 to achieve the “REF0 selected” state of logic 1.

The AFI monitors six PCU alarms and six fan alarms in the primary RCF (18 PCU alarms and 18 fan alarms if both growth RCFs are connected). Each of the alarms connects to the AFI through one signal line and a common ground return (see “C” and “D” in Figure 18-4, Sheet 2). The “no alarm” state of a PCU or fan alarm is an open (logic 1) between the associated line and the ground return. The polarity for a PCU or fan alarm is not configurable; each polarity bit is set by on-board firmware to 0 (for no inversion of the alarm signal) to achieve the alarm state of logic 0.

Linear amplifier circuit alarms are communicated to the AFI via an EIA-422 data link. The active AFI sends address and command messages to the linear amplifier circuits over one line pair, and receives acknowledge and alarm status messages from the linear amplifier units over another line pair.

Alarm Status Registers and Scan Points

Nineteen 8-bit alarm status registers (0-18) on the AFI store the current alarm information for the equipment being monitored by the AFI. Each bit of the first eleven alarm status registers (0-10) indicates the status of a unique alarm. Alarm status registers 0-2 collect 24 alarms via opto-isolators, while alarm status registers 3-10 collect 64 alarms via direct connections. Prior to ECP Release 7.0, alarm status registers 3-10 collected at most 36 alarms (18 PCU alarms and 18 fan alarms); 28 alarm inputs were unused. With ECP Release 7.0 and assuming that the User-Defined Cell Site Alarms (UDA) optional feature is activated, 24 of the previously unused 28 alarm inputs will be available due to the Increased Cell Alarms enhancement.

The remaining eight alarm status registers (11-18) collect LAC alarms via an EIA-422 data link. Each of these registers can store the status of four LACs by allocating a pair of bits to each LAC. Each pair of bits can hold one of four LAC alarm status codes: normal (binary 00), minor (binary 01), major (binary 10), or critical (binary 11). Only alarm status registers 11 and 12 are needed to collect seven LAC alarms.

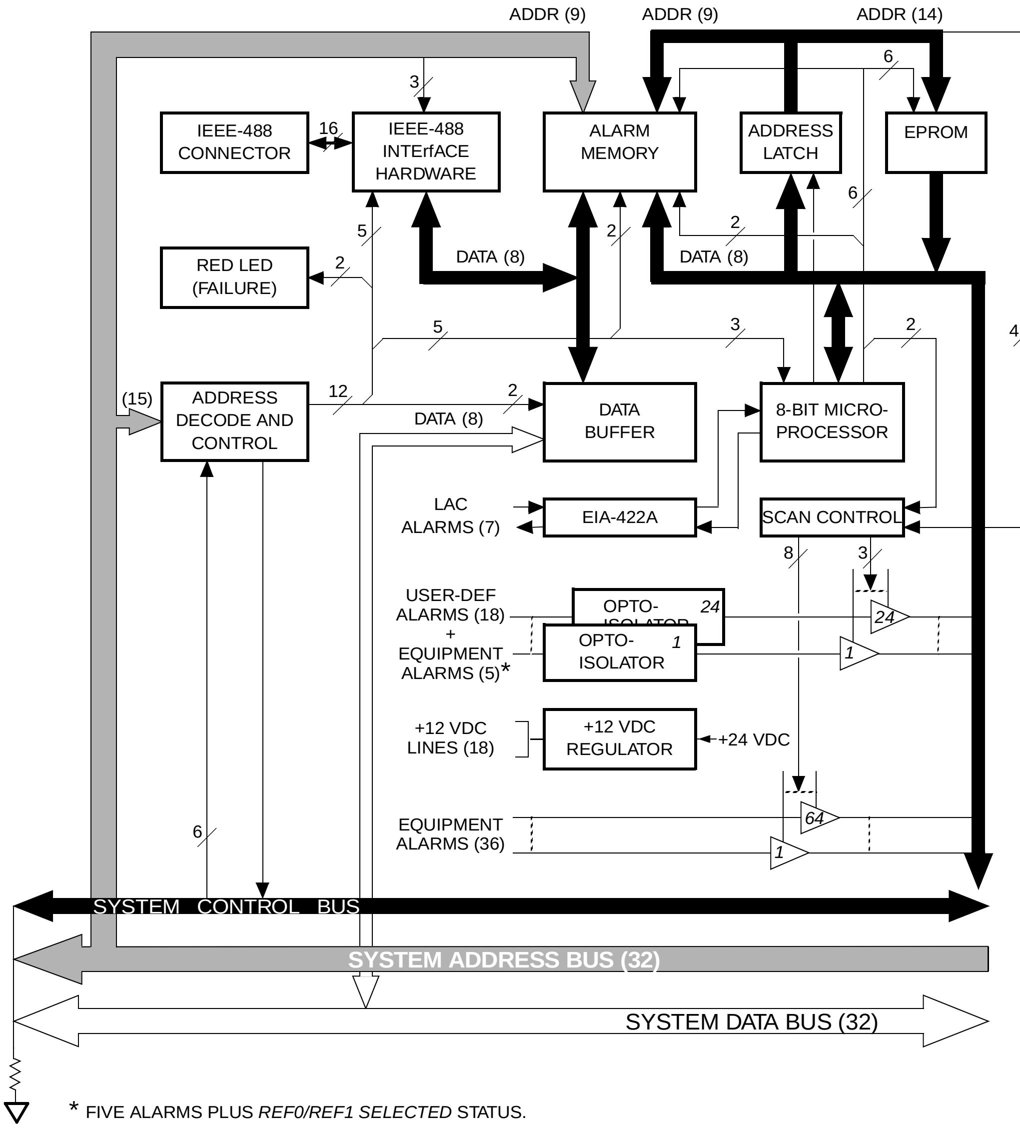
Prior to ECP Release 7.0, the equipment alarm inputs were permanently assigned, that is, the inputs were associated with specific equipment and could not be changed by the user or Cell Site software. With ECP Release 7.0 and assuming that the User-Defined Cell Site Alarms (UDA) optional feature is activated, the equipment alarm inputs will be assigned by Cell Site software based on the Cell Site equipment configuration. The equipment alarm input assignments for the RCF0, RCF1, RCF2, AIF, and LAF will not change.

Each alarm is assigned an alarm status register number and bit number (register_number - bit_number) called a scan point. As examples, the scan point for user-defined alarm 0 (user-defined alarms range from 0 through 17) is 0-0, the scan point for reference generator 1 is 2-6, and the scan point for LAC 0 is 11-0 (bit 0 is the first of two bits—bits 0 and 1—holding status for LAC 0).

Alarm Reporting to the ECP

The AFI scans the alarm inputs every two seconds to update its alarm memory. When the AFI detects an alarm condition, it sets a flag in the alarm memory. The CPU, which scans the alarm memory every four seconds, reads the flag and responds by transmitting the alarm condition via an X.25 signaling channel to the ECP.

The CPU reports an alarm condition only once to the ECP, at the time that the CPU initially senses the alarm. The CPU will also send an “all clear” message to the ECP when the alarm condition either clears itself or is cleared by Cell Site maintenance personnel.



* FIVE ALARMS PLUS *REF0/REF1 SELECTED* STATUS.

Figure 18-2. AFI Block Diagram

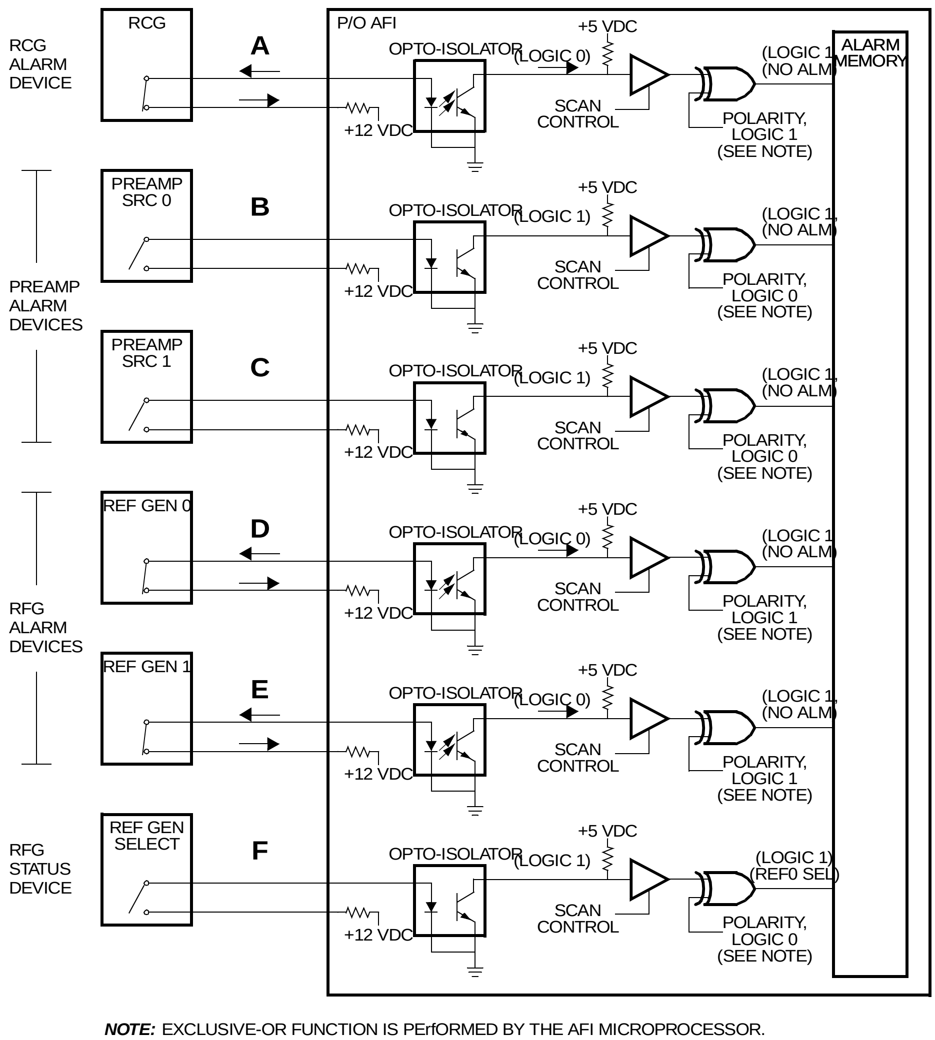
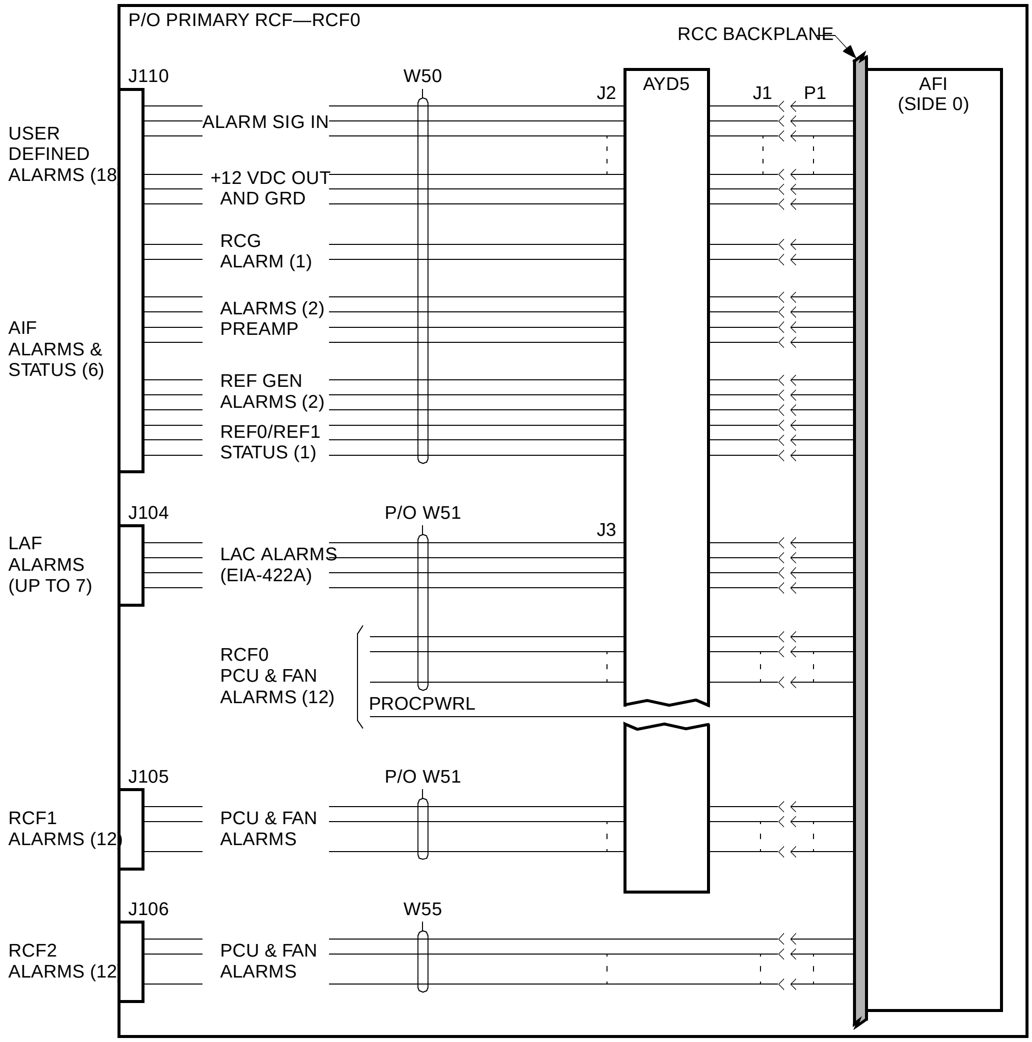


Figure 18-3. RCG, Receive Preamplifier, and RFG Alarm Devices



NOTE: P1 = EQUIPMENT LOCATION (EQL) 022.

Figure 18-4. Alarm Monitoring and Storage in the Primary RCF (Sheet 1 of 2)

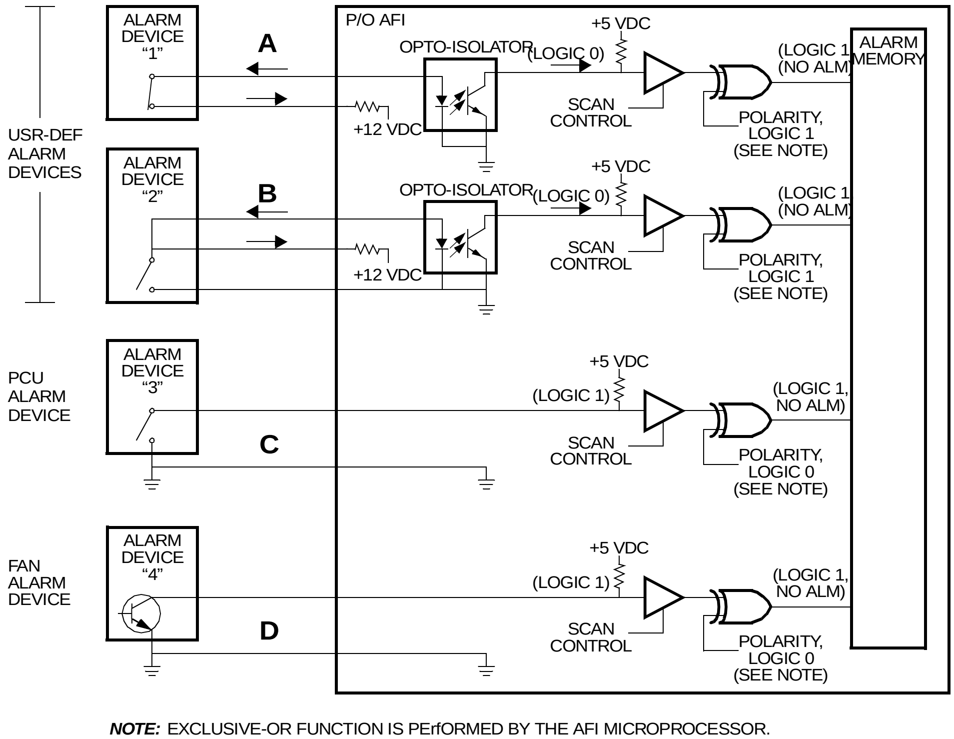
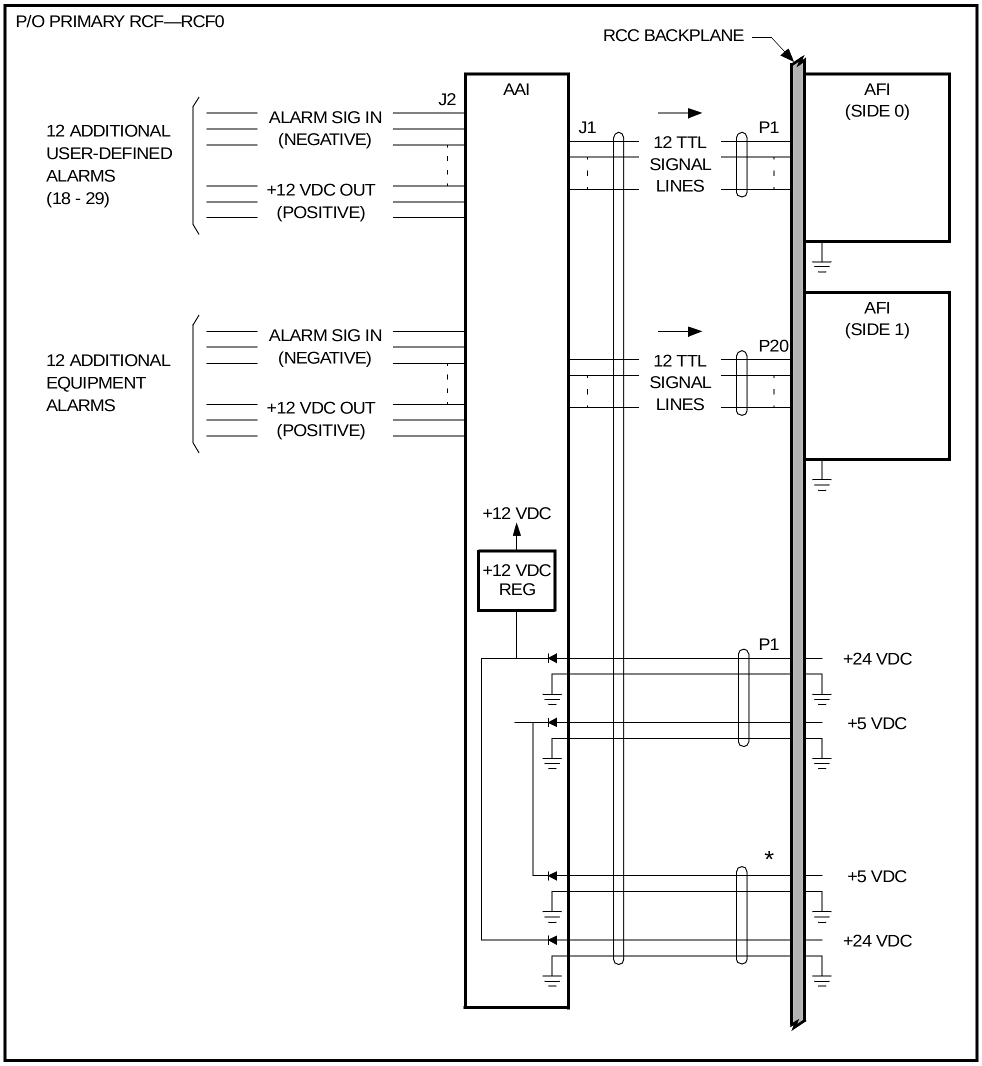


Figure 18-5. Alarm Monitoring and Storage in the Primary RCF (Sheet 2 of 2)

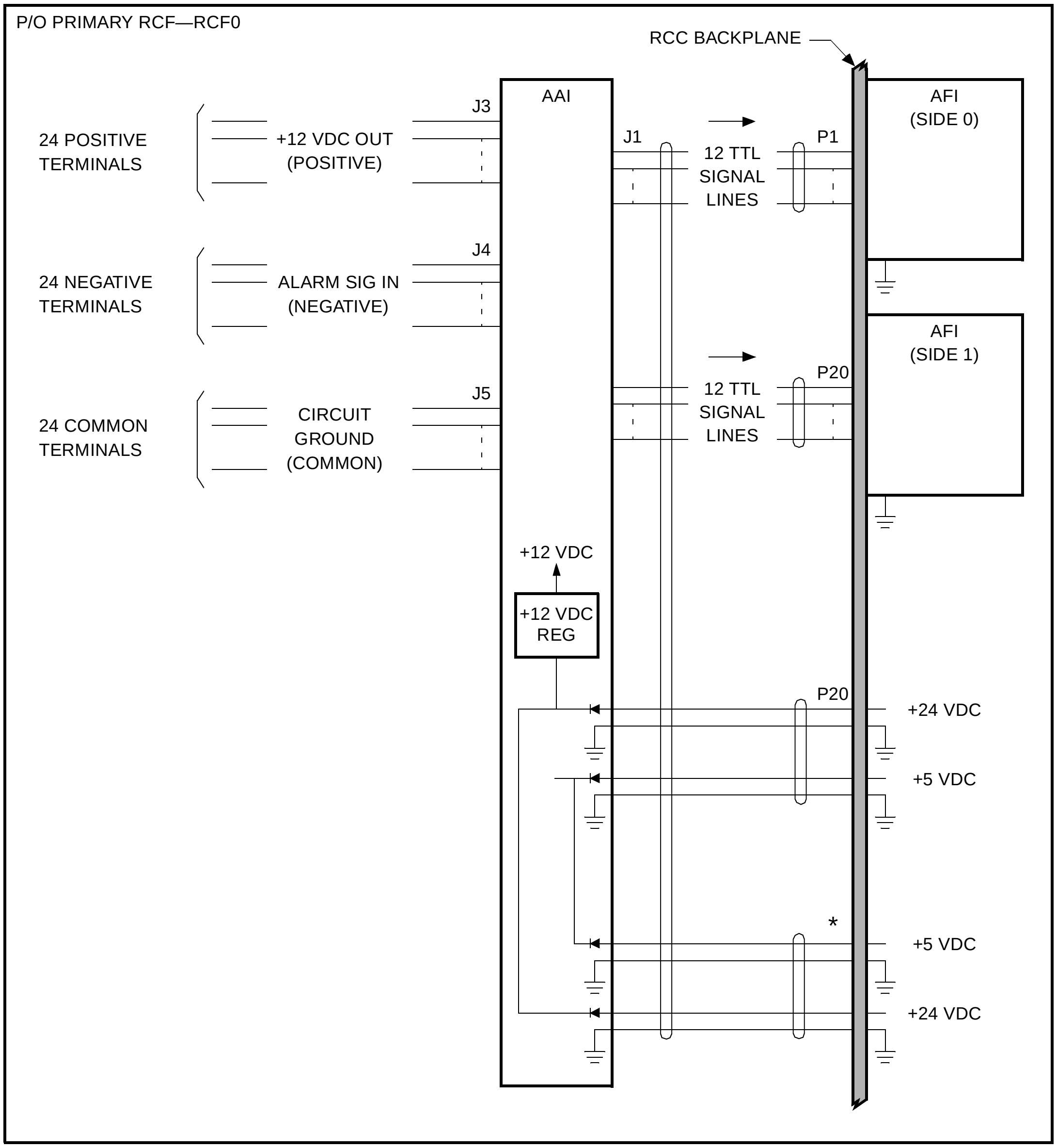
A complete description of all input/output messages is contained in Lucent Technologies 401-610-055, System 1000 Input Message Manual. Additional maintenance information on the Simulcast Setup feature is located in Lucent

Technologies Customer Information Bulletin (CIB) 205, AUTOPLEX Cellular Telecommunications Systems Simulcast Setup Feature. Maintenance information for the Series II Reference Frequency Generator is located in Lucent Technologies CIB 208, AUTOPLEX Cellular Telecommunications Systems Series II Reference Generator with Crystal Backup.



NOTE: P1 = EQUIPMENT LOCATION (EQL) 022, P20 = EQL 154, AND * = EQL 172.

Figure 18-6. Alarm Connections Via the AAI J2 Ribbon-Type Connector



NOTE: P1 = EQUIPMENT LOCATION (EQL) 022, P20 = EQL 154, AND * = EQL 172.

Figure 18-7. Alarm Connections Via the AAI J3, J4, and J5 Terminal Blocks

Cell Site Alarm Circuits

Cell Site alarm circuits are monitored by the AFI circuit boards on the RCC shelf. Each side of the RCC has one AFI board. The alarm inputs to the two boards are connected in parallel. The Core Processor reports the status of each alarm to the MSC by a data channel.

The AFI board is a buffered interface for the following alarms:

- Eighteen user-assigned alarms
- Five alarms from the Antenna Interface Frame (AIF)
- Twelve alarms from each Radio Channel Frame (RCF)
- Alarms from the Linear Amplifier Frames (LAFs) by an EIA-422 data link.

All of the alarms are connected to the Alarm/FITS Interface (AFI) board by an AYD5 adapter board.

On the AFI board, the interface for each of the user alarms and the AIF alarms is an opto-isolator with some protective input resistance. These are used for alarm connections made over lines that are 20 feet or greater in length. The design provides one of two alarm device switch arrangements. In both opto-isolator configurations 1 and 2, the “no alarm” condition is with current flowing through the diode element in the opto-isolator; the “alarm” state is with no current flowing. As shown in configurations 1 and 2, the “no alarm” state can be accomplished with either open or closed switch devices. This arrangement also provides a means for detecting a break in a line pair.

Each RCF reports the status of 12 alarms to the RCC—6 alarms for shelf power (one for each shelf) and 6 alarms for the fans (one for each fan). Each of these alarms is connected to the AFI board by one line and a common ground return. This is shown by alarm device 3. Each alarm is connected to the input of a tri-state gate in the AFI. For each RCF alarm, the alarm state is with a short (logic low) between the associated line and the ground return.

Alarms from the LACs are detected by the active AFI circuit sending address and command messages to the LACs over one line pair and receiving acknowledgment and alarm status messages over another line pair.

Cell Site alarm circuits are monitored by the AFI circuit boards on the RCC shelf. Each side of the RCC has one AFI board. The alarm inputs to the two boards are connected in parallel. The Core Processor reports the status of each alarm to the MSC by a data channel.

The AFI board is a buffered interface for the following alarms:

- Eighteen user-assigned alarms

- Five alarms from the Antenna Interface Frame (AIF)
- Twelve alarms from each Radio Channel Frame (RCF)
- Alarms from the linear Amplifier Frames (LAFs) by an EIA-422 data link.

All of the alarms are connected to the Alarm/FITS Interface (AFI) board by an AYD5 adapter board.

On the AFI board, the interface for each of the user alarms and the AIF alarms is an opto-isolator with some protective input resistance. These are used for alarm connections made over lines that are 20 feet or greater in length. The design provides one of two alarm device switch arrangements. In both opto-isolator configurations 1 and 2, the “no alarm” condition is with current flowing through the diode element in the opto-isolator; the “alarm” state is with no current flowing. As shown in configurations 1 and 2, the “no alarm” state can be accomplished with either open or closed switch devices. This arrangement also provides a means for detecting a break in a line pair.

Each RCF reports the status of 12 alarms to the RCC—6 alarms for shelf power (one for each shelf) and 6 alarms for the fans (one for each fan). Each of these alarms is connected to the AFI board by one line and a common ground return. This is shown by alarm device 3. Each alarm is connected to the input of a tri-state gate in the AFI. For each RCF alarm, the alarm state is with a short (logic low) between the associated line and the ground return.

Alarms from the LACs are detected by the active AFI circuit sending address and command messages to the LACs over one line pair and receiving acknowledgment and alarm status messages over another line pair.

User-Defined Alarms

User-defined alarms include miscellaneous alarm conditions, such as fire, forced entry, high temperature, and alarms from ancillary co-located equipment. All the user-defined alarms are connected to the AFIs via one 50-pin, D-type female connector. User-defined alarms are collected in an alarm control panel, which is an optional panel that may be mounted in the FIF or on a Cell Site wall.

The AFI derives +12 Vdc from +24 Vdc, which is available on the RCC backplane, using an on-board voltage regulator. The +12 Vdc branches to 24 output pins on the AFI, 18 of which serve as the source voltage for the external alarm switch devices used to implement user-defined alarms. In addition, each of the +12 Vdc output pins connects through the backplane to the corresponding pin on the mate AFI.

On the AFI, the interface for each user-defined alarm is an opto-isolator with some protective input resistance. Opto-isolators are used for alarm connections made over lines that are six meters or greater in length. As shown in both “A” and “B” of Figure 18-4, Sheet 2, the design provides for two different types of alarm switch devices: normally closed contact and normally open contact.

There are two translations associated with each user-defined alarm: an equipage translation used to enable the alarm and a polarity translation used to invert (if need be) the logic state of the alarm signal. The “no alarm” state for an alarm is with current flowing (see “A” and “B” in Figure 18-4, Sheet 2), which also provides a means for detecting a break in a line pair. The ECP technician must set the associated polarity translation to 1 so that the alarm signal is inverted before being written into the alarm memory. (The equipage and polarity translations for user-defined alarms are specified using the ceqcom2 RC/V form.)

A logic 0 in any bit position of the AFI alarm memory indicates an active alarm. That is, within the alarm memory, a logic 0 is the active alarm state, and a logic 1 is the “no alarm” state.

The alarm level (critical, major, or minor) and alarm text associated with each alarm are defined by the ECP technician using the User-Defined Cell Site Alarms (UDA) optional feature. For more information, refer to the User-Defined Cell Site Alarms (UDA) Optional Feature document (401-612-057), which is part of the AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features document (401-900-004).

Increased Cell Alarms Enhancement

An Increased Cell Alarms enhancement to the User-Defined Cell Site Alarms (UDA) optional feature is available in ECP Release 7.0, which will provide an additional 12 user-defined alarms and 12 equipment alarms for use in the cell.* Unlike other equipment alarms (which are permanently assigned), the additional 12 equipment alarms are assigned by the cell based on the Cell Site equipment configuration.

Initially, the Series II Cell Site will take advantage of the additional 12 equipment alarms to monitor cellular digital packet data (CDPD) and Battery adjuncts. (An adjunct, as used here, is simply an additional frame, or cabinet, at the base station providing a function that is not essential to base station operation.) The Series IIm T1/E1 Minicell and IImm T1/E1 Microcell will take advantage of the additional 12 equipment alarms to monitor CDPD, Battery, and CDMA adjuncts.

Besides providing additional user-defined and equipment alarms, the Increased Cell Alarms enhancement allows 42 existing equipment alarms to be assigned by the cell based on the Cell Site equipment configuration. Hence, upon implementing the Increased Cell Alarms enhancement, a total of 54 (42 plus 12) equipment alarms may be assigned by the cell. The cell recognizes the cell equipment configuration by reading the Cell Site translations data base; it then uses that information to assign the appropriate alarm text strings to the 8-bit alarm status registers in the AFI.

The alarm level (critical, major, or minor) and alarm text associated with a user-defined alarm are defined by the ECP technician using the User-Defined Cell Site Alarms (UDA) optional feature. For more information, refer to User-Defined Cell Site Alarms (UDA) Optional Feature (401-612-057).

The 42 existing equipment alarms that may be assigned by the cell are:

- Twelve alarms normally associated with the primary RCF—RCF0
- Twelve alarms normally associated with the first growth RCF—RCF1
- Twelve alarms normally associated with the second growth RCF—RCF2
- Six alarms normally associated with the RCG, receive preamplifiers, and RFG. (More exactly, there are five alarms plus the RFG REF0/REF1 selected status, which indicates which of the two oscillators—reference generator 0 or 1—is active.)

* The Increased Cell Alarms enhancement may be implemented in the Series II Cell Site, Series IIm T1/E1 Minicell, or Series IImm T1/E1 Microcell.

The equipment alarm input assignments for the RCF0, RCF1, RCF2, AIF, and LAF will not change from the assignments made prior to ECP Release 7.0.

New Hardware for the Increased Cell Alarms Enhancement

The Increased Cell Alarms enhancement requires a new hardware kit for existing Series II Cell Site equipment. The kit consists of an alarm adapter interface (AAI) AYD10 board, mounting hardware, cabling, and connectors. Since the mounting hardware and cabling depend on the type of Series II base station (traditional Series II, Series IIm, or Series IImm), several different kits are available. The figures show the AAI cabling in the traditional Series II Cell Site; the AAI mounts on top of the primary RCF.

The AAI interconnects to the wiring side of the RCC backplane via the frame cabling. The AAI sources +5 Vdc and +24 Vdc from the RCC backplane and shares a common ground connection with the AFI.

The AAI provides an opto-isolator interface that is electrically identical to the AFI opto-isolator interface. The AAI contains 24 opto-isolators, one for each of the external alarm switch devices used to implement the additional 24 alarms. The AAI derives +12 Vdc from the +24 Vdc using an on-board voltage regulator, to serve as the source voltage for the external alarm switch devices.

A 50-pin, ribbon-type female connector (J2) on the AAI is the interface (See Figure 18-6) for the 24 external alarm switch devices. There are two pins for each alarm input; the additional two pins are circuit ground. Twelve pin pairs are reserved for the additional user-defined alarms (alarms 18 through 29), and twelve pin pairs are reserved for the additional equipment alarms. Each pin pair consists of a positive lead (+12 Vdc) and a negative lead (alarm input).

As an alternative to the J2 connector, there are also three terminal blocks (J3, J4, and J5) on the AAI (See Figure 18-7) that may be used as the interface to the 24 external alarm switch devices. The terminal blocks provide an interconnection similar to the alarm control panel residing in the FIF. The J3 terminal block provides 24 positive terminals (+24 Vdc), the J4 terminal block provides 24 negative terminals (alarm input), and the J5 terminal block provides 24 circuit-ground terminals (common). The circuit-ground terminals allow for normally open contact alarm switch devices.

An AAI opto-isolator, by sensing the presence or absence of current on the alarm signal input line, places a transistor-transistor logic (TTL) 0 for “no alarm” or 1 for “alarm” onto an alarm signal output line. The 24 alarm signal output lines route through the RCC backplane to both the active and standby AFIs.

Of the 28 unused bits in AFI alarm status registers 3-10 (prior to ECP Release 7.0), 24 are now used to collect the additional 24 alarms made available by the Increased Cell Alarms enhancement.

Adjunct equipment at the Cell Site must be connected to the AAI according to the installation instructions to ensure proper alarm assignment.

New Translations for the Increased Cell Alarms Enhancement

While the cell can identify equipage of the CDMA adjunct via the translations data base, it cannot identify equipage of the CDPD or Battery adjunct. Therefore, two new translations—one for the CDPD adjunct and one for the Battery adjunct—have been created so that the cell can identify the CDPD and Battery adjuncts and assign the appropriate alarms.

Support Documentation for the Increased Cell Alarms Enhancement

The Increased Cell Alarms enhancement is described in the User-Defined Cell Site Alarms (UDA) Optional Feature document (401-612-057), which is part of the AUTOPLEX Cellular Telecommunications Systems System 1000 Optional Features document (401-900-004).

Procedures for installing the Increased Cell Alarms enhancement hardware in the Series II Cell Site, Series IIm T1/E1 Minicell, or Series IImm T1/E1 Microcell are included in the User-Defined Cell Site Alarms (UDA) Optional Feature document.

Directional Setup

The Directional Setup feature allows each sector in a directional Cell Site to have its own setup radio or radios, with each radio assigned a unique setup channel. The setup radios use the same Linear Amplifier Circuit (LAC) and antenna as the voice radios assigned to each sector. The setup radios transmit and receive on the directional faces, therefore eliminating the need for an omnidirectional antenna and equipment in the directional Cell Site.

Directional setup, coupled with the wideband LAC, increases the number of voice circuits that a cell can serve since a lower gain omnidirectional setup antenna no longer limits the coverage area. The Directional Setup only provides directional voice while the Omnidirectional Setup provides both directional and omnidirectional voice.

Two sparing policies are available to the customer for setup radios. Neither uses receive switches, thus each setup radio is uniquely associated with a given antenna sector and may be located in either single or double height radio shelves. The sparing policies are as follows:

Providing full duplication of each setup radio without receive switches (on-line spares)

Using the recent change/verify process for the manual radio reconfiguration without receive switches to change a voice radio to a setup radio (off-line spares).

Directional Setup is required for Microcells. Directional Setup also supports Mobile-Assisted Handoff for Dual-Mode Mobile Station (DMMS) operating in the digital mode by providing a continuous fixed power setup signal that the DMMS measures to determine the best serving face. Elimination or reduction of serving base station and neighbor base station location measurements decreases message traffic associated with digital mobile transceivers and accelerates the handoff process.

Received Radio Frequency (RF) signals are fed from the receiving antennas to the Antenna Interface Frame (AIF) where they are filtered, amplified, and divided for distribution to the Radio Frame Set (RFS). See Figure 18-8.

At the Radio Channel Frames (RCFs), there are two distinct RF receiver interface configurations, the switchable antenna connection and the fixed antenna connection. In Release 4, the switchable antenna configuration is used only in the upper 2 radio shelves (shelves 1 and 2) of the P-RCF to support setup and locate receive antenna switching needs. A diagram of this configuration is given in Figure.

Signals from the antenna interface enter the RCF by the common port of a 1:9 power divider located in the interconnection assembly at the top of the frame. An output port from as many as 4 (omni, alpha, beta, and gamma) power dividers is cabled to an RF switch board located in shelf 1.

The switch consists of a 4 by 12 matrix which allows any of the 12 radios on the shelf to have its receive inputs connected to any 1 of 4 antenna faces. The switch matrix is controlled by logic outputs from the Radio Channel Units (RCUs) themselves. The shelf contains 2 identical RF switch boards, one for Diversity 0 and one for Diversity 1. Shelf 2 is cabled in an identical manner as described above. In a 6-sector configuration, shelf 2 allows receive antenna switching among the omni, delta, epsilon, and zeta faces.

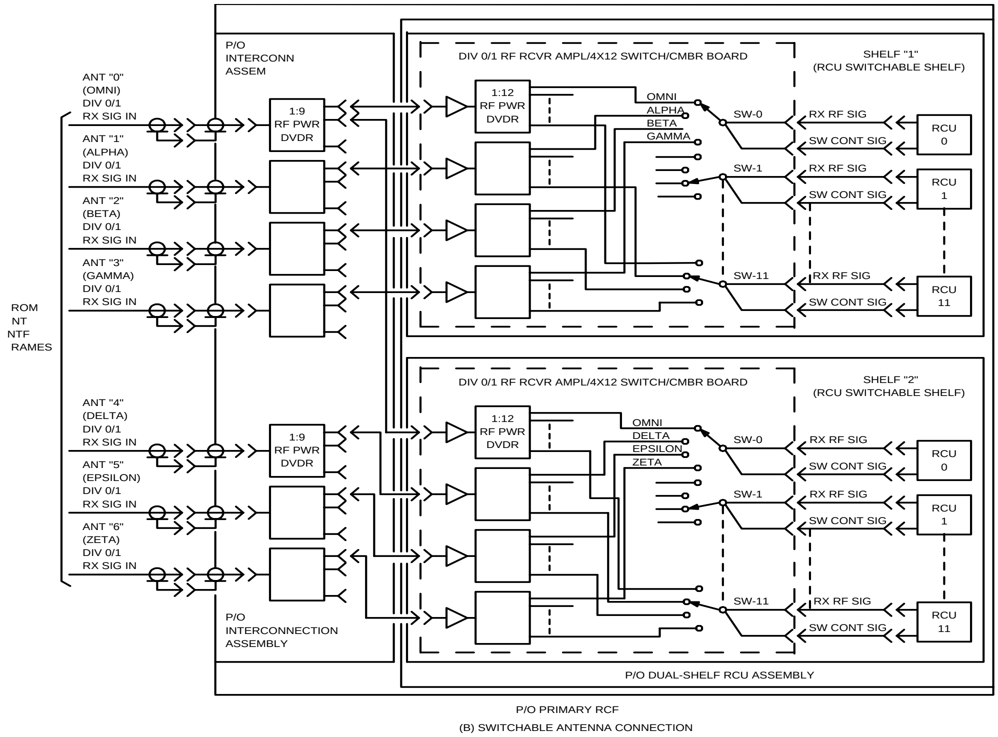


Figure 18-8. Radio Channel Frame (RCF) Receiver Radio Frequency (RF) Interfaces (Switchable Antenna Connection)

The Receive Filter Panel contains a bandpass and if required, a notch filter, a low-noise receive preamplifier and two couplers used to inject RF test signals. The couplers are used by diagnostics and functional tests to perform antenna return-loss and Radio Channel Unit (RCU) receive path measurements. One filter panel is required for each receive path inside the AIF.

Alarm Scanning Redesign

Introduction

Until recently, the amplifier Alarm Scanning (AS) software functioned as follows: The Cell Site was presumed to have only one type of amplifier. This amplifier type was hard-coded into an amplifier alarm table that was created specifically for that particular type of amplifier. Within that table each type of alarm pertaining to that specific amplifier was hard-coded and pre-defined. Also hard-coded and pre-defined was the alarm text string for each alarm type in the table.

There were multiple amplifier alarm tables for multiple types of amplifiers. However, at cell initialization only one amplifier alarm type/table was selected, based upon the type of amplifier the cell was equipped with. Once selected, the hard coded alarm table became the template for all amplifier alarm reports, including the text strings.

While this method was quick and simple in application, it only recognized one single type of amplifier for the entire cell, so all cell amplifiers had to be of the same type. Alarm scanning could not support a cell that had 2 or more different types of amplifiers.

To address these problems, the AS software has been redesigned and is being introduced in ECP Release 11.0 and CDMA Release 6.0. The current release of the AS redesign supports:

1. High-power Transmit Power Amplifier (HTPA) used with the CDMA Cellular minicell
2. PCS CDMA Amplifier (PCA) and High-power PCS CDMA Amplifier (HPCA) used with the CDMA Personal Communications Services (PCS) minicell.

With the introduction of the AS Redesign feature, the amplifier alarm table is dynamically populated, according to the amplifier type, on a per amplifier alarm address basis. Any amplifier unit whose amplifier type is supported can be assigned to any amplifier address. The new populated alarm table does not hard code the information of the physical amplifier unit number and the corresponding alarm text. Therefore, it is possible to make the amplifier unit self-configuring.

Although, the AS Redesign feature begins with one type of amplifier, the CDMA Transmit Unit (CTU) / Receive Unit (RU), the long term goal is to layout a common architecture such that future development can be used to eliminate all hard coded alarm tables and to support mixed type amplifier configurations.

The AS Redesign feature in this release supports only CDMA PCS and CDMA Cellular Minicell technologies, such as the cellular CDMA Adjunct to small cells. It does not affect the existing hard-coded alarm processing used by the Series II AMPS, TDMA, and CDMA.

Previously, Alarm Scanning (AS) software for alarms at the Cell Site and the Mobile Switching Center used hard-coded tables to assign not only the Alarm and FITS Interface (AFI) alarm addresses, but the alarm text string for each internal device unit (e.g. amplifiers) as well

With the introduction of this feature, the Cell Site software provides a generic reporting function, so that all amplifier alarm specific assignment information (amplifier unit number/amplifier alarm address and alarm text string assignments) can be retrieved from the cell translation data/Executive Cellular Processor (ECP) database and ECP global data owned by the AS RTR Unix process.

The goal is to provide a long-term solution for amplifier alarm reporting mechanism with minimum effort whenever a new amplifier/device or new amplifier alarm configuration is added to the Cell Site.

Constructing the alarm text string for all amplifier alarm messages at the ECP AS RTR Unix process makes it possible for the alarm reports at the Cell Site and alarm reports from the Executive Cellular Processor (ECP) to be synchronized. In particular, the following 2 reports are synchronized:

1. Spontaneous Amplifier Alarm Report, that is initiated from the cell site
2. AS Office Alarm Summary Report, that is directly processed by the ECP in response to an office alarm summary request.

As a result, this feature will solve any incorrect AS query problem due to the amplifier alarm hardcoded design that fails to handle different amplifier alarm address and corresponding amplifier unit assignment.

The AS redesign is intended to establish a common platform that could provide groundwork to support all technologies. When the feature is incorporated in the AMPS/TDMA applications, future implementation of new technologies can be minimized. However, the feature is currently applied to only CDMA applications.

Scope

Alarm Scanning Redesign depends on the existing AUTOPLEX System amplifier alarm infrastructure and alarm reporting capabilities defined in the cell site and MSC OA&M documents. The feature adds the following amplifier alarm related capabilities:

- Provides amplifier alarm address assignment flexibility for the amplifier alarm hardware design; any combination of currently supported amplifiers of the same or different types in the Radio Channel Frames (RCF) - Primary and Growth Frames 0 and 1 as well as CDMA adjunct. The reconfiguration of the currently supported amplifiers can be performed via the Recent Change and Verify (RC/V) interface without Software Update (SU)/Retrofit.

- Allows the reuse, or reassignment, of existing amplifier alarm states (4-bit alarm data representations) and their alarm descriptions (alarm text) to a different amplifier/type with minimum effort.
- Allows all amplifier related alarm reports (alarm office summary report, amplifier alarm query response, and spontaneous alarm scan report) to be synchronized with consistent amplifier unit number, amplifier name, and alarm text string for the same alarm status.
- Allows a single or multiple amplifier alarm status of the PCS CDMA Minicell CDMA Transmit Unit (CTU) / Receive Unit (RU) amplifier to be reportable by the MSC.

Customer Perspective

This feature provides a new platform for more amplifier alarm related applications/configurations [e.g. Cellular CDMA adjunct to Series IIm (Minicell)/Series IImm (Microcell)].

Features

The alarm scanning redesign is an on-going OA&M effort targeted for all technologies as well as all various alarm types (amplifier, AIF, power/fan, equipment, and user alarms).

The ECP/Cell Site release for this feature is backward compatible with earlier release. The existing alarm reporting capabilities are not affected. The new ECP release supports both new and old cell site releases.

Cell Site Functions

Dynamically Populated Amplifier Alarm Table

The amplifier unit number and alarm text string assignments were previously hardcoded in the cell amplifier alarm tables on a per alarm address basis. The hardcoded design led to the propagation of cell alarm tables, which are difficult to maintain, and fail to support amplifier alarm address reconfiguration. The dynamically populated alarm table is therefore required to provide alarm address flexibility and self-configuration.

The amplifier alarm address is sent to the ECP and is used as logical amplifier unit number for all amplifier alarm reports. An Amplifier alarm address has 2 representations:

1. Denoted as offset/register number and bit number.
2. Referred as circuit ID with a range of 0-31 in the ceqcom2 RC/V form).

The amplifier alarm table is dynamically populated according to the amplifier type on a per amplifier alarm address basis for CDMA Cellular Minicell and PCS CDMA Minicell. The new populated alarm table does not hardcode the information of the alarm text and physical amplifier unit number.

As it is populated on a per amplifier alarm address basis, any amplifier unit with a supported amplifier type is assignable to any amplifier address. The dynamically populated table allows the amplifier unit to configure itself.

NOTE:
For the TDMA, Series II CDMA and AMPS cells, the system uses the existing hardcoded amplifier alarm table for alarm processing. Because at this point, this feature is for the CDMA Minicell technology only, the existing hardcoded alarm processing for other technologies (TDMA, Series II CDMA, AMPS) is not be affected.

The dynamically populated amplifier alarm table supports the Cellular Minicell Adjunct to the Series IIm (Minicell) configurations to allow the coexistence of mixing Series IIm (Minicell) ICLA and CDMA Cellular Minicell HTPA amplifier alarm types.

The amplifier alarm table supports the Cellular MiniCell Adjunct to the Series IImm (Microcell) configurations to allow the coexistence of mixing Series IImm (Microcell) and LAC amplifier alarm types in the same cell.

MSC Functions

Amplifier Alarm Reporting/Query

Every 4 seconds, the AFI polls the alarm status of each amplifier circuit through the EIA-422 bus interface message containing the amplifier alarm address. The Alarm Scanning Process in the Cell Site software then reads the alarm data associated with each amplifier alarm address and reports to the MSC.

Previously, amplifier alarm reporting and query functioned as follows: The physical amplifier unit number was hardcoded as part of a text string in the cell site amplifier alarm table. It was not retrievable by the Cell Site/ECP software. The amplifier alarm report, requested by the Cell Site software or technician worked well when the amplifier alarm address lined up with the physical amplifier unit number (e.g. alarm address x used by physical amplifier unit x) for traditional Series II LAC amplifiers. However, the physical amplifier unit number could be different from the amplifier alarm address number to which the amplifier unit was assigned. Because the Cell Site software was not capable of communicating to the remote amplifier controller, it could not relate the alarm status from each amplifier alarm address to the remote amplifier unit being queried.

For the PCS CDMA Minicell, the alarm assignment of the CDMA Transmit Unit (CTU) / Receive Unit (RU) amplifiers begins with amplifier alarm address 29. The alarm status of CTU physical amplifier unit 0 is passed on to the RCC through amplifier alarm address 29, address 30 for CTU physical amplifier unit 1, etc.

The physical amplifier unit number was previously hardcoded to the spontaneous alarm report at the ROP. When the technician was informed that the physical amplifier unit 0 was at the alarm state, he/she had to query the amplifier alarm status of this alarmed amplifier by entering the amplifier alarm address 29 in the OP:CELL-LAC alarm input command.

This inflexibility of the user interface has been corrected by defining a logical amplifier unit number for each amplifier unit associated with an amplifier alarm address and providing the logical amplifier unit number to the physical amplifier unit mapping. But, to provide the logical to/from physical amplifier unit number mapping and configuration information to the RC/V would have a great impact on the existing amplifier installation procedure. In order not to introduce any additional amplifier installation overhead, such as RC/V administration work, the following statements apply:

- The Existing amplifier alarm address (referred as circuit ID in the RC/V form) is the logical amplifier alarm unit number for the associated amplifier unit.
- The Physical amplifier unit numbering will no longer be supported by the AS reporting software.

The technician will be instructed to locate the physical amplifier unit based on the sector, carrier, and radio Baseband, Bus and Analog (BBA) trio circuit information given in the ECP database. Consequently, all amplifier alarm input/output messages and Status Display Page will all use the logical amplifier unit number to report the amplifier alarm status.

NOTE:
The Baseband Combiner and Radio (BCR), Bus Interface Unit (BIU) and Analog Conversion Unit (ACU) trios are known collectively as the BBA.

Upon detecting a non-sanity related amplifier alarm, the cell derives the amplifier alarm state from the amplifier type and the value of the four scanning point bits as defined in the HW spec/arch document and send the MSC the alarm address (offset #, bit #), alarm level/severity, alarm state summary (off normal or normal), and alarm state.

Four amplifier alarm states for the HTPA amplifier and 6 amplifier alarm states for the PCA/HPCA amplifier should be reported.

With this release, the following amplifier alarms are supported:

Four alarm states are supported for the Linear Amplifier Circuit (LAC) alarm:

0 - None
1 - LAC minor alarm
2 - LAC major alarm
3 - LAC critical alarm.

Six alarm states are supported for the PCS CDMA MiniCell:

0 - None

1 - CDMA Transmit Unit (CTU) failure-critical alarm,

2 - Single Receive Unit (RU) failure-major alarm

3 - CTU and single RU failure-critical alarm

4 - Both RU failure-critical alarm

5 - CTU and double RU failure-critical alarm.

The content of the interface message is not changed, except the alarm text string to be replaced by the amplifier alarm state.

The MSC then constructs the spontaneous scanning amplifier alarm report to provide the following information:

- Cell Number
- Alarm Scan Point (offset# & bit#)
- Logical Amplifier Unit number converted from alarm scan point
- Amplifier name associated with the amplifier type
- Alarm description (text string) associated with the state and amplifier type
- Alarm summary state (The "OFF NORMAL" alarm condition indicates a hardware/communication failure).

The technician originated office alarm summary (OP:ALARM) report, in addition to other data, contains the alarm scan point and the "OFF NORMAL/NORMAL" alarm summary state.

The amplifier name on a per amplifier type basis and alarm text string on a per amplifier type and amplifier alarm state basis is assignable through ECP global data owned by ECP AS Unix process.

Up to 16 amplifier alarm states per amplifier type as well as up to 70 alphanumeric characters per alarm text string is supported.

Upon receiving the amplifier sanity failure message from the cell site, the ECP, rather than the Cell Site, constructs the following alarm text string on a per system basis for the amplifier sanity failure reporting: "SANITY ALARM COMMUNICATION FAILURE."

The logical amplifier unit number (0-31) and amplifier alarm state of each alarmed amplifier in the cell site is delivered to the MSC, on Status Display Page (SDP) 2136, showing display/update every 15 seconds.

The sanity failure is displayed as it is now.

The basic alarm state (on or off) per alarm unit on the SDP 2136 page is supported for amplifier units of a new amplifier type reusing an existing amplifier alarm state (4-bit alarm data representations).

The MSC also sends to the cell site the logical amplifier unit number (0-31) for the individual amplifier OP query request from the technician.

A new AU option for the OP:CELL command is allowed to query the alarm status of non-LAC type amplifiers.

One "REPT:CELL-ALARM SCANNING" report showing both CDMA Transmit Unit (CTU) and Receive Unit (RU) alarm status is sent to the ROP.

The LAC alarm data is in the form of 4 bits labeled W, C, Bit 1, and Bit 0. These 4 bits in the alarm response message are used to indicate the status of the CTU and RUs. Because the hardware reports both CTU and RU status simultaneously, one report is generated

Prior to this feature, the physical amplifier unit number (0), rather than the logical amplifier unit number (29), was indicated in all amplifier alarm related output messages (i.e. alarm office summary report, amplifier alarm query response report, and spontaneous scan output report) at the ROP for the CDMA PCS Minicell. In order to minimize the impact to this existing user interface, the physical amplifier unit number will be provided as well in all amplifier alarm output messages.

Without logical to/from physical amplifier unit number mapping information in the RC/V, this would have to be done through a hardcoded method in the TI. Note that providing both physical and logical amplifier unit numbers is for PCS CDMA Minicell only, not for CDMA Cellular Minicell adjuncts to the Series IIm (Minicell) / Series IImm (Microcell).

This would be an interim solution until input from customers regarding the amplifier unit physical numbering for the mixed amplifier cell configuration is obtained.

CDMA Transmit Unit (CTU) and Receive Unit (RU) Separate Alarms

The CDMA Transmitter unit (CTU) has the following alarm conditions:

- Transmit (Tx) up-converter synthesizer out-of-lock
- Transmit (Tx) amplifier alarm (amplifier malfunction, amplifier over-temperature, and over current).

If any of these alarm conditions occur, the Radio Control Complex (RCC) is informed.

Each Receive Unit (RU) has 2 alarm conditions:

- Low Noise Amplifier (LNA) failure

- RU down converter synthesizer out-of-lock.

If either of these alarm conditions occur, the RCC is informed.

For the PCS CDMA Minicell, the receiver unit alarm was reported as part of the CTU transmit amplifier status message. Any failure occurring on both diversity receive units would result in a critical alarm. Currently, RU and CTU alarms are accurately reported at the ROP, but incorrectly reported in the "OP:ALARM,ALL" or "OP:CELL-LAC" input command response. This feature will report the CTU critical alarm, single receiver unit major alarm and double receiver unit critical alarm separately on the display pages and the ROP.

A single receiver unit alarm indicates the loss of half the diversity pair and traffic capacity limitation while the double receiver unit alarm indicates a total loss of the receiver diversity pair. Most of all, it allows the multiple amplifier alarm (state 3 and state 5) to be reported.

This feature will also provide a CTU/RU status page (new 2136 page) to display the status of all CTUs/RUs at a single PCS CDMA Minicell. Because the receiver unit alarm message from the alarm circuit does not pass the affected RU number, the major (yellow background for single RU failure) and critical (red background for double RU failure) indicators will be highlighted on the pair of diversity amplifiers.

Upon being informed of a single amplifier alarm, the technician has to check the LED indicator at the Alarm Control Board's faceplate to determine which RU causes a single receiver alarm. Furthermore, to facilitate amplifier maintenance, the sector number and carrier number associated with the CTU and the sector number associated with the RU pair must also be displayed. The display page supports the configurations of 1 carrier-6 sectors, 1-3 carriers-3 sectors, 1-9 carriers-omni. The CTU/RU numbering will be based on the logical amplifier unit number.

This feature provides the alarm reporting capabilities for each CTU and each pair of the RU. These include new "OP:CELL-CTU" and OP:CELL-RU" input command options, the modified "OP:ALARM,ALL" output report and spontaneous alarm reports (REPT:CELL a ALARM SCANNING).

The RCG icon in the 2131 page are marked "uneq" for CDMA Cellular Minicell and PCS CDMA Minicell. An RU (PCS CDMA Minicell Receive Unit)" icon reflects the status summary of both down-converters/receive diversity pair based on the 2 RUs in the diversity receive paths of the PCS CDMA Minicell. A single receive diversity alarm will be displayed with a yellow background to indicate the loss of half the diversity pair and traffic capacity limitation while a double RU alarm will be in a red background to indicate a total loss of the receive diversity pair.

Upon the single CDMA transmit unit or double receive diversity (DRD) alarm/ failure, the traffic from CCCs/CCUs toward the affected antenna is blocked from sector with a reason of "ctu" or "drd" in the 2139 page.

Two BFS reasons, ctu and drd, to indicate the single CTU or double RU alarms for the OP:CELL-CCC report is provided.

NOTE:
A pair of receive diversities serves one sector for all carriers to determine which RU causes a single receive diversity alarm.

The OP:CELL-RCG report shows "UNEQ" and the REPT:CELL-ALM-SCN

report does not include the RCG alarm for a PCS CDMA Minicell and CDMA Cellular Minicell.

Performance & Capacity

Alarm Scanning Redesign will result in:

- Less CPU processing time and data link bandwidth usage during the cell site alarm message processing since the alarm text will not be passed to the MSC from the cell site.
- An increase in the MSC memory usage but a decrease in cell memory usage as a result of maintaining the alarm text at the MSC, rather than the cell site.
- More CPU processing time during the MSC alarm reporting (i.e. look up text string for each alarm to be reported).

Cell Site Hardware LED Descriptions

19

Contents

LED Descriptions Table

Most of the Cell Site hardware units have one or more LEDs that continually provide information on the current operating conditions of the units. A technician at an on-site location can observe the LEDs to identify faulty hardware units. Except for the linear amplifier circuits in the LAF and the channel service units in the FIF, the LEDs for the various Cell Site hardware units are listed and described in Figure 19-1.

The RFG entry in Figure 19-1 pertains to the reference frequency generator, which has two rows of red, yellow, and green LEDs, one row for each of the redundant 15-MHz oscillators. The RFTG entry in the table pertains to the reference frequency and timing generator (CDMA only), which has the same two rows of LEDs as the RFG.

Table 19-1. Cell Site Hardware Status Indicators

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
CPU	x				Red	Off during powerup or after a system reset; lights if self-test fails; lighted during normal operation if software detects a CPU failure.
					Green	The on-line (active) CPU has this LED lighted; the off-line CPU has its green LED off. In addition, the green LED can be turned on or off by software for diagnostic purposes.
MEM	x				Red	Off during powerup or after a system reset; lighted during normal operation if software detects a MEM failure
AFI	x				Red	Lighted during the self-test initiated upon powerup or after a system reset and goes off after successful completion of the self-test; lighted during normal operation if software detects an AFI failure.

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
CPI	x				Red	Lighted momentarily during the self-test initiated upon powerup or after a system reset and is off after successful completion of the self-test; lighted during normal operation if software detects a CPI failure or the CPI is insane.
NCI	x				Red	Lighted momentarily during the self-test initiated upon powerup or after a system reset and is off after successful completion of the self-test; lighted during normal operation if there is no valid TDM bus clock source or the NCI is insane.
DS1	x				Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the DS1 is insane.
					Yellow	Lighted if the DS1 detects an alarm other than a *minor*, *misframe*, or *slip* alarm on the connected T1 line.
					Green	The DS1 selected as the synchronization reference for the TDM bus (TDM0, TDM1) has this LED lighted; only one DS1 (or DFI) on the TDM bus can have the green LED lighted; if the local oscillator on the CAT is the synchronization reference, no DS1 (or DFI) will have its green LED lighted for the bus. Note: TDM buses are always installed "red stripe up."

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
DFI	x				Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the DFI is insane.
					Yellow	Lighted if the DFI detects an alarm other than a *minor*, *misframe*, or *slip* alarm on the connected T1 line, or other than a *10e-6 error-ratio* or *slip* alarm on the connected E1 line.
					Green	The DFI selected as the synchronization reference for the TDM bus (TDM0, TDM1) has this LED lighted; only one DFI (or DS1) on the TDM bus can have the green LED lighted; if the local oscillator on the CAT is the synchronization reference, no DFI (or DS1) will have its green LED lighted for the bus.Note: TDM buses are always installed "red stripe up."
CAT	x				Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the CAT has a board error or is insane.
					Green	The on-line (active) CAT has this LED lighted; the off-line CAT has its green LED off. (The active CAT provides TDM bus clocks.)

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
RCU, SBRCU		x			Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the RCU/ SBRCU has a board error or is insane.
					Yellow	Lighted during non-volatile memory (NVM) update.
					Green	Lighted when the RCU/ SBRCU is transmitting.
RTU		x			Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the RTU has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted when the RTU is transmitting.
RFG		x	x		Red	Upon powerup, lights for approximately 4 to 6 minutes while oscillator is warming up and then goes off; during normal operation, lighted red LED indicates an oscillator failure or, for a crystal oscillator, that the oscillator may be in an unlocked state.
					Yellow	For a rubidium-crystal oscillator combination, indicates that the backup crystal oscillator is phase-locked to the rubidium oscillator; for a two-rubidium oscillator combination, indicates that the backup rubidium oscillator is ready for operation.
					Green	Indicates that the oscillator is active.

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
PCU (415AA) +5 Vdc		x	x		Red	Indicates one of the following alarms: low input voltage shutdown alarm (*non-latched shutdown*), high output voltage shutdown alarm (*latched shutdown*), over-current shutdown alarm (*latched shutdown*) or low output voltage alarm (*no shutdown*).
					Green	Indicates the presence of input voltage (+24 Vdc nominal).
PCU (419AA) ±12 Vdc		x	x		Red	Indicates one of the following alarms high output voltage shutdown alarm (*latched shutdown*) or low output voltage alarm (*no shutdown*).
					Green	Indicates the presence of input voltage (+24 Vdc nominal).
DRU, EDRU			x		Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the DRU/ EDRU has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted when the DRU/ EDRU is transmitting.
TRTU			x		Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the TRTU has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted when the TRTU is transmitting.

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
PCU (415AC) +5 Vdc			x		Red	Indicates one of the following alarms: low input voltage shutdown alarm (*non-latched shutdown*), high output voltage shutdown alarm (*latched shutdown*), over-current shutdown alarm (*latched shutdown*) or low output voltage alarm (*no shutdown*).
					Green	Indicates the presence of input voltage (+24 Vdc nominal).
CCC				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the CCC has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted if the CCC is in-service (either receiving or ready to receive calls).
CCU				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the CCU has a board error.
					Green	Lighted if the CCU is in-service (either receiving or ready to receive calls).
BIU				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the BIU has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted if the BBA is in-service (either receiving or ready to receive calls).

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type: Gen	AMPS	TDMA	CDMA	LED	Description
ACU				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the ACU has a board error.
					Green	Lighted when the ACU is supplying reverse path data to the shelf RXDATA bus.
BCR				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the BCR has a board error.
					Green	Lighted when the BCR is transmitting.
SCT				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the SCT has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	The on-line (active) SCT has this LED lighted; the off-line SCT has its green LED off. (The active SCT provides CDMA reference signals for the entire CDMA growth frame in which it resides; and, if so configured, may also provide TDM bus clocks. That configuration is accomplished manually via a TDM enable switch on the wiring side of the backplane associated with the installed SCT.)

Table 19-1. Cell Site Hardware Status Indicators (Contd)

Hardware Unit	Hardware Type				LED	Description
	Gen	AMPS	TDMA	CDMA		
CRTUi				x	Red	Lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the CRTUi has a board error or is insane.
					Yellow	Lighted during NVM update.
					Green	Lighted when a CDMA functional test is executing.
RFTG				x	Red	Upon powerup, lights for approximately 4 to 6 minutes while oscillator is warming up and then goes off; during normal operation, lighted red LED indicates an oscillator failure or, for a crystal oscillator, that the oscillator may be in an unlocked state.
					Yellow	For a rubidium-crystal oscillator combination, indicates that the backup crystal oscillator is phase-locked to the rubidium oscillator; for a two-rubidium oscillator combination, indicates that the backup rubidium oscillator is ready for operation.
					Green	Indicates that the oscillator is active.
PCU (430AA) +5 Vdc				x	Red	Indicates one of the following alarms: low input voltage shutdown alarm (*non-latched shutdown*), high output voltage shutdown alarm (*latched shutdown*), over-current shutdown alarm (*latched shutdown*) or low output voltage alarm (*no shutdown*).
					Green	Indicates the presence of input voltage (+24 Vdc nominal)

AMapping Status Display Page Unit Numbers to Hardware

20

Contents

Introduction

This section shows how logical unit numbers on the ECP status display pages map to their physical counterparts in the Series II Cell Site. For example, logical unit DS1 0 on the 2134 - Cell DS-1 Unit Status page maps to a DS1 or DFI hardware unit seated in shelf 3, slot 12, of the primary RCF. The mapping is established through translations, or system-configuration parameters, which hold the static data determining the behavior of the Cell Site.

The recent change and verify (RC/V) subsystem at the ECP is used to build (or update) the Cell Site translations data base, that is, assign specific attributes to the various translations. Specifically, the RC/V ceqcom2 form is used to establish how Series II Cell Sites are equipped, that is, establish the logical-to-physical mappings of hardware units for each and every Series II Cell Site.

In the current RC/V implementation, some logical-to-physical unit mapping is fixed and cannot be changed by the user: the mapping is the same for each and every Series II Cell Site sold by Lucent Technologies. (DS1 0 is an example of this type of mapping.) Other logical-to-physical unit mappings are not fixed and can be established as the user sees fit. For the latter case, the only way to identify the physical location (frame, shelf, slot) associated with a logical unit number on the status display page is to consult the ceqcom2 form.

Logical-to-Physical Mappings of Generic Cell Site Units

The mappings in Figure 20-1 show how the CSC (RCC) and certain DS1 and CAT logical unit numbers on the status display pages map to their physical counterparts in the primary RCF. CSC 0 and CSC 1, DS1 0 and DS1 1, and CAT 0 and CAT 1 are fixed and cannot be changed by the user. The other two DS1s residing in shelf 0, slot 21, and shelf 5, slot 14, serve as examples of logical-to-physical mappings established by the user; *they can be assigned any DS1 logical numbers within the range 2 through 13*.

The range for DS1 logical numbers is 0 through 13 since a fully equipped, non-CDMA, Series II Cell Site can hold up to 14 DS1s. Seven DS1 slots connect to TDM bus 0 (TDM0) (See Figure 20-2), and seven DS1 slots connect to TDM bus 1 (TDM1).

NOTE:
TDM buses are always installed "red stripe up."

A DFI may reside in any slot reserved for the DS1. When DS1 and DFI units are equipped using RC/V, both units are given “DS1” logical numbers. With few exceptions, there is no distinction between DFI and DS1 units on the status display pages; both are lumped together under the “DS-1” heading.

Although the DFI has two physical facility ports, only a single facility port is currently supported.

The mappings in Figure 20-1 shows how the CAT logical unit numbers on the status display pages map to their physical counterparts in a partially and fully equipped, non-CDMA, Series II Cell Site. The range for CAT logical numbers in a non-CDMA Cell Site is 0 through 3. The active (on-line) CAT, CAT 0 or CAT 1 (See Figure 20-3), provides the TDM bus clocks for TDM0. The active CAT, CAT 2 or CAT 3, provides the TDM bus clocks for TDM1.

NOTE:
TDM buses are always installed "red stripe up."

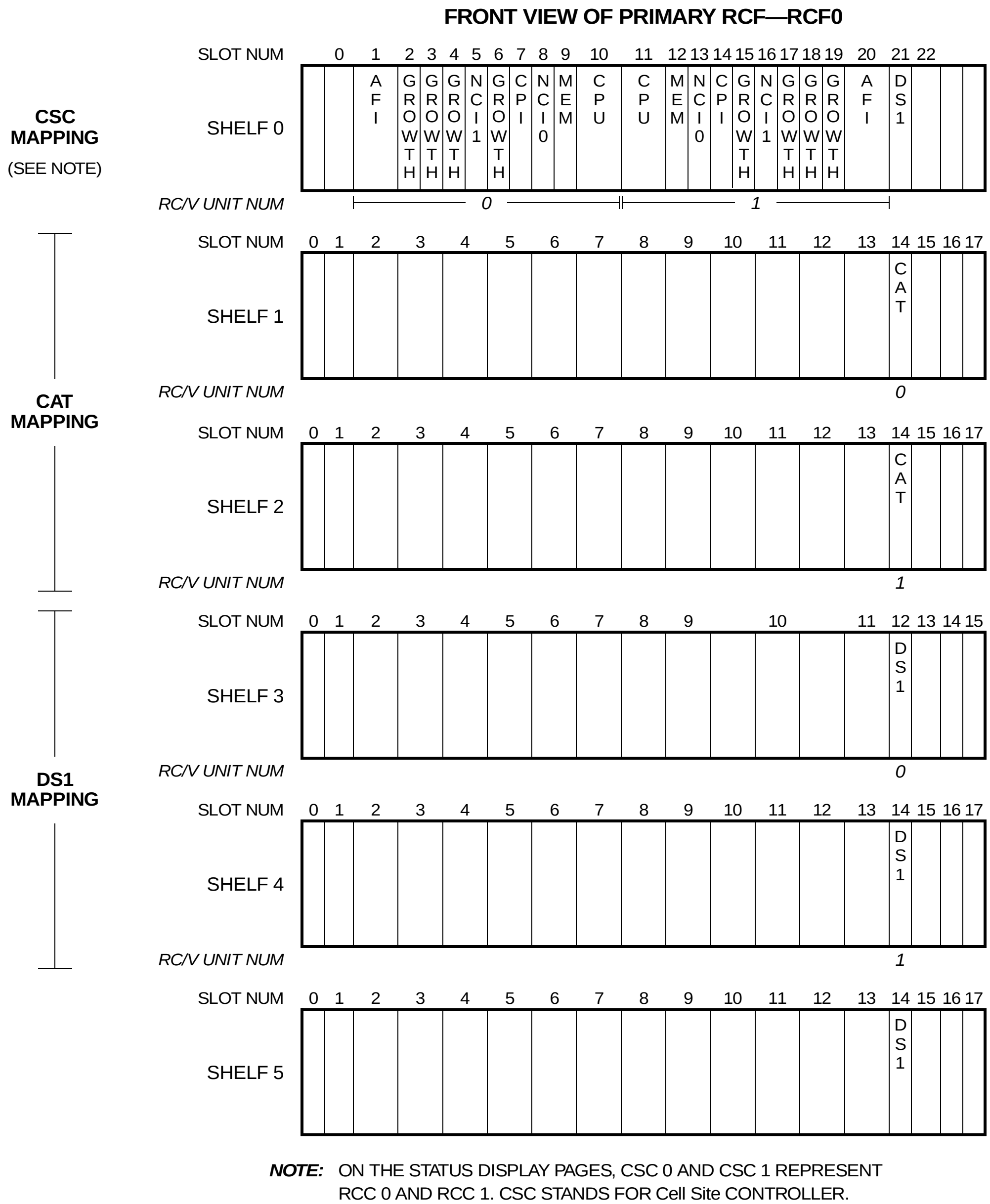


Figure 20-1. Logical-to-Physical Unit Mapping for the RCC, DS1, and CAT in Primary RCF

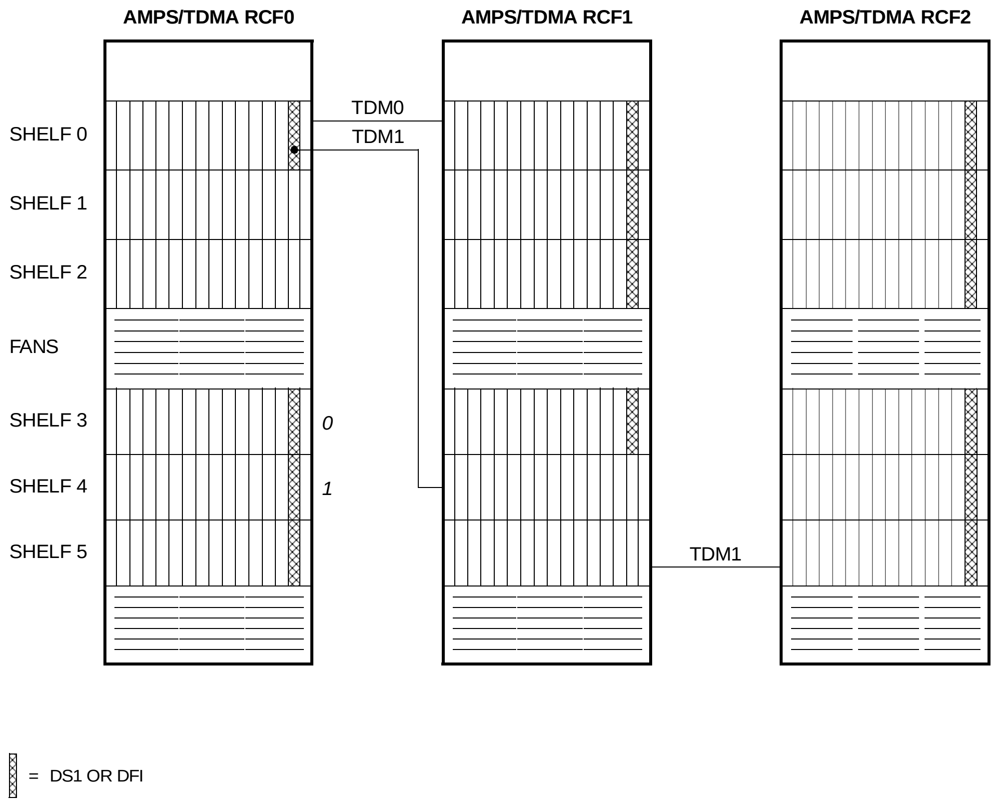


Figure 20-2. Logical-to-Physical Unit Mapping for the DS1

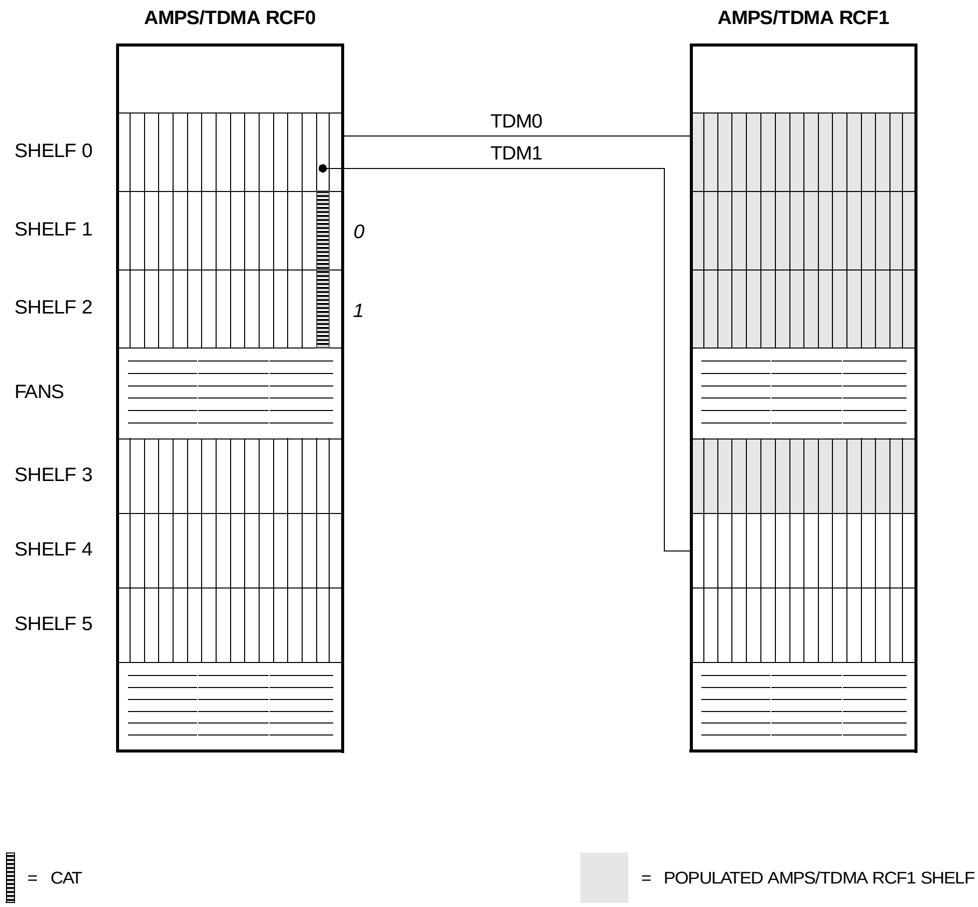


Figure 20-3. Logical-to-Physical Unit Mapping for the CAT (Sheet 1 of 3)

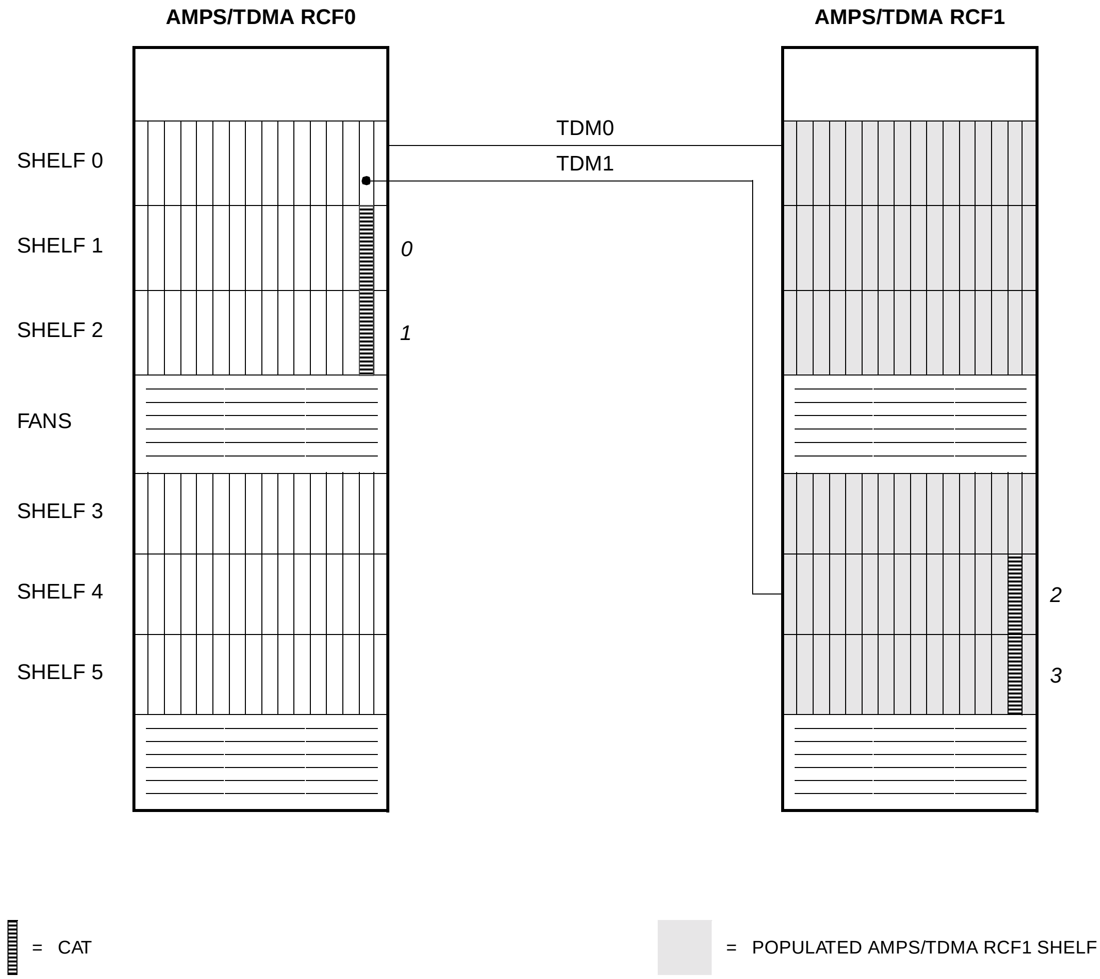


Figure 20-4. Logical-to-Physical Unit Mapping for the CAT (Sheet 2 of 3)

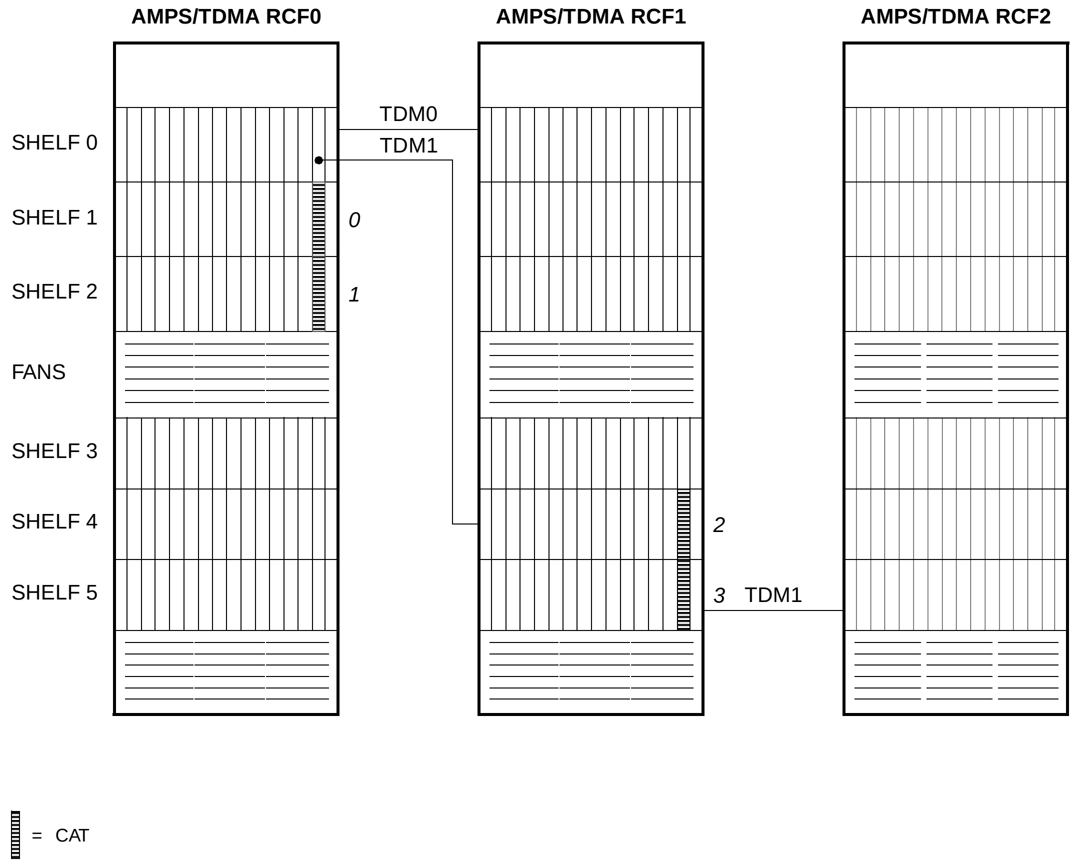


Figure 20-5. Logical-to-Physical Unit Mapping for the CAT (Sheet 3 of 3)

Logical-to-Physical Mappings of CDMA-Specific Cell Site Units

The mappings in Figure 20-6 and Figure 20-8 show how the CDMA logical unit numbers on the status display pages map to their physical counterparts in the Series II Cell Site. For example, as highlighted in reverse video in Figure 20-6, logical unit CCC 7 on the status display page maps to the CCC seated in shelf 0, slot 12, of CDMA growth frame RCF1. In the current RC/V implementation, the logical-to-physical unit mapping for CDMA units is fixed and cannot be changed by the user.

Up to two CDMA growth frames, CDMA RCF1 and CDMA RCF2, may reside at a Series II Cell Site.

CCUs are addressed using a fixed numbering scheme that associates each CCU with its particular CCC. For example, as highlighted in gray in Figure 20-6, Sheet 1, address *18-3* identifies CCU 3 associated with logical unit CCC 18.

The “DS1” logical numbers associated with the DFI units in Figure 20-10—denoted by an asterisk (*)—are suggested values. The user could associated other “DS1’ logical numbers with those DFIs, but the DFIs must be physically located as shown in the Figure 20-10. *DFIs are required for CDMA operation.* (Slot 24 of shelves 2 and 3 of the CDMA growth frame is reserved for the DFI.)

The range for CAT logical numbers in a CDMA Cell Site is 0 through 5. *CAT 4 and CAT 5 are always SCT units*. (Slot 24 of shelves 0 and 1 of the CDMA growth frame is reserved for the SCT.)

On the status display pages, SCT and CAT units are lumped together under the “CAT” heading. A c displayed next to a CAT logical number indicates a CAT board, and an s displayed next to a CAT logical number indicates a SCT board.

When equipping SCT and CAT units using RC/V, SCT units are configured for GPS timing, while CAT units are configured for *no* GPS timing. RC/V is *not* used to configure a SCT for TDM bus timing; that configuration is accomplished manually via a TDM enable switch on the wiring side (rear side) of the backplane associated with the installed SCT. The active (on-line) SCT provides CDMA reference signals for the entire CDMA growth frame in which it resides.

Upon comparing the two figures, you will notice a difference in TDM1 cabling between the AMPS/TDMA RCF2 and the CDMA RCF2. The TDM1 cabling in the AMPS/TDMA RCF2 starts at the bottom of the frame, whereas the TDM1 cabling in the CDMA RCF2 starts at the top.

NOTE:
TDM buses are always installed "red stripe up."

Figure 20-6. Logical-to-Physical Unit Mapping for the CCC (Sheet 1 of 2)

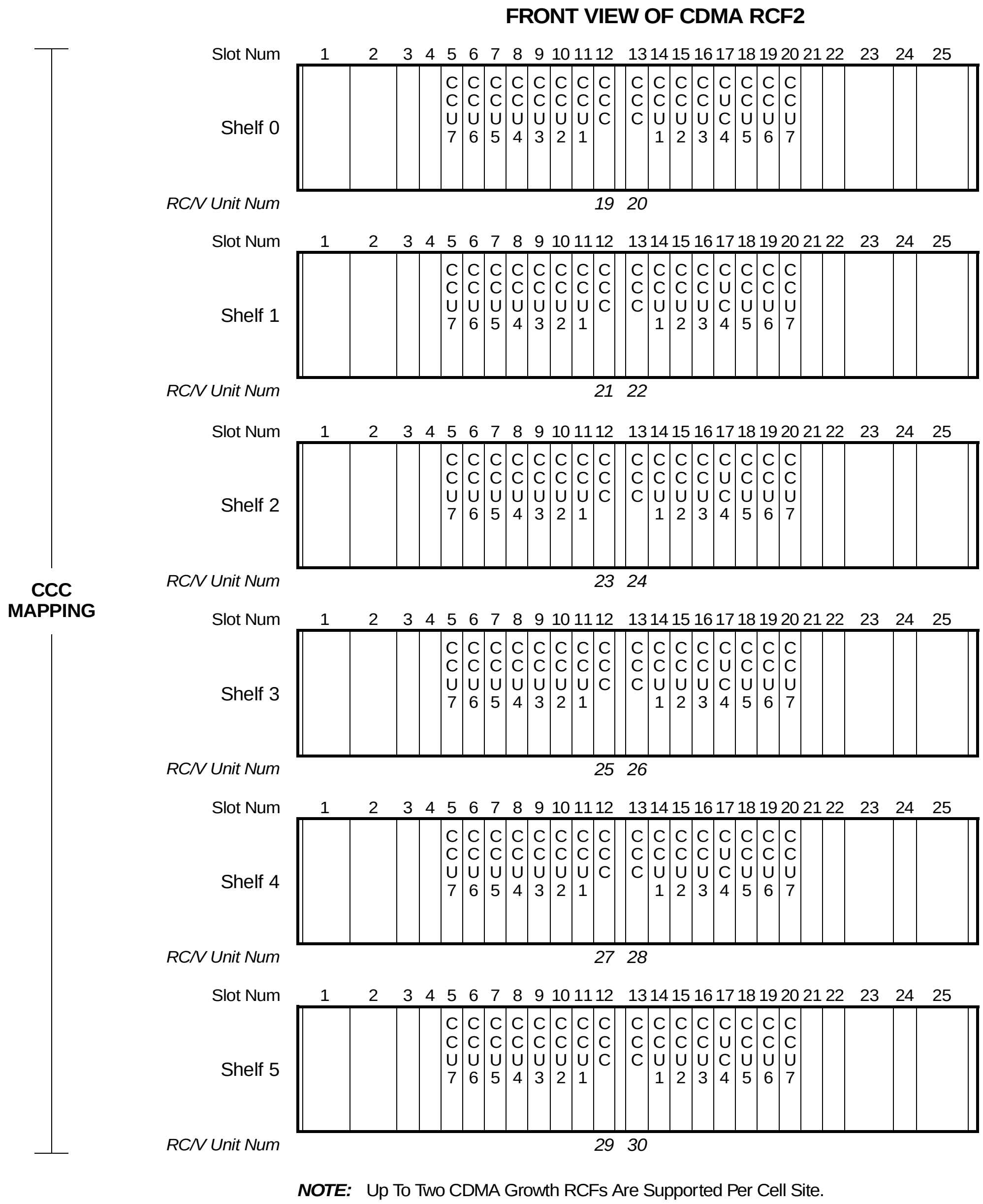


Figure 20-7. Logical-to-Physical Unit Mapping for the CCC (Sheet 2 of 2)

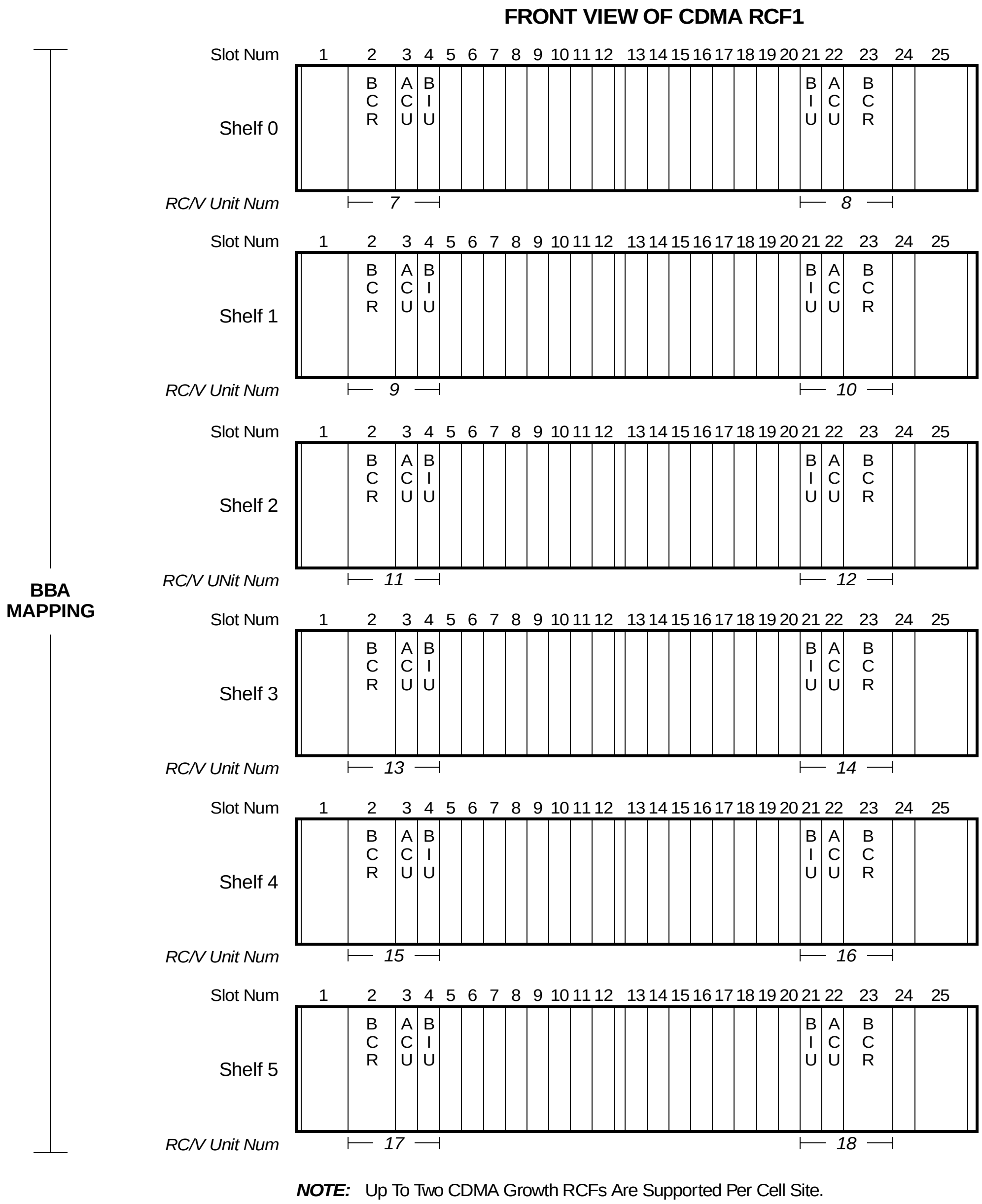
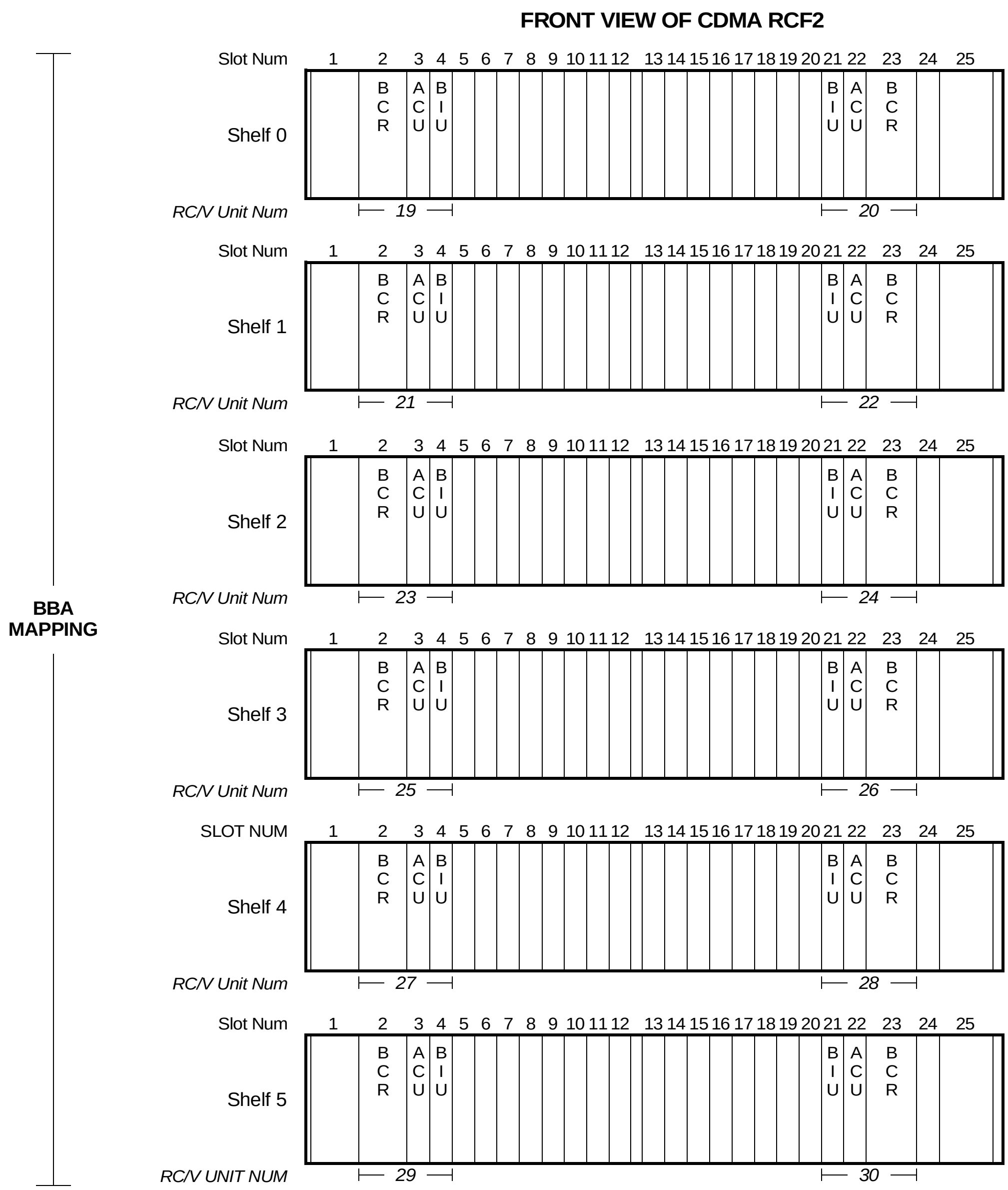


Figure 20-8. Logical-to-Physical Unit Mapping for the BBA (Sheet 1 of 2)



NOTE: Up To Two CDMA Growth RCFs Are Supported Per Cell Site.

Figure 20-9. Logical-to-Physical Unit Mapping for the BBA (Sheet 2 of 2)

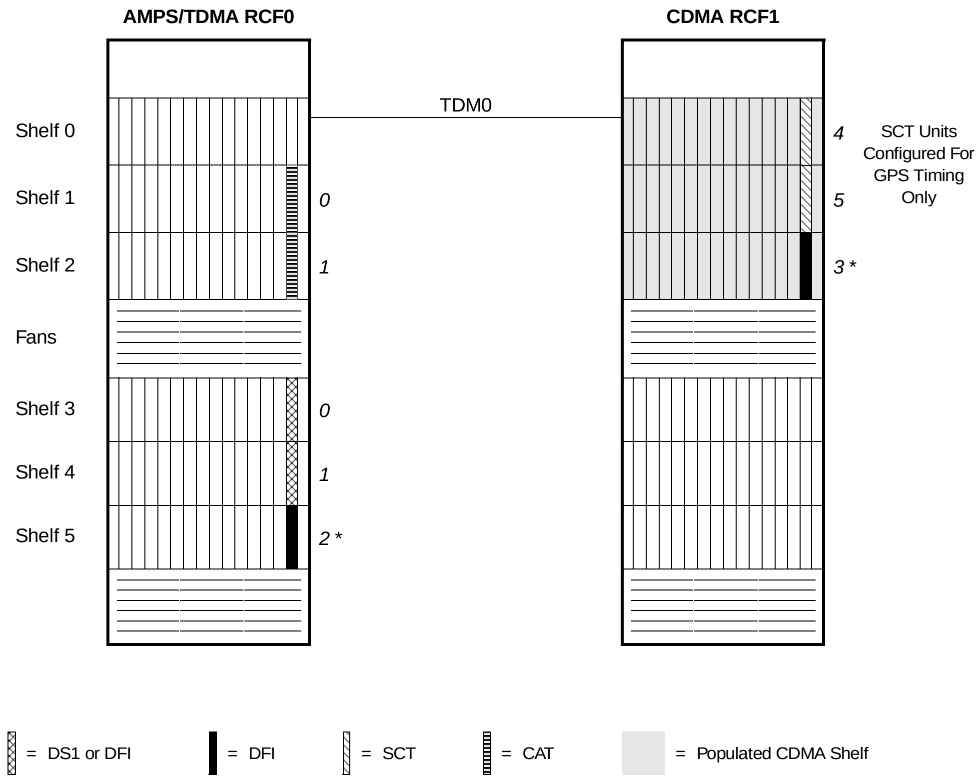


Figure 20-10. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT (Sheet 1 of 6)

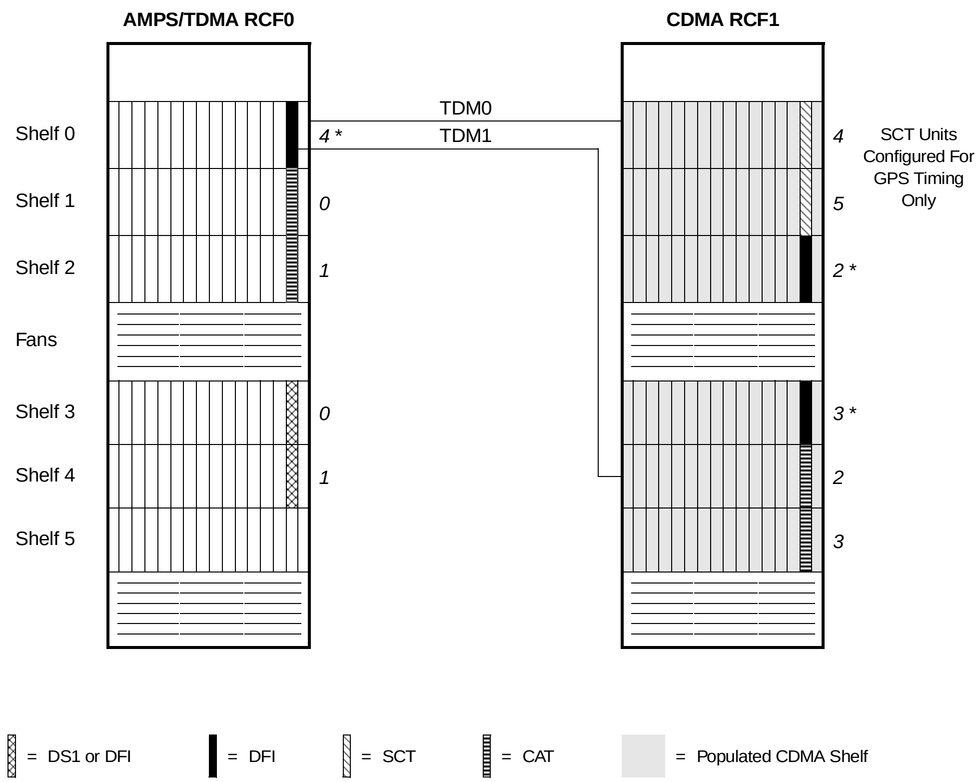


Figure 20-11. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT (Sheet 2 of 6)

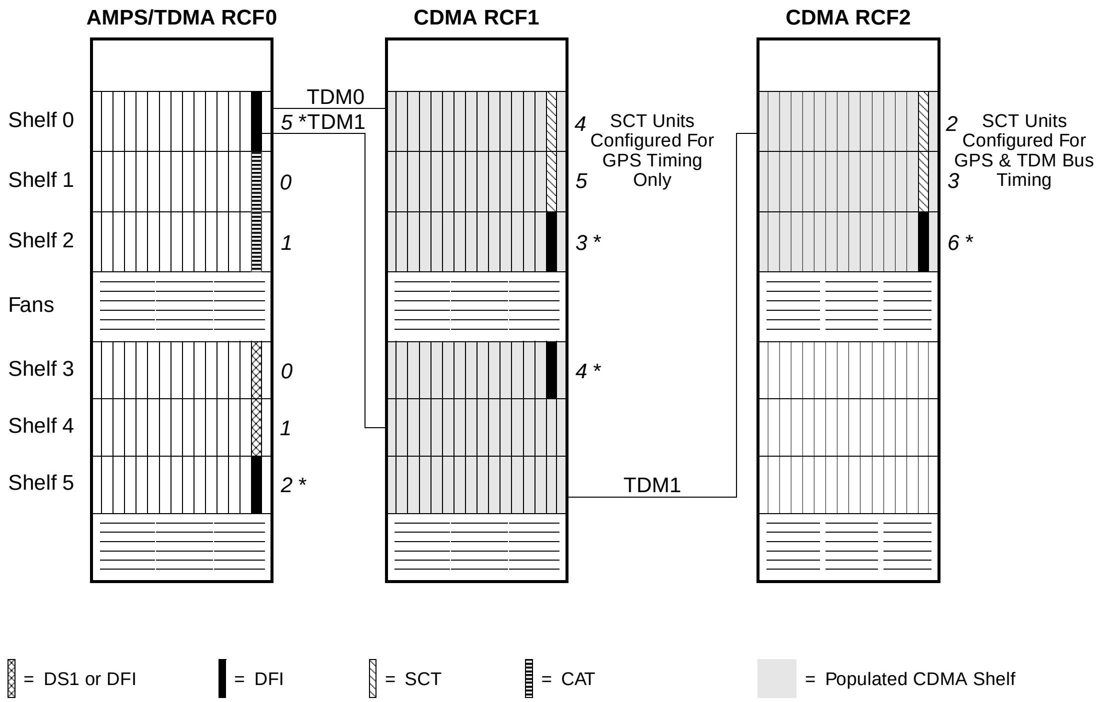


Figure 20-12. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT (Sheet 3 of 6)

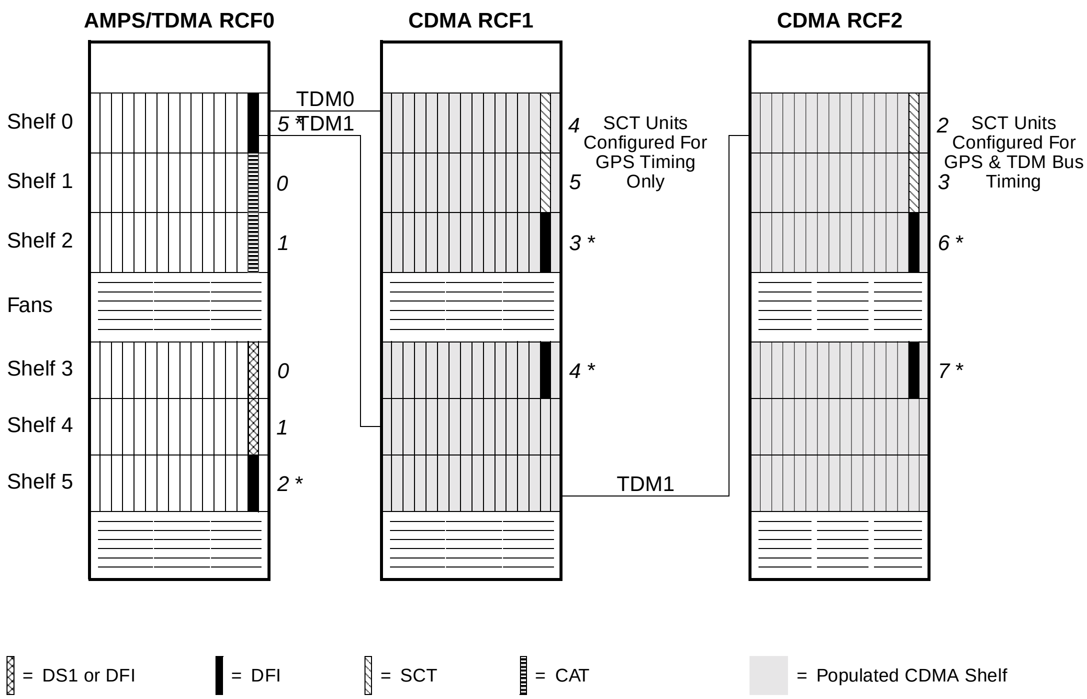


Figure 20-13. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT (Sheet 4 of 6)

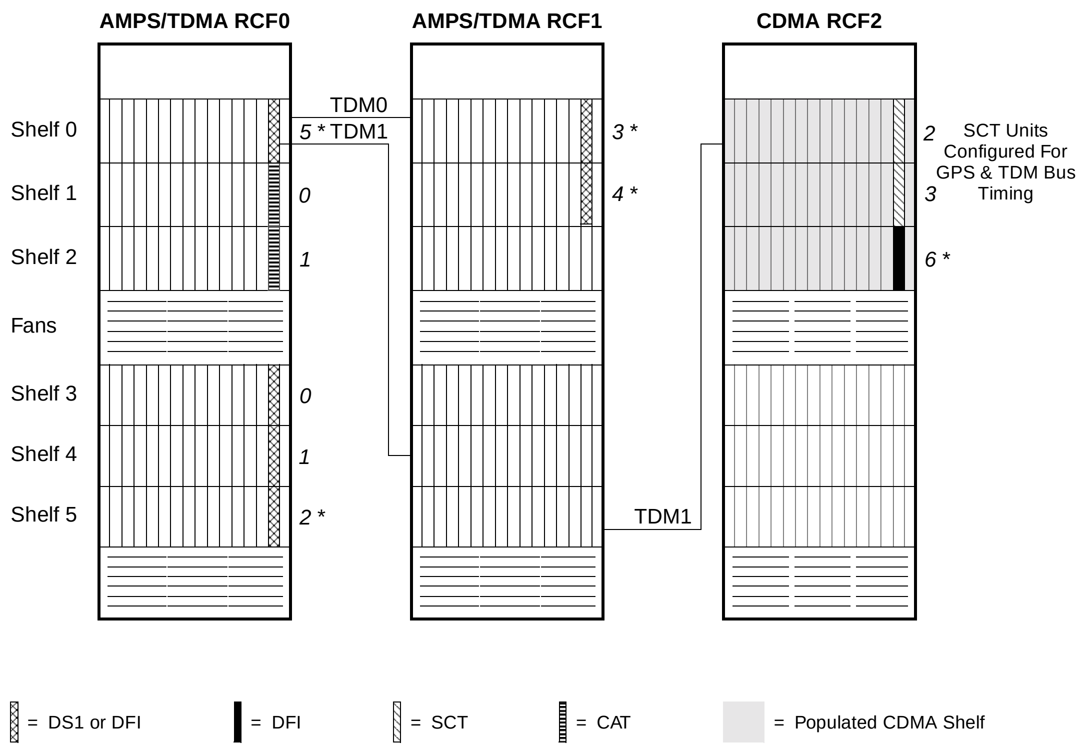


Figure 20-14. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT (Sheet 5 of 6)

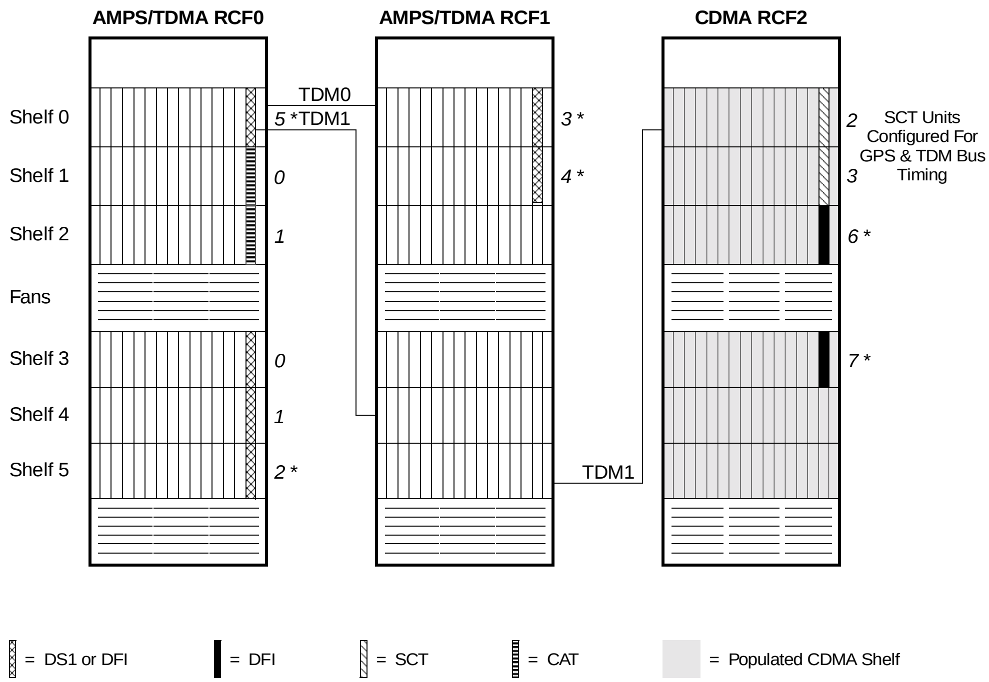


Figure 20-15. Logical-to-Physical Unit Mapping for the DFI/DS1 and SCT/CAT) (Sheet 6 of 6)

CDMA Maintenance

21

Contents

Introduction

This section describes the code division multiple access (CDMA) system as implemented in the Series II platform and presents trouble-clearing procedures to correct faults pertaining to CDMA Cell Site hardware units. It also presents cursory trouble-clearing procedures to correct faults pertaining to CDMA voice-processing hardware units at the 5ESS®-2000 Switch DCS.

CRTU and CDMA Functional Testing

The CDMA radio test unit (CRTU) is used by the RCC to verify proper operation of CDMA radio equipment at a Series II Cell Site, Cellular CDMA Minicell, or Personal Communications Services (PCS) CDMA Minicell. The CRTU can test 8- or 13-kbit/s CDMA vocoder operation.

The CRTU supplements Cell Site diagnostic testing with functional testing. CDMA functional testing verifies that the network is able to originate mobile calls over the cell CDMA channels and that all cell CDMA radio equipment is operational. The CRTU can automatically test every *idle* (in-service and non-busy) CDMA traffic channel element (CE) in the cell without human intervention.

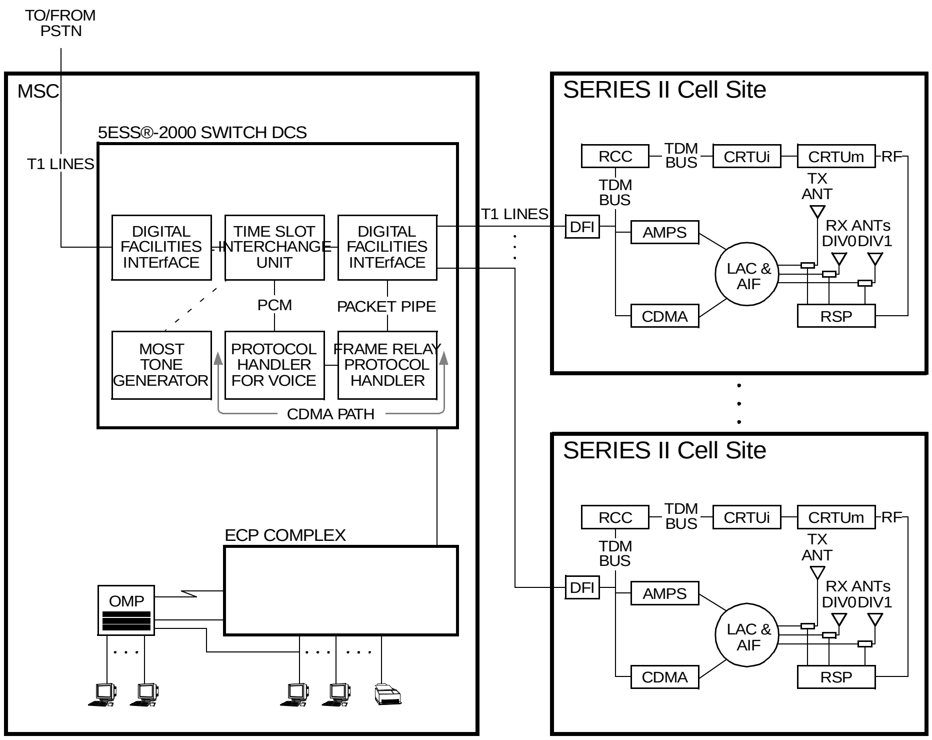
There are two types of CDMA functional tests:

1. **Overhead channel functional tests**, which verify that the pilot/sync/access (P/S/A) CEs and page CEs are operational.
2. **Traffic path functional tests**, which verify that the CDMA traffic CEs are operational.

The CDMA functional tests require that the CRTU set up test calls using the mobile station test (MOST) feature.

The CRTU has a TDM bus connection to the RCC, and RF connections through the radio switch panel (RSP) to the directional couplers of the transmit and receive filter panels at the antennas (See Figure 21-1).

NOTE:
TDM buses are always installed "red stripe up."



DEFINITIONS:

CRTUi	CDMA RADIO TEST UNIT INTErfACE	MOST	MOBILE STATION TEST (FEATURE)
CRTUm	CDMA RADIO TEST UNIT MODULE	RSP	RADIO SWITCH PANEL

Figure 21-1. High-Level View of the CRTU Test System

CRTU Components

The CRTU consists of two hardware components (See Figure 21-1): the CRTU interface (CRTUi) and the CRTU module (CRTUm). The CRTUi is a plug-in board installed in the primary RCF through which the RCC communicates with an IS-95B compliant mobile station in the CRTUm. From an RCC perspective, the CRTUi and CRTUm together look like a single maintenance unit, just like the RTU or TRTU.

The CRTUi contains the firmware needed to run the CDMA functional tests. In response to functional test messages from the RCC, the CRTUi carries out the specified actions and returns the test information to the RCC. The message exchange is through TDM0.

NOTE:
The term *CRTU* will be used in this document except when it is necessary to distinguish between the CRTUi and CRTUm components.

The CRTUi communicates with the CRTUm through an EIA-422 asynchronous data link. It is over this data link that the CRTUi, under the direction of the RCC, instructs the CRTUm to perform individual CDMA functional tests, and over which the CRTUi and RCC collect the test results. Included with the four-wire EIA-422 data link are two control leads. One control lead allows the CRTUi or RCC to turn off the CRTUm by disabling power to the CRTUm. The other control lead is reserved for future use.

The CRTUi communicates with the RSP through an RSP control board (RCB)* and a second EIA-422 asynchronous data link. It is over this data link that the CRTUi, under the direction of the RCC, instructs the RSP to set its internal RF switches to connect to the desired RF path (See Figure 21-2).

An AYD12 paddleboard (circuit board), installed on the wiring side of the CRTUi slot pinfield, provides the two physical connectors needed to interconnect the CRTUi with the CRTUm and the RCB.

NOTE:
Be aware that the port designations *J1* and *J2* on the PCS CDMA Minicell RSP map to port designations *J2* and *J1* on the Series II Cell Site RSP or Cellular CDMA Minicell RSP—the port designations are reversed. As clarification, J1 on the PCS CDMA Minicell RSP allows access to the transmit filter panels, whereas J1 on the Series II Cell Site RSP allows access to the receive filter panels.

The CRTUi faceplate has three light-emitting diode (LED) indicators, one red, one yellow, and one green. Their meanings are as follows:

Red LED

Controlled by the CRTUi; lighted during the self-test initiated upon powerup or after a reset and goes off after successful completion of the self-test; lighted during normal operation if the CRTUi has a board error or is insane.

Yellow LED

Controlled by Cell Site system software; Lighted during non-volatile memory (NVM) update.

Green LED

Controlled by the CRTUi; Lighted when a CDMA functional test is executing.

* Since the Series II Cell Site has both CDMA and AMPS radios, the RCB is needed so that both the CRTU and RTU can access the RSP. No RCB is needed for the Cellular CDMA Minicell or PCS CDMA Minicell since neither contains AMPS (or TDMA) radios.

RC/V Form Changes to Support the CRTU

Certain fields and parameters have been added to the following recent change and verify (RC/V) forms to support the CRTU:

- Executive Cellular Processor form (ecp)
- Series II Cell Equipage Common form (ceqcom2)
- Subscriber and Feature Information form (sub)
- Cell Equipage Component Location form (ceqcloc).

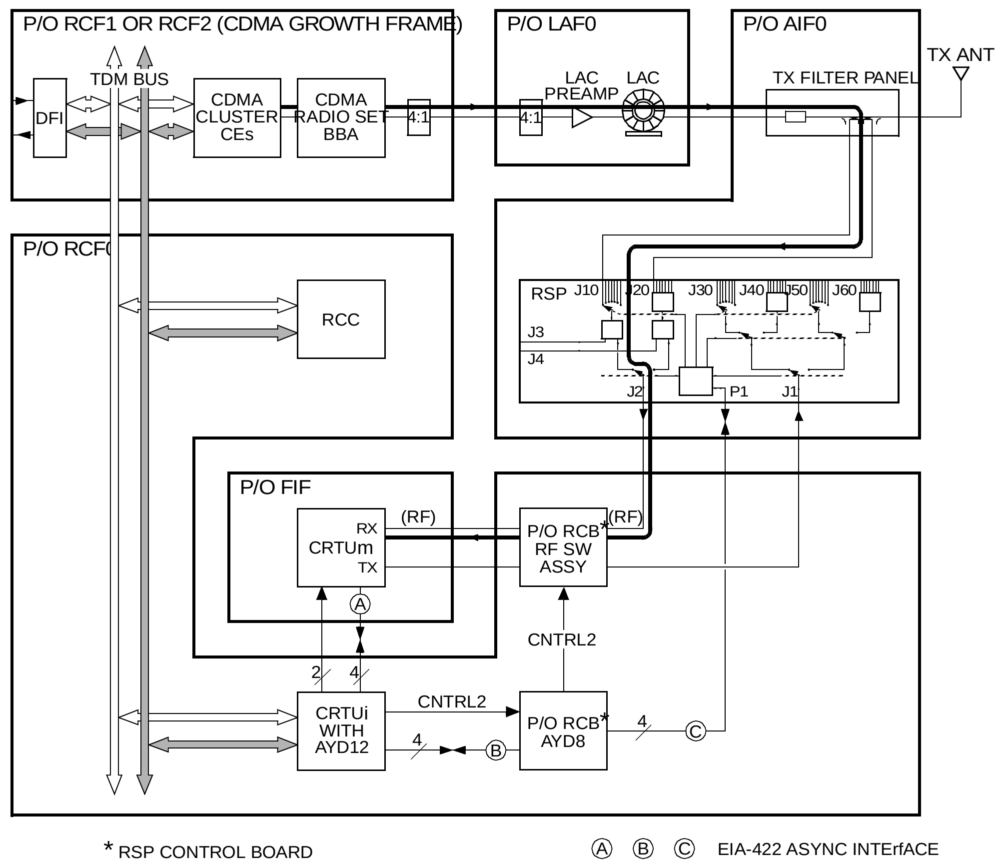


Figure 21-2. RF Transmit Path Setup for CDMA Functional Tests at the Series II Cell Site

Executive Cellular Processor Form

The ecp form contains the ECP information used to process calls, make service measurements, and provide automatic message accounting (AMA) information. The values specified here will be used for each cell served by this ECP unless other values are specified on an individual cell basis using the RC/V cell forms, such as ceqcom2. *The values on the RC/V cell forms for an individual cell take precedence over the ECP values.*

The following new fields have been added to the “CDMA Information (Non-Power Control)” screen of the ecp form:

- **Overhead Channels Functional Test Interval (min)**—The interval between automatic requests of the CDMA overhead channel functional test.

  The interval value for the routine (scheduled) overhead channel functional test can be set to any value within the range 1 - 1440 minutes in increments of 1 minute. The default interval value is 25 minutes.

  Value 1439 has special meaning. Setting the interval value to 1439 disables (inhibits) the execution of routine CDMA overhead channel functional tests and prevents the Cell Sites from reporting an off-normal alarm to the ECP. (Unlike the INH command, which *does* cause the targeted Cell Site to report an off-normal alarm to the ECP. The INH command is intended for short-term disabling—inhibiting.)
  (A Cell Site off-normal alarm indicates one or more of the following off-normal states at the cell: inhibited, alarmed, out-of-service, overload, or initializing.)

- **Traffic Path Functional Test Interval (min**)—The interval between automatic requests of the CDMA traffic path functional test.

  The interval value for the routine (scheduled) traffic path functional test can be set to any value within the range 1 - 1440 minutes in increments of 1 minute. The default interval value is 60 minutes

  Value 1439 has special meaning. Setting the interval value to 1439 disables the execution of routine CDMA traffic path functional tests and prevents the Cell Sites from reporting an off-normal alarm to the ECP.

- **Traffic Path Functional Test MOST DN**—A special directory number dialed by the CRTU during CDMA overhead channel and traffic path functional tests

  MOST DN stands for mobile station test (MOST) directory number (DN).

Cell Equipage Common Form

The ceqcom2 form contains information concerning Cell Site equipment configuration, status, and maintenance-related parameters for an *individual* Series II cell. The values on the ceqcom2 form take precedence over the values on the ecp form.

The following new fields have been added to the “Radio Test Unit” screen of the ceqcom2 form:

- **CDMA RTU - Status**—Used to equip a CRTU at a Series II cell.

  The allowed values for the CDMA RTU (CRTU) status field are unequipped, equipped, and growth. The default value is unequipped. When equipped, the CRTUi slot location is fixed at frame 0, shelf 0, slot 15.

- Functional Test Intervals:
  - CDMA Overhead Channels (min)
  - CDMA Traffic Path (min)

The interval value for the routine (scheduled) overhead channel functional test and the interval value for the routine (scheduled) traffic path functional test can be set to any value within the range 1 - 1440 minutes in increments of 1 minute. There are no default interval values on the ceqcom2 form.

Value 1439 has special meaning. Setting the interval value to 1439 for CDMA Overhead Channels (min) disables the execution of routine CDMA overhead channel functional tests and prevents the Cell Site from reporting an off-normal alarm to the ECP. Likewise, setting the interval value to 1439 for CDMA Traffic Path (min) disables the execution of routine CDMA traffic path functional tests and prevents the Cell Site from reporting an off-normal alarm to the ECP.

An interval value specified here will override the interval value (*including 1439*) specified on the ecp form. However, when an interval value is null (no entry) on the ceqcom2 form, the interval value on the ecp form is used by the cell.

Subscriber and Feature Information Form

The sub form contains information for the mobile subscriber, including any custom calling features the subscriber may have.

The following new values have been added to the Mobile Directory Number Type field of the sub form:

- **y** for CDMA RTU (CRTU) test mode mobile
- **b** for CDMA test mode mobile.

There are two types of CDMA MOST calls: those that are originated by the CRTU, and those that are originated by any other IS-95 compliant test mobile. Both the ECP and RCC can distinguish between the two types of MOST calls because each type has a *unique* Mobile Directory Number Type value (**y**, **b**)* designated via the sub form. Both types of CDMA MOST calls use the same special directory number specified in the Traffic Path Functional Test MOST DN field of the ecp form.

Cell Equipage Component Location Form

The ceqcloc form is a review-only form containing information about how Series II cells are equipped. It contains the physical layout information for each slot on each shelf in each frame.

The following new equipment assignment can be reviewed on the ceqcloc form: the CRTUi at frame 0, shelf 0, slot 15. After you enter the Series II cell number *a* (1-222), frame **0**, shelf **0**, and slot **15** in the ceqcloc form, the Component Type field of the form should display CDMA RTU.

Status Display Page Changes to Support the CRTU

Certain indicators and commands have been added to the following status display pages to support the CRTU:

- 2131 - Cell Equipment Status page
- 2132 - Cell Software Status page.

2131 - Cell Equipment Status Display Page

The 2131 page displays the configuration of Cell Site hardware units and provides a status summary of each unit or group of units for an individual Cell Site.

The CRTU indicator and four additional page commands† have been added to the 2131 page. You can use the additional page commands to execute any of the following operations on the CRTU:

- Remove CRTU from service
- Restore CRTU to service
- Diagnose CRTU
- Generate status output message report on CRTU.

The result of the remove, restore, diagnose, or generate-status page command is identical to entering the RMV, RST, DGN, or OP command at the ECP Craft Shell prompt or at the command line at the bottom of a status display page.

* The values **y** and **b** are literal values, not variables. You enter **y** in the Mobile Directory Number Type field of the sub form for the CRTU.

† Page commands are also known as *poke* commands.

The CRTU can be in one of four states (active, out-of-service, unequipped, or growth) as indicated by the video state of the CRTU indicator:

1. act (steady black on green)
2. oos (steady black on red)
3. uneq (steady magenta on black)
4. grow (steady white on magenta).

2132 - Cell Software Status Display Page

The 2132 page provides software status indicators and allow/inhibit page commands for the following Cell Site software processes:

- Audits
- Audit/HEH (hardware error handler) output
- Boot (initialization)
- Call processing
- Forward setup channel control
- Routine functional tests
- Interrupts
- Phase monitoring
- Routine diagnostics
- Diversity error imbalance output.

The result of an allow or inhibit page command is identical to entering the ALW or INH command at the ECP Craft Shell prompt or at the command line at the bottom of a status display page.

Inhibiting a Cell Site software process causes the affected cell to send an off-normal alarm to the ECP. (A steady black on white CELL status indicator on the status display pages means that at least one Cell Site in the system is in the inh state.) A subsequent allowing of the Cell Site software process causes the affected cell to send an “all clear” message to the ECP, thereby clearing the cell off-normal alarm at the ECP.

Two menu commands for the CDMA functional tests have been added to the 2132 page: oc for overhead channel tests, and tp for traffic path tests. You can use the additional menu commands to:

- Allow or inhibit the execution of routine (scheduled) overhead channel functional tests.
- Allow or inhibit the execution of routine (scheduled) traffic path functional tests.

Entering the menu command to allow or inhibit the execution of a routine CDMA functional test when the test is disabled via translations has no affect. You must first revisit the RC/V ecp or ceqcom2 form and specify an interval value *other than 1439*.

Command and Report Changes to Support the CRTU

Several technician interface input commands and reports have been modified to support the CRTU. Most but not all of the modified input commands are listed below:

- **ALW:CELL *a*,FT OC -** Allows the execution of routine (scheduled) overhead channel functional tests at cell *a* (1-222).

  (Entering the **ALW:CELL *a*,FT OC** command when the CDMA overhead channel test is disabled via translations has no affect. You must first revisit the RC/V ecp or ceqcom2 form and specify an interval value *other than 1439*, then enter the **ALW** command. You must enter the **ALW:CELL *a*,FT OC** command for *each cell* so that each cell will know that its CDMA overhead channel test interval value has been updated. The same line of reasoning holds true for the **ALW:CELL *a*,FT TP** command that follows.)
- **ALW:CELL *a*,FT TP -** Allows the execution of routine (scheduled) traffic path functional tests at cell *a*.
- **DGN:CELL *a*,CRTU -** Diagnoses the CRTU at cell *a*. (All standard DGN options are supported for the CRTU.)
- **DNLD:CELL *a*,CRTU -** Requests a non-volatile memory (NVM) update of the CRTU at cell *a*.
- **EXC:CELL *a*,FT OC -** Executes the overhead channel functional test on all sectors at cell *a*. Variation examples of this command are:
  - **EXC:CELL *(a,b)*,FT OC -** Executes the overhead channel functional test on all sectors at cell *a* and cell *b*.
  - **EXC:CELL *a*,FT OC 1 -** Executes the overhead channel functional test *only* on sector 1 at cell *a*.
  - **EXC:CELL *a*,FT OC 1-2 -** Executes the overhead channel functional test on sectors 1 and 2 at cell *a*.
  - EXC:CELL *a*,FT TP - Executes the traffic path functional test on all sectors at cell *a*. Variation examples of this command are:
  - **EXC:CELL (*a*,*b*),FT TP -** Executes the traffic path functional test on all sectors at cell a and cell b.
  - **EXC:CELL *a*,FT TP 1 -** Executes the traffic path functional test *only* on sector 1 at cell *a*.
  - EXC:CELL *a*,FT TP 1-2 - Executes the traffic path functional test on sectors 1 and 2 at cell *a*.

  - INH:CELL *a*,FT OC - Inhibits the execution of routine (scheduled) overhead channel functional tests at cell *a*.
  - INH:CELL *a*,FT TP - Inhibits the execution of routine (scheduled) traffic path functional tests at cell *a*.

- **OP:CELL *a*,CRTU -** Requests the current status (active, out-of-service, unequipped, growth) of the CRTU at cell *a*.
- **OP:CELL a,CRTU;UCL:VERSION -** Displays the version of firmware and/or software installed on the CRTU at cell *a*.
- **RMV:CELL *a*,CRTU -** Conditionally removes the CRTU from service at cell *a*.

  To unconditionally remove the CRTU from service at cell *a*, enter **RMV:CELL *a*,CRTU;UCL** at the ECP Craft Shell prompt or at the command line at the bottom of a status display page.
- **RST:CELL *a*,CRTU -** Conditionally restores the CRTU to service at cell *a*. To unconditionally restore the CRTU to service at cell *a*, enter

  RST:CELL *a*,CRTU;UCL

  at the ECP Craft Shell prompt or at the command line at the bottom of a status display page.
- **STOP:DGN;CELL *a*,CRTU -** Aborts a previously requested diagnostic of the CRTU at cell *a*.

CRTU Growth Procedures

The recommended procedures for growing a CRTU at a CDMA Cell Site are as follows:

1. Enter the following commands to inhibit the execution of routine CDMA functional tests:

   INH:CELL *a*,FT OC
   INH:CELL *a*,FT TP

2. Install the CRTU hardware.

Consult the installation procedures in the *Installation Handbook 225, Section 880* to install the CRTU hardware.

Part of the CRTU installation is to assign the CRTUm a directory number and to program the CRTUm with the cell-site-specific CDMA carrier assignment (1.23-MHz segment of spectrum). A CDMA carrier is specified by center RF channel number.

The installer uses a special Lucent Technologies personal computer (PC) window-based tool to load the CRTUm directory number, the CDMA channel information, and many other mobile-related parameters into the CRTUm. The loading process is known as *NAMing*. (NAM stands for number assignment module.)

3. Access the RC/V Series II Cell Equipage Common form (ceqcom2) and set the CDMA RTU - Status field to **g** for grow. Consult the 2131 - Cell Equipment Status page or enter the **OP:CELL** *a***,CRTU** command to verify that the CRTU is now in the growth state.

4. Enter the following command to initiate an NVM update operation on the CRTU:

   DNLD:CELL *a*,CRTU

5. Enter the following command to diagnose the CRTU:

   DGN:CELL *a*,CRTU

6. Access the RC/V Subscriber and Feature Information form (sub) and specify the CRTU directory number and other mobile-related data. Set the Mobile Directory Number Type field to **y**.

7. Access the RC/V Executive Cellular Processor form (ecp), find the Overhead Channels Functional Test interval (min) field and the Traffic Path Functional Test Interval (min) field, and then use those fields to set the interval values for the CDMA functional tests.

The default interval value for the routine overhead channel functional test is 25 minutes. The default interval value for the routine traffic path functional test is 60 minutes.

8. Optional*: Access the RC/V ceqcom2 form, find the two CDMA-related interval value fields under Functional Test Intervals, and then use those fields to set the interval values for the CDMA functional tests.
9. Access the RC/V ecp form, find the Traffic Path Functional Test MOST DN, and then use that field to specify the special directory number dialed by the CRTU during CDMA functional tests.
10. Access the RC/V Cell Equipage Face form (ceqface) and verify that the Pilot PN Sequence Offset Index is *null* (no entry) for all unequipped CDMA sectors.
11. Access the RC/V Cell Equipage Component Location form (ceqcloc) and verify that the CRTUi resides in frame 0, shelf 0, slot 15. Enter the Series II cell number *a* (1-222), frame **0**, shelf **0**, and slot **15**; CDMA RTU should display in the Component Type field.
12. Access the RC/V ceqcom2 form and set the CDMA RTU - Status field to **e** for equipped. Consult the 2131 - Cell Equipment Status page or enter the **OP:CELL *a*,CRTU c**ommand to verify that the CRTU is now in the out-of-service state.
13. Enter the following command to conditionally restore the CRTU to service:

    RST:CELL *a*,CRTU

14. Enter the following commands to manually execute the CDMA functional tests on all sectors:

    EXC:CELL *a*,FT OC
    EXC:CELL *a*,FT TP

15. Enter the following commands to allow the execution of routine CDMA functional tests:

    ALW:CELL *a*,FT OC
    ALW:CELL *a*,FT TP

CDMA Functional Tests

Functional tests are run on Cell Site equipment that is in-service. Functional tests can be initiated manually (on demand) to test new installations or troubleshoot suspected problems, or can be initiated on a scheduled basis (*routine* functional tests). The frequency, or interval value, of routine functional tests is specified in the ECP translations. The RCC automatically runs routine functional tests according to the prescribed schedule.

* Complete this step only if you want to override the interval values specified in the ecp form (Step 7). The interval values on the ceqcom2 form for an individual cell take precedence over the ECP interval values.

The RCC uses the CRTU to perform CDMA functional tests on every antenna face (omni, alpha, beta, gamma, delta, epsilon, zeta) of a CDMA cell. The CRTU must be in the active state to perform the tests.

There are two types of CDMA functional tests: overhead channel functional tests and traffic path functional tests. Testing is limited to one CDMA carrier per antenna face with the following exception: *for CDMA Series II Cell Sites, CDMA traffic path testing of multiple CDMA carriers is supported.*

NOTE:
Multiple CDMA carriers on an omni cell or cell sector consist of one or two *common* CDMA carriers and one or more optional *non-common* CDMA carriers. For the cellular band class (850 MHz), the TIA IS-95 standard defines two common carriers: the *primary* CDMA carrier, which is centered on RF channel 283 for System A (A band) and 384 for System B (B band), and the *secondary* CDMA carrier, which is centered on RF channel 691 for System A (A' band) and 777 for System B (B' band). *Each CDMA omni cell or cell sector must be assigned at least one common carrier.* Non-common CDMA carriers are chosen by the system operator within certain limits defined in the IS-95 standard. The 1.23-MHz bandwidth for a CDMA carrier suggests that the minimum center frequency separation between center frequencies is 1.23 MHz.

NOTE:
For the PCS band class (1900 MHz), candidates for common CDMA carriers range from channel numbers 25 to 1175 in increments of 25.

NOTE:
A common CDMA carrier has its own unique pilot channel, sync channel, paging channel, access channel, and traffic channels. A non-common CDMA carrier has its own unique pilot channel and traffic channels but no sync, paging, or access channels. In CDMA Release 3.0, there is one paging channel per common carrier per antenna face, known as the *primary paging channel*, which is covered (spread) using Walsh code function number 1.

Each common CDMA carrier (primary, secondary) on an antenna face has one channel element (CE) configured as the pilot/sync/access overhead channel, known as the *P/S/A CE*, and another configured as the paging overhead channel, known as the *page CE*. The two CEs may be on the same CDMA channel unit (CCU) or on different CCUs within the same CDMA cluster.

The overhead channel and traffic path functional tests verify the operation of the following Cell Site equipment: RF transmit paths, RF receive paths, and CDMA radio equipment.

Default Interval Values

The interval values for the routine (scheduled) CDMA functional tests are specified in the ECP translations. The default interval value for the routine overhead channel functional test is 25 minutes, and the default interval value for the routine traffic path functional test is 60 minutes.

For a 3-sector cell, the various antenna faces are tested in a sequential fashion: sector 1 (alpha), then sector 2 (beta), and then sector 3 (gamma). Sector 1 is tested during the first 1/3 of the interval value, sector 2 is tested during the second 1/3 of the interval value, and sector 3 is tested during the last 1/3 of the interval value. A similar scenario holds true for a 6-sector cell.

Transmit and Receive Test Paths

Access to the transmit and receive test paths is established through the RCB, RSP, and the dual-port directional couplers located on the antenna side of the transmit and receive filter panels. The RCC selects the required test paths by controlling the switches on the RSP via an EIA-422 data link between the CRTUi and the RSP.

The RCC directs the RSP to select the *incident* directional-coupler port of the transmit filter panel. This port passes a portion of the RF transmit signal from the CE_under_test to the CRTUm receiver.

The RCC also directs the RSP to select the incident directional-coupler port of the receive filter panel associated with the diversity 0 receive path (See Figure 21-3). This port passes the RF transmit signal from the CRTUm to the CE_under_test.

NOTE:
Currently, the CDMA functional tests verify the operation of the diversity 0 receive path but not the diversity 1 receive path.

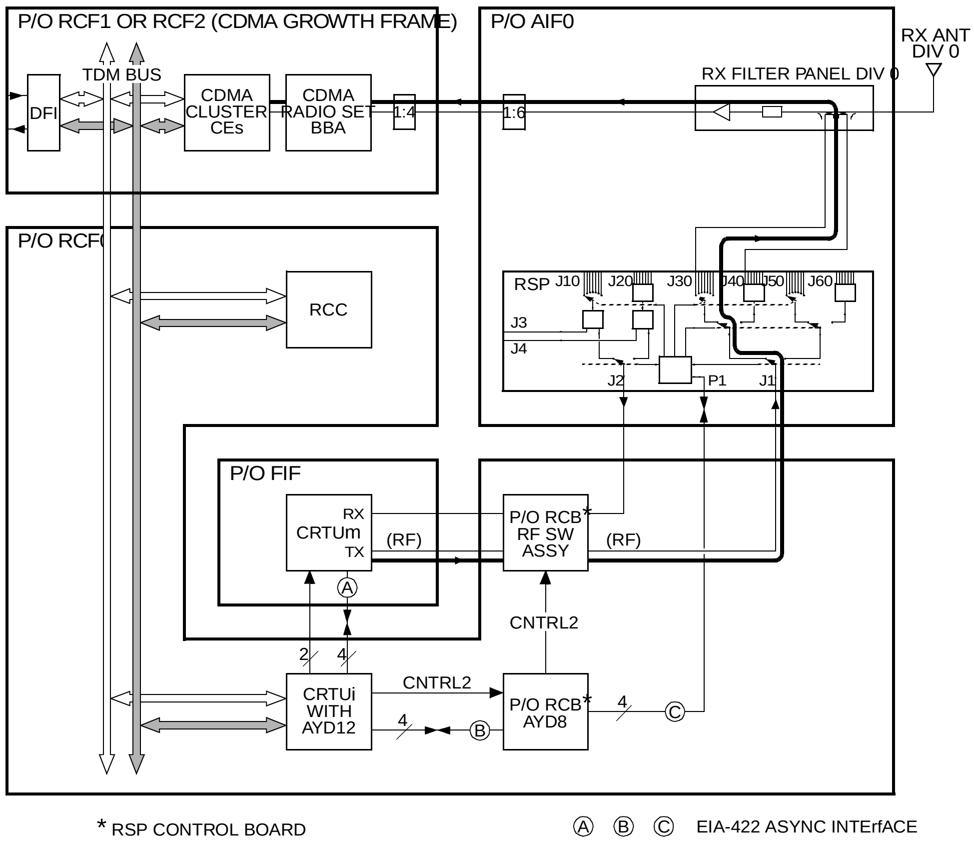


Figure 21-3. RF Diversity 0 Receive Path Setup for CDMA Functional Tests at the Series II Cell Site

MOST-Terminated Test Calls

The CDMA functional tests require that the CRTU set up test calls using the mobile station test (MOST) feature.

There are two types of CDMA MOST calls: those that are originated by the CRTU as described in this section, and those that are originated by any other IS-95 compliant test mobile. Both the ECP and RCC can distinguish between the two types of MOST calls because each type has a *unique* Mobile Directory Number Type value designated via the RC/V sub form. The Mobile Directory Number Type value for the CRTU is **y**.

The RCC instructs the CRTU to dial the CRTU-designated MOST directory number. Upon receiving the call, the ECP identifies the call as a MOST call during digit analysis and terminates the test call to a low-tone source at the DCS. The ECP also identifies the call as a MOST call originating from the CRTU.

NOTE:
Both the ECP and RCC set certain bits in their call records to identify the call as a MOST call originating from the CRTU.

By instructing the CRTU to send a certain 3-digit feature code, the RCC can trigger any one of several MOST test functions *including forced handoff*. During the traffic path functional test, the RCC uses the MOST forced handoff function to hand off the call from one traffic CE to another within the same physical antenna face, or sector, until the call has been handled by each *idle* (in-service and non-busy) traffic CE available to the antenna face.

For a CDMA *subcell* * on an antenna face, the RCC uses the MOST forced handoff function to hand off the call to each idle CE in the subcell. For multiple subcells on an antenna face, the RCC uses the MOST forced handoff function to hand off the call to each idle CE in the one subcell, then hand off the call to each idle CE in the next subcell, and so on until the call has been handled by each idle CE available to the antenna face.

Special software at the RCC provides the CE selection algorithm for the MOST forced handoff function. After the RCC triggers a MOST forced handoff, the CE selection algorithm starts at the CE currently handling the call and searches forward through an *ordered* list of CEs until it finds an idle CE to handle the call. The RCC then hands off the call to the selected CE. After executing the handoff, the RCC can either trigger another forced handoff to continue the test session or release the MOST call if all idle traffic CEs have been tested.

Overhead Channel Functional Test

The overhead channel functional test verifies the pilot, sync, paging, and access special purpose channels for each antenna face, or sector, of the cell. The testing of one antenna face takes approximately 30 seconds to complete.

During overhead channel functional testing, the CRTU acquires the pilot, sync, and paging channels—known as the CDMA *forward control channels*—by locking on to a particular CDMA center frequency (carrier) and pilot pseudo-noise (PN) offset. During the final portion of the testing, the CRTU calls the CRTU-designated MOST directory number to verify access and paging operation.

* At a CDMA cell, up to three CDMA shelves—shelves 0, 1, and 2 or shelves 3, 4, and 5—can be interconnected to form a subcell. All CEs within a subcell are available to the antenna face.

The overhead channel functional test may be initiated in one of three ways: by a manual request, by a timer—scheduled—assuming that the overhead channel functional tests are in the allowed state, or by the RCC after an overhead channel has been *migrated* to a different CE.

NOTE:
If during normal operations the RCC detects a failure in an overhead channel or a failure in the CCU carrying the overhead channel, the RCC will automatically migrate the overhead channel to another CE—select an idle traffic channel and reconfigure it as the overhead channel. The overhead channel CEs for a common CDMA carrier on an omni cell or cell sector must be on the same CDMA cluster, that is, must be controlled by the same CDMA cluster controller (CCC). *This recovery action does not apply to a failure detected during CDMA overhead channel functional testing; with CDMA Release 3.0, the RCC takes no recovery action for a failed CDMA overhead channel functional test other than reporting the failure to the ECP.*

The overhead channel functional test consists of two parts:

1. Pilot, sync, and paging channel acquisition test—Verifies that the overhead-channel forward path is functioning.

The pilot channel is an unmodulated, direct-sequence spread-spectrum signal transmitted continuously by each sector of a CDMA cell. It allows the mobile to acquire the timing of the forward control channels and provides a coherent carrier phase reference for demodulating the sync and paging channels.

The sync channel provides time-of-day and frame synchronization to the mobile. The mobile uses this channel to acquire cell and sector-specific information.

The paging channel transmits control information to idle mobiles during mobile powerup and when a mobile is acquiring a new Cell Site. It conveys pages to the mobiles.

For the pilot, sync, and paging channel acquisition test, the RCC instructs the CRTU to connect to a certain antenna face through the RSP. When connected to the antenna face, the CRTU acquires the pilot, sync, and paging channels for the face and transitions to the *system idle state*. The RCC then queries the status of the CRTU, to which the CRTU must return the *system idle state* for the test to pass.

2. Access-paging channel test—Verifies that the overhead-channel reverse path is functioning.

The access channel is a CDMA reverse channel used for short signaling message exchange such as mobile registration, mobile call origination, and response to pages. The access channel is a slotted random access channel used by mobiles to communicate to the Cell Site.

For the access-paging channel test, the RCC instructs the CRTU to initiate a CRTU-designated MOST call. The test passes if the network can set up the call.

For a multiple-sector cell, the RCC performs both parts of the overhead channel functional test on sector 1 (alpha), then performs both parts of the overhead channel functional test on sector 2 (beta), and so on until the RCC has tested all sectors of the cell.

The overhead channel functional test consists of the following basic steps.

1. The RCC selects an antenna face to test.
2. The RCC instructs the CRTU to connect the RSP to the selected antenna face. (The CRTU connects the RSP to the transmit path and the diversity 0 receive path.)
3. The RCC queries the status of the CRTU.
4. The CRTU returns the *system idle state* to the RCC, indicating that the CRTU has acquired the pilot, sync, and paging channels.

   The RCC now knows that the overhead-channel forward path is functioning. What remains is to test the overhead-channel reverse path—perform the access-paging channel test.
5. The RCC instructs the CRTU to dial the CRTU-designated MOST directory number.
6. The CRTUm dials the MOST directory number.
7. The P/S/A CE for the selected antenna face receives an “over the air” origination message from the CRTU and passes the message to its controlling CCC.
8. The controlling CCC instructs its page CE to acknowledge the CRTU origination. The page CE sends an “over the air” acknowledgment message to the CRTU.
9. The controlling CCC informs the RCC that the CRTUm has originated a call.
10. The RCC instructs the CRTU to release the MOST call. The CRTU releases the call and then releases control of the RSP (and RCB for a Series II Cell Site).

At this point, the overhead channel functional test for the selected antenna face is complete.

NOTE:
If the overhead channel functional test fails for any reason, the RCC will try up to two more times to complete the test. If all three attempts fail, the RCC

will abort the overhead channel functional test for the selected antenna face.

If the cell being tested has more than one antenna face, and if the test was initiated *manually for more than one antenna face*, the RCC will immediately select and begin testing the next antenna face. If the test was initiated by a *timer*—a scheduled functional test, the RCC will wait a certain amount of time before testing the next antenna face.

The RCC will report the test results (pass, fail) of all manually initiated overhead channel functional tests to the ECP. In contrast, the RCC will only report the tests results of a routine (scheduled) overhead channel functional test *if the test fails*.

Traffic Path Functional Test

The objective of the traffic path functional test is to verify that a CDMA traffic path can be established and maintained through every traffic CE on every antenna face, or sector, of the cell. A CE configured as a traffic channel contains the necessary circuitry to process one CDMA traffic channel.

NOTE:
A traffic channel, which is a communication path between a mobile station and a Cell Site, carries user and signaling information. The term *traffic channel* implies a forward and reverse pair.

The test begins with an overhead channel functional test, during which the RCC instructs the CRTU to dial the CRTU-designated MOST directory number to test the access-paging portion of the overhead channel test. The RCC then completes the call using a traffic CE available to the antenna face being tested, and then hands off the call from CE to CE to test every traffic channel path available to the antenna face.

The RCC repeats the MOST call origination and handoff for each antenna face of the cell. The testing time of one antenna face varies from less than one minute to more than three or four minutes, depending upon how many idle traffic CEs are available to the antenna face.

The traffic path functional test may be initiated in one of two ways: by a manual request or by a timer—scheduled—assuming that the traffic path functional tests are in the allowed state.

The traffic path functional test consists of the following basic steps.

1. The RCC selects an antenna face and then performs an overhead channel functional test on that face. The RCC instructs the CRTU to dial the CRTU-designated MOST directory number to test the access-paging portion of

the overhead channel test.

Only if the overhead channel test passes will the RCC continue to Step 2.

2. Upon receiving the CRTU origination, the RCC allocates a traffic CE to handle the call and sends a message to the ECP requesting message and subscriber validation. (RCC-ECP message exchange is through the Cell Site data link.)
3. The ECP identifies the call as a CRTU-designated MOST call during digit analysis and terminates the test call to a low-tone source at the DCS.
4. The ECP sends a subscriber validation message to the RCC. The ECP also sets up the proper speech handler connections at the DCS.
5. The RCC passes the Walsh code assignment of the allocated traffic CE to the CCC controlling the page CE. The CCC instructs its page CE to send the assignment to the CRTU, and the page CE responds by sending an “over the air” channel assignment message to the CRTU.
6. The RCC receives a speech handler assignment and a call ID from the ECP and passes the information to the CCC controlling the allocated traffic CE. (This CCC need *not* be the same CCC controlling the page CE.) The RCC also sends a channel confirmation message to the ECP.
7. The CCC controlling the allocated traffic CE passes the speech-handler assignment and call ID to the traffic CE. The traffic CE uses this information to complete the call path through the DCS, at which time the MOST low tone is received by the CRTU.

   At this point, both the ECP and RCC have certain bits set in their call records to identify the call as a MOST call originating from the CRTU.
8. The RCC queries the status of the CRTU. The CRTU returns the *traffic channel state* to the RCC, verifying that the CRTU is in the talk state.
9. The RCC instructs the CRTU to send a certain 3-digit feature code to trigger the MOST forced handoff function. The CRTU sends the 3-digit feature code as an “over the air” *flash with information* message, which is extracted by the traffic CE and forwarded to the RCC.

   (CDMA supports both mobile-to-ECP and ECP-to-mobile *flash with information* messages. The communication path consists of (1) the mobile-to-RCC path via the established traffic channel and (2) the RCC-to-ECP path via the Cell Site data link. The flash with information messages are used to support certain feature activations and deactivations such as MOST service requests, 3-way calling, and call waiting. The contents of a flash with information message sent to the mobile will display on the mobile’s backlit display.)

10. The RCC sends the flash with information message to the ECP. (RCC-ECP message exchange is through the Cell Site data link.) The ECP sends a MOST forced handoff command to the RCC.
11. The MOST CE selection algorithm at the RCC selects the next CE to which the call should be handed off. The RCC writes data pertaining to the selected CE (CE, CCU, CCC, and sector) into a global data area and then attempts to hand off the MOST call to the selected CE.
12. If the handoff is successful, the RCC reports the result to the ECP and sends an “over the air” flash with information message to the CRTU. The message contains the CE, CCU, CCC, and sector pertaining to the handed-off call. (Since the mobile is inside the CRTUm, you will not be able to see the message on the mobile’s backlit display.) The RCC also updates the global data area for the selected CE with the successful test result.

    If the handoff fails, the RCC reports the result to the ECP but does not send an “over the air” flash with information message to the CRTU. The RCC updates the global data area for the selected CE with the failed test result.
13. After executing a forced handoff, the RCC consults the global data area to determine whether to trigger another forced handoff or terminate the test session. The RCC will terminate the test session if all idle traffic CEs available to the selected antenna face have been tested.
14. To terminate the traffic path functional test, the RCC instructs the CRTU to release the MOST call. The CRTU releases the call and then releases control of the RSP (and RCB for a Series II Cell Site).

At this point, the traffic path functional test for the selected antenna face is complete.

If during the test a handoff fails and the call drops, the RCC will try up to three times to re-establish the call. If successful, the traffic path functional test will continue with a handoff to the next CE after the last failed CE. If all three attempts fail to re-establish the call, the RCC will abort the traffic path functional test for the selected antenna face.

If the cell being tested has more than one antenna face, and if the test was initiated *manually for more than one antenna face*, the RCC will immediately select and begin testing the next antenna face. If the test was initiated by a *timer*—a scheduled functional test, the RCC will wait a certain amount of time before testing the next antenna face.

The RCC will report the test results (pass, fail) of all manually initiated traffic path functional tests to the ECP. In contrast, the RCC will only report the tests results of a routine (scheduled) traffic path functional test *if the test fails*.

Functional Test Errors and System Recovery Actions

When a CDMA functional test fails, the RCC hardware error handler (HEH) software subsystem responds in one of two ways, depending upon the failure:

- Reports the failure to the ECP, takes action to correct the failure, and then reports the result of the recovery action to the ECP.
- Does nothing more than report the failure to the ECP.

The ECP decodes the data in the HEH-initiated report into an output message and prints the output message at the read-only printer (ROP). In situations where no automatic recovery action is taken or automatic recovery action fails, the technician must perform manual recovery procedures from the ECP. Manual recovery procedures for a failed overhead channel or traffic path functional test can be found in the *Release 3.0 Isolation Strategy* memorandum written by Thomas E. Wing.

When a technician initiates a CDMA functional test, the RCC will report the test results (pass, fail) to the ECP. In contrast, the RCC will only report the tests results of a routine (scheduled) CDMA functional test *if the test fails*. The RCC routine maintenance scheduler (RMS) software subsystem generates the report (pass, fail) for manually initiated CDMA functional tests, whereas HEH generates the report (fail only) for routine CDMA functional tests.

General Errors

Some errors are common to both the overhead channel and traffic path functional tests. Those errors, together with the automatic recovery actions, are listed and described below:

- Functional test timer expired.

  The RCC sets a timer at the beginning of a functional test; if the functional test does not complete before the timer expires, the functional test aborts. HEH takes no recovery action other than to report the failure to the ECP.
- RCC-to-CRTUi communication failure

  HEH conditionally restores the CRTU and sends a report to the ECP.
- CRTUi-to-CRTUm communication failure

  HEH conditionally restores the CRTU and sends a report to the ECP.

Overhead Channel Functional Test Errors

Currently, for a failed overhead channel functional test, HEH does nothing more than report the failure to the ECP. The technician must perform manual recovery procedures from the ECP.

What follows is an RMS-generated report for a manually initiated overhead channel functional test that passed:

```
M 40 EXC:CELL 132 FT OC, COMPLETED
     OC 1          COMPLETED    ALL TESTS PASSED
```

```
OC 2    COMPLETED    ALL TESTS PASSED
OC 3    COMPLETED    ALL TESTS PASSED
```

What follows is an RMS-generated report for a manually initiated overhead channel functional test that failed:

```
M 11 EXC:CELL 132 FT OC, COMPLETED
    OC 1        PARTIALLY COMPLETED LOST PILOT
```

An RMS-generated report contains the results for each sector tested (*OC 0* = omni, *OC 1* = sector 1, *OC 2* = sector 2, ...). If a sector fails the overhead channel functional test, the RMS-generated report identifies the failed sector but does *not* identify the location of the faulty overhead channel CE. RMS makes no attempt to identify the faulty CE.

Compare the previous RMS-generated reports with the following HEH-generated report:

```
M 23 REPT:CELL 132 HEH, CCC 7, CCU 2, CE 0
   PID:  OS= FTSUPV, N/A, 0
   FT OC FAILURE: NO_OVERHEAD
    99  15  00  00  84  00  02  a8  00  00
    00  00  00  10  07  75  00  02  03  23
    00  00  5b  19  04  52
```

An HEH-generated report differs from the RMS-generated report in that (1) the HEH-generated report does *not* include sector numbers, (2) the HEH-generated report does *not* include any information about individual tests that passed, and (3) the HEH-generated report *does* include the location of the faulty overhead channel CE. HEH identifies the faulty CE by CE number, CCU number, and CCC number.

Traffic Path Functional Test Errors

A traffic path functional test will fail for any one of the following reasons:

- Executing the overhead channel test portion of the traffic path functional test revealed that one or more overhead channels are *not* working. The test aborts. The reason identified here will appear in the report sent to the ECP.
- MOST call was unexpectedly torn down. The test aborts. The reason and source of the call termination will appear in the report sent to the ECP.
- Handoff to selected CE failed and the call dropped. The test continues assuming a call can be re-established within three attempts; otherwise, the test aborts. The failed CE will appear in the report sent to the ECP.

- Handoff to selected CE is rejected but the call is maintained on the previously selected CE. The test continues; the CE selection algorithm selects the next CE for testing. The failed CE will appear in the report sent to the ECP.

Currently, for any type of failure encountered during a traffic path functional test, HEH takes no recovery action other than to report the failure to the ECP. The technician must perform manual recovery procedures from the ECP.

What follows is a RMS-generated report of a manually initiated traffic path functional test that passed:

```
M 49 EXC:CELL 132 FT TP, COMPLETED
    TP 1   COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 2, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 4, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 4, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 5, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 5, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 6, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 6, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 1, CE  1    COMPLETED    ALL TESTS PASSED
```

What follows is a RMS-generated report of a manually initiated traffic path functional test that failed:

```
M 06 EXC:CELL 132 FT TP, COMPLETED
    TP 1   PARTIALLY COMPLETED LOST TRAFFIC
   CCC  7, CCU 4, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 4, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 5, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 5, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 6, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 6, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 1, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 2, CE  1    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 3, CE  0    COMPLETED    ALL TESTS PASSED
   CCC  7, CCU 3, CE  1    PARTIALLY COMPLETED LOST TRAFFIC
```

An RMS-generated report contains the results for each sector tested (*TP 0* = omni, *TP 1* = sector 1, *TP 2* = sector 2, ...) and the results for each traffic CE tested within the individual sectors. The passed and failed CEs are identified by CE number, CCU number, and CCC number. Although the report does not identify which CEs were skipped during the testing—the traffic CEs that were traffic-busy, blocked, or out-of-service, the technician can determine which CEs were skipped by noting their absence in the report. By observing the passed and failed test results, the technician can make an informed decision as to how to isolate and correct the error.

Compare the previous RMS-generated reports with the following HEH-generated report:

```
M 35 REPT:CELL 132 HEH, CRTU - PART 1 OF 1
   PID:OS = FTSUPV,N/A
   FT TRAFFIC PATH 1 RESULTS:   COMPLETED
   CCC   CCU   CE   REASON        RESULT
     7    5    1              PASS
     7    6    0              PASS
     7    6    1              PASS
     7    1    1              PASS
     7    2    1              PASS
     7    3    0   TrfFICFL       FAILED
     7    3    1   TrfFICFL       FAILED
     7    4    0              PASS
     7    4    1              PASS
     7    5    0              PASS
```

Linear Amplifier Circuit (LAC) Maintenance

22

Contents

LAC Maintenance Procedures

This chapter provides the recommended procedures for identifying and troubleshooting problems with Linear Amplifier Circuits (LACs) in Series II cell site. All cell site maintenance personnel and ECP operators should be familiar with these procedures.

It is important to recognize that there are a number of preliminary diagnostic steps which should be taken at the MSC, prior to dispatching maintenance personnel to the cell site. Lighted LAC LEDs at the cell site or LAC alarm reports at the MSC, by themselves, do not provide sufficient information for troubleshooting LAC problems.

LAC maintenance procedures should include the following four steps:

1. Obtaining and analyzing LAC alarm reports at the MSC. These include both the "LACSUM" and "LACALM" reports.
2. Assigning priorities to LAC alarms and, if necessary, dispatching maintenance personnel to the cell site.
3. Observing visual indicators at the cell site and determining the proper course of action indicated in the table.
4. Performing the procedures indicated in the table to determine the cause of the problem and then taking the proper steps to remedy the situation.

The response to LAC alarms should be prioritized depending upon the type of alarm being generated, either MINOR, MAJOR, or CRITICAL. The appropriate response also depends upon whether the alarm is continuous or intermittent. Continuous alarms, which are more likely to be service affecting, are also relatively easy to detect at the MSC and to troubleshoot at the site. Intermittent alarms, while often harder to diagnose than continuous alarms, are generally not service affecting.

Knowledge of LAC alarm history is extremely useful for determining the cause of LAC-related problems. While at the cell site, maintenance personnel should also be in constant contact with the operator at the MSC in order to monitor the current LAC alarm status. The LAC Alarm Query System (LAQS) test equipment can also be used to monitor the LAC alarm status at the site.

Although reported as LAC alarms, many problems may be caused by other equipment in the cell site, such as failed radios, loose or faulty cabling, failed alarm reporting circuits in the Radio Channel Frame (RCF), etc. While every effort has been made to consider these potential causes in the procedures described herein, problems will occasionally arise which have not been considered. For further assistance, call the CTSO Hotline at 1-800-225-4672.

LAC Alarm Summary: LACSUM

Before the start of the maintenance period, log-on to the ECP and print a copy of the LACSUM report*. This report provides a summary of the day's LAC alarms for each cell site controlled by the ECP.

After logging on, type in the following commands:

cd /user/pecc/LAC-MON	to change to the LACMON directory
cat LACSUM	to list the LACSUM file

NOTE:
As an aid in troubleshooting, a copy of the LACSUM report should be taken to the cell site when performing maintenance.

The LACSUM report, which is updated hourly, records the number of LAC alarms, by category, for up to 24 hours beginning at 6AM. At 6AM the following day, the 24 hour summary is saved for reference as LACSUM.Ext, where Ext denotes the day of the week the file was saved. (LACSUM.Fri contains alarms from 6AM Thursday to 6AM Friday.)

A sample LACSUM report listing alarm totals by cell and LAC number under the following categories is shown in Table 22-1:

* If the LACSUM file is not found in the LACMON directory on the ECP, contact the system administrator or call the AT&T CTSO Hotline at 1-800-225-4672.

MIN = MINOR MAJ = MAJOR MAJS = SANITY CRI = CRITICAL INFO = OTHER

Table 22-1. Sample LACSUM report

LAC ALARM SUMMARY FOR 05/05/03 06:00-05/06/93 20:00 PERIOD							
CELL	LAC	MIN	MAJ	MAJS	CRI	INFO	Most Probable Indication:
1	3	0	0	14	0	0	Sanity
							This Section is Not Part of the Report
6	2	176	0	0	0	0	LAM
9	1	0	76	0	0	0	Preamp
12	0	0	0	0	7	0	Critical
13	2	4	0	0	0	14	OverDrive
18	0	4	3	27	0	0	Sanity
18	1	1	2	23	0	0	Sanity
18	2	0	0	23	0	0	Sanity
52	1	3	0	0	0	0	No Problem
106	5	107	62	0	0	0	Multiple LAMs

= =

LAC Alarm Detailed Report: LACALM

A detailed listing of all LAC alarms as they occur throughout the day is contained in the LACALM report, which can be referred to for more information about the time of day alarms occurred, how they were spaced in time, and what the history of alarm activity has been for a particular LAC.

To access the report enter the following commands:

`cd /user/pecc/LACMON`	to change to the `LACMON` directory
`tail -20 LACALM`	to list the last 20 lines of the file

The LACALM file shows the cell site number, the LAC number, the type of alarm, and the date and time at which the alarm occurred. The alarm types are identified as follows:

* A = MINOR **A = MAJOR *CA = CRITICAL **S = SANITY A = INFO

The resulting printout is shown below.

9	1	**A	05/05/93 16:04
9	1	**A	05/05/93 16:13
1	3	**S	05/05/93 16:21
13	2	A	05/05/93 16:21
9	1	**A	05/05/93 16:22
6	2	* A	05/05/93 16:24
6	2	* A	05/05/93 16:44
1	3	**S	05/05/93 17:21
13	2	A	05/05/93 17:21
106	5	* A	05/05/93 17:51
106	5	* A	05/05/93 17:54
106	5	**A	05/05/93 17:57
1	3	**S	05/05/93 18:22
13	2	A	05/05/93 18:22
18	0	**S	05/05/93 18:33
18	1	**S	05/05/93 18:33
18	2	**S	05/05/93 18:33
1	3	**S	05/05/93 19:21
13	2	A	05/05/93 19:21
12	0	*CA	05/05/93 19:55

Note that the LACs in cells 1 and 13 are issuing an alarm every hour, indicating a continuous alarm. All other alarms are intermittent. Also, the LAC in cell 106 is issuing a combination of MINOR and MAJOR alarms, which may indicate multiple Linear Amplifier Modules (LAMs) in alarm. This is in contrast to the LAC in cell 9, which is **only** issuing MAJOR alarms, indicating a Preamp problem.

An easy way to view alarm activity throughout the day for a particular LAC is to search the file for each occurrence of a particular string of characters by using the grep command.

For example, to see all alarms for cell 1, LAC 3, beginning at 6 AM, enter:

grep '1 3' LACALM (Press the TAB key between 1 and 3)

The computer will return the following from the example **LACALM** file:

1	3	**S	05/05/93 06:21
1	3	**S	05/05/93 07:22
1	3	**S	05/05/93 08:21
1	3	**S	05/05/93 09:21
1	3	**S	05/05/93 10:22
1	3	**S	05/05/93 11:21
1	3	**S	05/05/93 12:21
1	3	**S	05/05/93 13:21
1	3	**S	05/05/93 14:22
1	3	**S	05/05/93 15:21
1	3	**S	05/05/93 16:21
1	3	**S	05/05/93 17:21
1	3	**S	05/05/93 18:22
1	3	**S	05/05/93 19:21

As suspected, all alarms generated by cell 1, LAC 3 occur hourly, indicating a continuous alarm.

Interpreting the LAC Alarm Reports

This section describes how to interpret the LACSUM and LACALM reports at the MSC. The following alarm descriptions are intended as a guide for determining possible causes and corrective actions for LAC alarms, to the greatest extent possible, from the MSC. Knowledge of the detailed troubleshooting procedures in paragraph D is assumed. It is also important to understand the differences in how A/B-Series and C-Series LACs report alarms, as described in paragraph F. Additional technical details of the LAC alarm detection and reporting system are also included in paragraph G.

NOTE:
Be sure that the line of "equals" signs is printed out at the bottom of the LACSUM report. This line indicates that the hourly update has been completed. If this line is not present, the file was printed in the middle of the update and is not complete. Reprint the file.

CAUTION:
Be careful that LAC alarms generated as a result of recent maintenance activities are not mistakenly interpreted as legitimate LAC alarms. This can be avoided by printing out the LACSUM file, ***not*** *LACSUM.Ext, at the beginning of the maintenance window.*

Continuous Alarms

Continuous alarms are potentially service affecting and should be attended to promptly. Since continuous alarms are reported once an hour, the number of occurrences recorded will depend upon the time period covered by the LACSUM report. A full 24-hour summary report would show 24 occurrences for a continuous alarm. In the example above, cell 1, LAC 3 lists 14 occurrences over a 14-hour period, which may indicate a continuous alarm. Suspected continuous alarms should be confirmed by looking at the detailed LACALM report, as illustrated in the preceding example.

MINOR Alarms

The table summarizes the possible causes of MINOR alarms. These causes are, in order of likelihood: LAM alarms, Processor alarms, and Low-Level Thermal alarms. Intermittent MINOR alarms are generally not service affecting, but may lead to a service-affecting condition if they persist. A small number of intermittent MINOR alarms (less than 5 per day) is not usually cause for concern since they can be expected to occur, occasionally, as a result of transient traffic conditions. If they continue to occur over a number of days, or increase in frequency over time, a site visit may be warranted.

NOTE:
A/B-Series LACs report fan failures and LAM bias power failures as MINOR alarms. Beginning with the 1C LAC, these conditions are reported as MAJOR and CRITICAL alarms, respectively. See the Fan Alarm Procedure and LAM Bias Fault Procedure for further details.

LAM alarms are the most frequent cause of MINOR alarms and are commonly caused by a bad LAM or its associated fuse. Large numbers of intermittent MINOR alarms are usually due to a faulty LAM or a loose LAM fuse, whereas a continuous MINOR alarm is usually due to a blown LAM fuse. A bad LAM or fuse is indicated at the cell site by a lighted LAM LED on the circular power distribution (AYM) board. If no LAM LEDs are visible upon entering the site, use the Radio Control Procedure to uncover suspected LAM alarms.

Processor alarms are less frequent and are indicated at the cell site by a lighted LINEARIZER LED on the LAC. If the Radio Control Procedure fails to identify a bad LAM, the Processor Alarm Query Procedure should be performed to determine if the LAC has issued a Processor alarm. A LAC should not be replaced for a MINOR alarm if it has not issued a processor alarm*.

Low-level Thermal alarms indicate that the LAC is beginning to overheat. Overheating may be caused by the LAC being overdriven or may be due to a Linear Amplifier Unit (LAU) fan failure or a cell site air conditioning failure. This type of alarm is seldom encountered. See Thermal Alarm Procedure.

NOTE:
If the LAC has not issued a processor alarm and over-heating has been ruled out, an intermittent MINOR alarm was most likely caused by an LAM. It is often difficult to identify LAMs which alarm only a few times in one day. Since a failed LAM is not service affecting, it may be best to continue to monitor the LAC from the MSC and return to the site if the alarms become more frequent.

MAJOR Alarms

MAJOR alarms are, in order of likelihood:

- Preamp alarms
- Multiple LAMs in alarm
- a blown Final Correction Amplifier (FCA) fuse
- a failed fan (C-Series LACs)
- a mid-level thermal alarm.

A major alarm, particularly a continuous alarm, indicates that the LAC is operating in a condition which may be service affecting, or may soon become so. Although the LAC output power may be reduced (due to a bad preamp or a blown preamp fuse), service should not be completely interrupted due to a MAJOR alarm condition.

* Except for A/B-Series LACs with a LAM Bias Fault. See LAM Bias Fault Procedure.

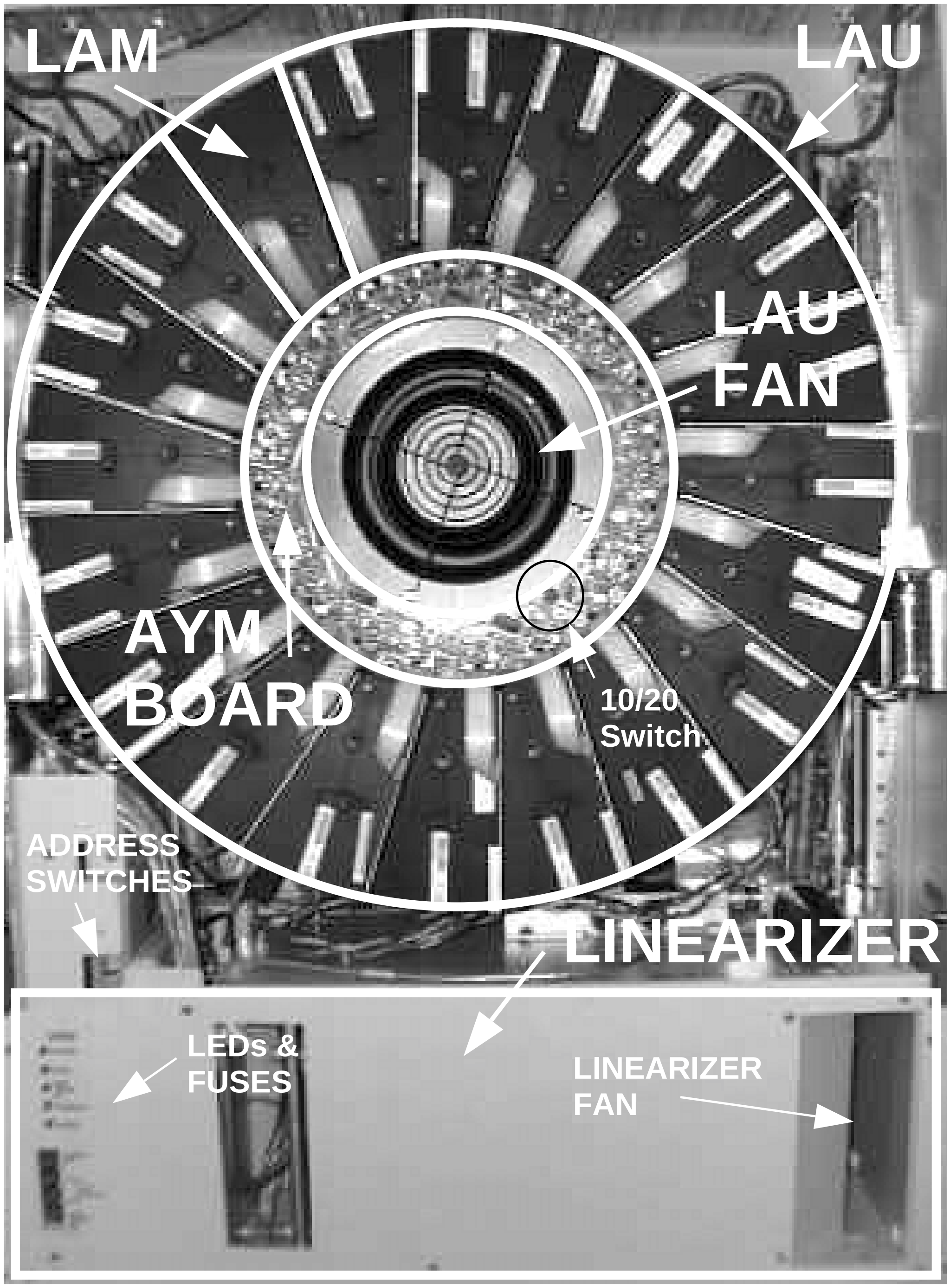


Figure 22-1. Front View of the LAC

Preamp alarms are the most frequent cause of MAJOR alarms. MAJOR alarms without accompanying MINOR alarms are almost always generated by the Preamp, especially if they are intermittent. A bad Preamp or blown Preamp fuse is indicated by a lighted LAC Preamp LED at the cell site. If a Preamp LED is not visible upon entering the cell site, use the Radio Control Procedure to uncover an intermittent preamp problem. See Preamp Alarm Procedure.

Multiple LAMs in alarm will also generate MAJOR alarms. This may involve from 2-6 LAMs, depending upon the LAC configuration. A tripped LAC breaker will cause groups of LAMs to generate a continuous MAJOR alarm. Intermittent MAJOR alarms of this type are usually accompanied by MINOR alarms, since individual failed LAMs may not respond exactly the same to changing traffic conditions. This type of LAM alarm is usually easy to diagnose at the cell site since multiple LAM LEDs will be lighted. See LAM Alarm Procedures.

A blown FCA fuse will generate a MAJOR alarm in C-Series LACs. This may be caused by the LAC being over-driven or may result from the LAC being powered-up with too many radios turned on. A blown FCA fuse is indicated by a continuously lighted LINEARIZER LED at the cell site. (A/B-Series LACs report a blown FCA fuse as a MINOR alarm. The FCA fuse is not field accessible in these LACs, however.)

A bad fan or a blown fan fuse will also generate a MAJOR alarm in C-Series LACs, which is indicated at the cell site by a lighted FANS LED in combination with another lighted LED indicating the particular fan, either LINEAR AMPLIFIER UNIT, PRE-AMPLIFIER, or LINEARIZER. See FAN Alarm Procedure.

Mid-level Thermal alarms indicate that the LAC is about to overheat. Overheating may be caused by the LAC being overdriven or may be due to an LAU fan failure. These alarms will be preceded in time by low-level thermal alarms (MINOR) and should usually not be allowed to progress to the mid-level. (A cell site air conditioning failure should not cause the LAC to heat up to the mid-level, as long as the LAU fan is functioning properly.) See Thermal Alarm Procedure.

CRITICAL Alarms

CRITICAL alarms are, in order of likelihood:

- Multiple LAMs in alarm
- A complete loss of LAM Bias Voltage
- A failed component in the Linearizer
- A High-level thermal alarm.

CAUTION:
A CRITICAL LAC alarm results in immediate loss of service and must be attended to promptly. *(When a critical alarm condition is detected, bias*

voltage is removed from the LAMs, thereby shutting down the RF output power of the LAC.)

Multiple LAMs in alarm due to tripped breakers are the most common cause of CRITICAL alarms. Other possibilities include multiple blown LAM fuses or failed LAMs, although it is unlikely that the number of LAM failures would have been allowed to progress to this level. This type of failure is indicated by multiple lighted LAM LEDs at the cell site. See LAM Alarm Procedures.

NOTE:
When a CRITICAL number of LAM failures has been detected, 5-volt LAM bias is turned off, shutting down the LAMs, and a CRITICAL alarm is issued. The radios on the LAC will be blocked from service by the ECP in response to the CRITICAL alarm. Once the LAMs shut down, or RF is removed, LAM failures can no longer be detected (except for a blown fuse) and the CRITICAL alarm will clear after about a 5-second delay. If radios are re-applied before the cause of the CRITICAL alarm condition is corrected, the cycle will repeat.

An LAM bias fault will also generate a CRITICAL alarm on C-Series LACs and is indicated by simultaneously lighted LINEAR AMPLIFIER UNIT and LINEARIZER LEDs (See Figure 22-11) at the cell site. See LAM Bias Fault Procedure.

High-level thermal alarms indicate that the LAC has overheated. The LAC will shut itself down when its temperature reaches this level and will remain shut off until its temperature falls to the mid-level. Overheating may be caused by the LAC being overdriven or may be due to an LAU fan failure. This alarm will be preceded in time by low-level (MINOR) and mid-level (MAJOR) thermal alarms and should not be allowed to progress to the high level. (A cell site air conditioning failure should not cause the LAC to heat up to the high-level, as long as the LAU fan is functioning properly.) See Thermal Alarm Procedure.

SANITY Alarms

SANITY (MAJS) alarms indicate that the LAC is not responding correctly to queries by the UN166 Alarm/FITS Interface (AFI) Board in the Radio Channel Frame. Common causes include mis-addressed LACs, faulty alarm cables, and incorrectly installed LAC microprocessors. SANITY alarms may also be caused by a damaged alarm circuit in a LAC or in a UN166/AFI board.

In the presence of LAC SANITY alarms in a cell, view all LAC alarms with suspicion. One mis-addressed or otherwise "insane" LAC will often confuse alarm reporting for all LACs in the site. Cell 18 (paragraph B) illustrates a situation where 3 LACs are reporting SANITY alarms, as well as other alarms. This is most likely the result of a problem with only one of the LACs.

SANITY alarms, by themselves, are not service affecting, but they may mask other service-affecting conditions. Therefore, this type of alarm should be investigated promptly.

NOTE:
Resolve SANITY alarms before attempting to troubleshoot other alarms, since the other alarms may or may not be real. See Sanity Alarm Procedure.

INFO Alarms

All alarms which do not fit into one of the four previous categories are reported as INFO alarms. The only alarms which fall into this category are Input Drive alarms, which are issued by the LAC when it is being overdriven. This type of alarm should be investigated promptly, since overdriven LACs can trip breakers, resulting in a CRITICAL alarm condition.

NOTE:
An INFO alarm will often be issued as a result of problems with the alarm reporting system and may occur in combination with SANITY alarms. A damaged UN166 AFI Board will often issue Input Drive warnings when they don't really exist. See Info Alarm Procedure.

Troubleshooting Procedures at the Cell Site

Initial Procedure at the Cell Site

LAC alarm indicator LEDs may not be lit when initially entering the cell site. Many alarms are dependent on radio traffic and may be intermittent, making them difficult to diagnose. This is especially true of LAM alarms (MINOR), as well as Preamp alarms (MAJOR). Check the LACALM file to determine the time of day when alarms occur most often and visit the site at that time, if possible.

Upon entering the cell site:

1. Observe the LAM LEDs and the LEDs on the front faceplate of the LAC.
2. If LEDs are **ON,** follow the procedure indicated in the LAC Alarm Troubleshooting table.
3. If NO LEDS are **ON,**
   - — and **MINOR** or **MAJOR** alarms have been reported, follow the Radio Control Procedure below.
   - — and **SANITY** alarms have been reported, proceed to Sanity Alarm Procedure.
   - — and **INFO** alarms have been reported, proceed to INFO Alarm Procedure.

Radio Control Procedure for Traffic Dependent Alarms

This procedure is used to exercise the LAC in order to uncover those types of alarms which are traffic dependent. The conditions under which an alarm is generated often depends upon the number of radios active, the frequencies at which they are operating, and also upon the operating temperature of the LAC and/or Preamp.

Observe the LAC LEDs while following the procedure described in Step 2 below. When an alarm and LED is observed, refer to the table for the appropriate troubleshooting procedure. If an LED does not light while performing Step 2, follow the instructions given in Steps 3 through 6.

1. Have the MSC take the radios on the LAC out of service.
2. Have the MSC configure (Turn ON) all radios* on the LAC.
   a. Wait 1 minute. Turn OFF one radio with the manual switch.
   b. Wait 3 seconds. Turn OFF another radio.
   c. Continue in this manner until all radios are off.
   d. Turn ON one radio. Watch for an LED for 3 seconds. Turn OFF the radio.
   e. Turn ON the next radio. Watch for an LED for 3 seconds. Turn OFF the radio.
   f. Continue in this fashion until each radio has been tried, one at a time.
   g. Turn ON all radios and observe the LEDs while allowing the LAC to warm up for 5 minutes.
   h. After the LAC has warmed up, repeat steps a through f, above.
   i. When finished, have the MSC reinstate the radios into service.
3. If a lighted LED is not observed, and major alarms have been reported, refer to the LACALM report to determine the time of day when the alarms occur, and return to the site at that time.
4. If a lighted LED is not observed, and minor alarms have been reported, check that all LAM fuses are securely seated in their sockets. If an LAM LED lights when its associated fuse is wiggled, remove the fuse and bend the leads slightly; looking at the bottom of the fuse with one lead on the left and one on the right, bend one slightly up, and the other slightly down. Reinsert the fuse.

* For information on using the `CFR MULTI` command to turn on multiple radios, refer to AT&T 401-610-055 Issue 5, *AUTOPLEX* Cellular Telecommunications Systems Input Messages, Volume 1.

5. If a lighted LED is still not observed, and minor alarms have been reported, proceed to the Processor Alarm Procedure to determine if the LAC has generated a processor alarm.
6. If the LAC has not issued a Processor alarm, and minor alarms have been reported, the alarm was probably caused by a faulty LAM or a loose LAM fuse. Refer to the LACALM report to determine the time of day when the alarms occur, and return to the site at that time.

CAUTION:
Make sure that all radio switches are turned ON before leaving the cell site.

LAM Alarm Procedures

Case 1 - One or More Individual LAM LEDs Light

Symptoms:

Non-adjacent LAM LEDs are lighted. *If a group of adjacent LAM LEDs are lighted, see Case 2 below.*

Probable Causes:

1. LAM fuse improperly seated in socket.
2. Blown or missing LAM fuse.
3. LAM module not properly seated in LAU.
4. Improperly seated LAM ribbon cable connector.
5. Faulty LAM module.

NOTE:
A faulty LAM requires at least one radio to be active with a LAC output power of at least 15 watts in order to issue an alarm and light its LED. If a LAM failure is suspected and no LAM LEDs light, follow the Radio Control Procedure to apply radios to the LAC.

Procedure:

1. Check that the associated LAM fuse is securely seated in its socket. If the LED goes out when the fuse is wiggled, remove and bend the leads slightly: looking at the bottom of the fuse with one lead on the left and one on the right, bend one slightly up, and the other slightly down. Reinsert the fuse. Check all other LAM fuses.
2. Make sure that the LAM is securely seated in the LAU and that the thrumbscrew, which secures the LAM in the LAU, is tight. (Thumbscrews should be finger tight.)
3. Remove and reseat the LAM ribbon cable connector.

4. Remove and check the fuse; if the fuse is good proceed to Step 5.
   a. If the fuse is blown, replace it with a new fuse. Do not take one from a 10 LAM LAC, thinking the fuse is spare just because the slot is not equipped with an LAM.

NOTE:
A good fuse must always be in place to prevent a false alarm.

   b. If the fuse blows right away with little or no traffic present, replace the LAM.
   c. If within the maintenance window, have the MSC turn up (configure) all the radios on the LAC and wait 15 minutes to be sure the fuse doesn't blow again under full power conditions. If it does, move the LAM to another position. If the fuse blows in the new position, replace the LAM.
   d. If more than one LAM has a blown fuse, check the output power of the LAC to be sure it is not being overdriven. (See Step 3 for Case 2 below.)
   e. If the LAC is operating within its power rating, and an LAM continues to blow fuses, regardless of position, replace the LAM.
5. Interchange the suspect LAM with another LAM in the LAU. If the suspect LAM still alarms, replace it. Before concluding that the alarm has cleared, be sure that there is at least one radio active with a LAC output power of at least 15 watts.
6. Use the Radio Control Procedure to check with each radio ON alone, and then with all radios ON together.

Case 2 - Groups of LAM LEDs Light

Symptoms:

1. For a 20 LAM LAC: groups of 5 LEDs are lighted sequentially.
2. For a 10 LAM LAC: groups of 2 or 3 LEDs, depending on the breaker.

Probable Causes:

One or more tripped 20A breakers feeding the LAU.

Procedure:

1. Check the main 20A breakers (See Figure 22-2).

— If only one breaker has tripped, and it is found during an active traffic period, reset the breaker, verifying that it does not trip again. If the breaker does trip again, have the MSC block one or more radios from service until the breaker holds. Return during the maintenance window.

— If a tripped 20A breaker is found during the maintenance window, have the radios taken out of service. Turn off all breakers supplying the LAC, wait 10 seconds, then turn all breakers back on, beginning with the breaker supplying the Linearizer.

2. If breakers trip again without any radios on, check for shorts in the DC power cabling, frame capacitors, LAM power connectors, etc.

3. During the maintenance period, have the MSC configure all of the radios on the LAC. Using the switch on each radio, turn off all but one and measure the output power of each radio at the J4 antenna connector to be sure that the LAC is operating within its rating of 240 watts for a full-power LAC or 100 watts for a half-power LAC, taking into account the insertion loss from the LAC output to the J4 antenna connector.

4. Verify with the MSC that the radios on the LAC are using the correct VRAL settings.

5. In addition to measuring the output power at the J4 antenna connector, verify that the insertion loss between the LAC and the J4 antenna connector is correct by measuring the power on the output end of the first cable leaving the LAC.

6. If the LAC is operating close to its maximum power rating and a breaker trips with all radios ON, turn OFF one or two radios. If the breaker no longer trips, swap three of the LAMs operating from the tripping breaker with LAMs operating from the other breakers, one from each breaker. Check again with all radios ON.

NOTE:
When measuring RF power, always allow margin for measurement uncertainty; for example, assuming an uncertainty of 5%, be sure the power does not exceed 95% of rating. If it is high, readjust the power.

Case 3 - All LAM LEDs Light

Probable Causes:

1. Tripped breakers
2. 10/20 LAM switch setting

Procedure:

1. For a C-Series or later LAC (See Figure 22-3) with 20 LAMs, check that the 10/20 switch, located on the circular AYM board is in the 20-LAM position.
2. Follow the procedure for Case 2, above.

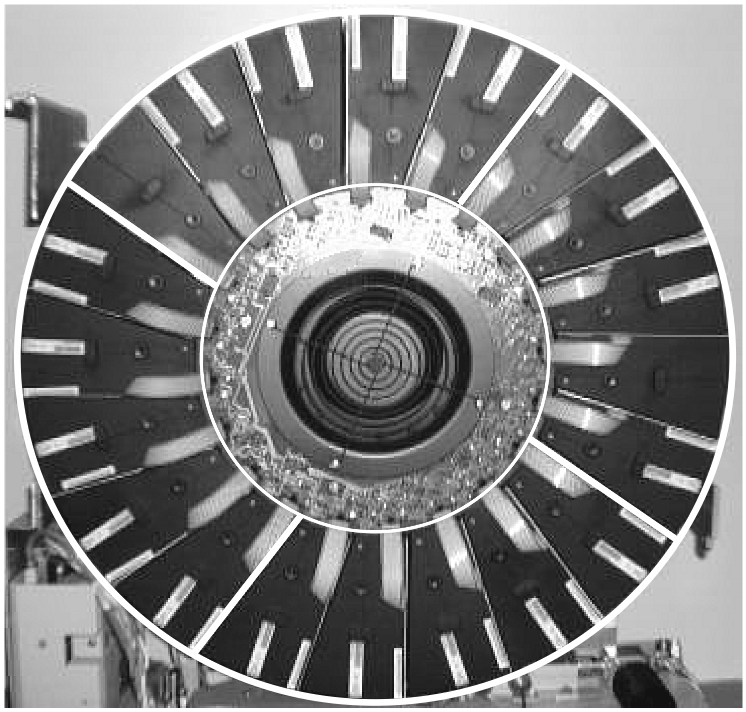


Figure 22-2. LAMs Powered by Common Breakers

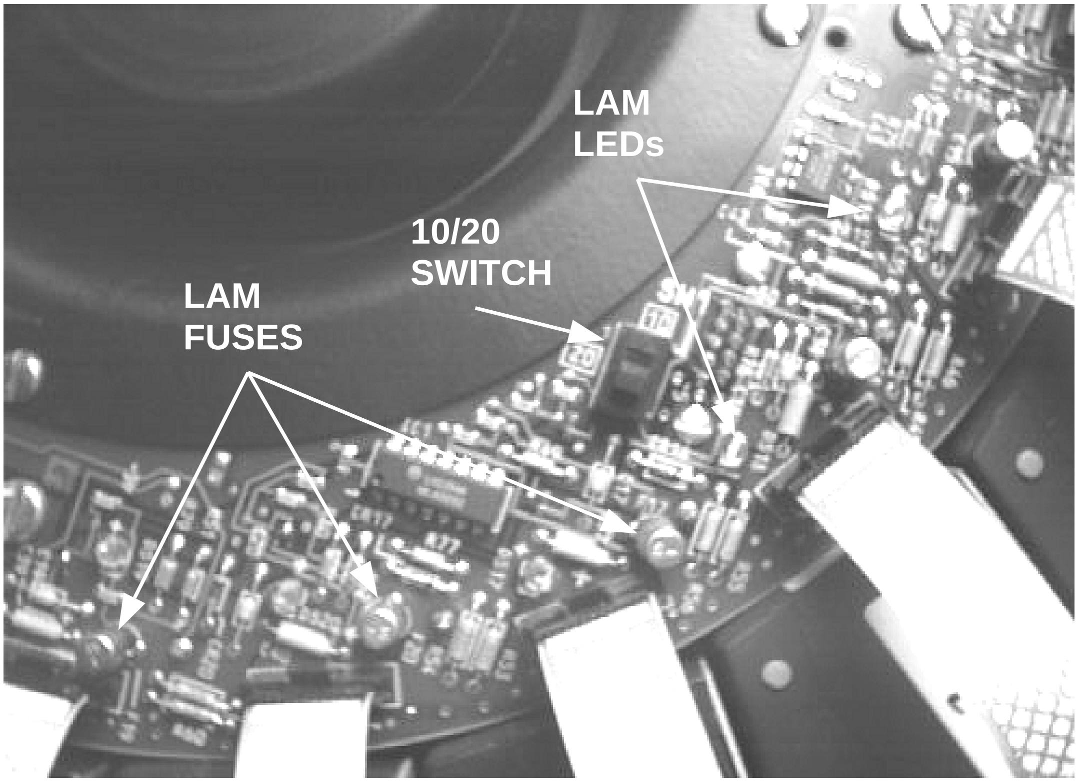


Figure 22-3. Location of LAM Fuses, LEDs, and the 10/20 Switch (on C-Series LACs)

Preamp Alarm Procedure

Notes about Preamps

1. Before a preamp is installed, check that the gain adjustment screw is turned fully counter-clockwise (minimum gain).
2. Before adjusting the gain, **be sure to allow at least a 30-minute warm-up period** to allow the preamp to stabilize.

Notes about Preamp Alarms

1. A blown fuse can result in an intermittent alarm for some preamps; the alarm will clear without traffic. This is true for AT&T as well as Amplidyne preamps. Trontech and Decibel units will give a continuous alarm for a blown fuse. This is due to a difference in the implementation of the alarm circuitry.

2. The preamp alarm circuitry monitors the output power difference between the two redundant RF power paths within the preamp. Therefore, in the very unlikely case of two blown fuses, both outputs will be zero and an alarm will not be issued.

3. A preamp alarm may occur at low power level but not at high, or vice versa, or it may be a function of frequency and occur with one radio or group of radios but not with another. Use the Radio Control Procedure to check for intermittent preamp alarms.

   Preamp Troubleshooting Procedures

   Symptoms:

   1. Major Alarms reported at the MSC.
   2. The PREAMP LED on the LAC lights for some combination of radios.
   3. The FANS LED is **not** lighted.

   Probable Causes:

   1. Blown Preamp fuse.
   2. Loose or faulty RF connections at the preamp input/output.
   3. Faulty DC cable to the preamp.
   4. Faulty preamp.

   Procedure:

   1. Make certain that all RF cables are tight.
   2. Follow the Flow Chart (See Figure 22-4).

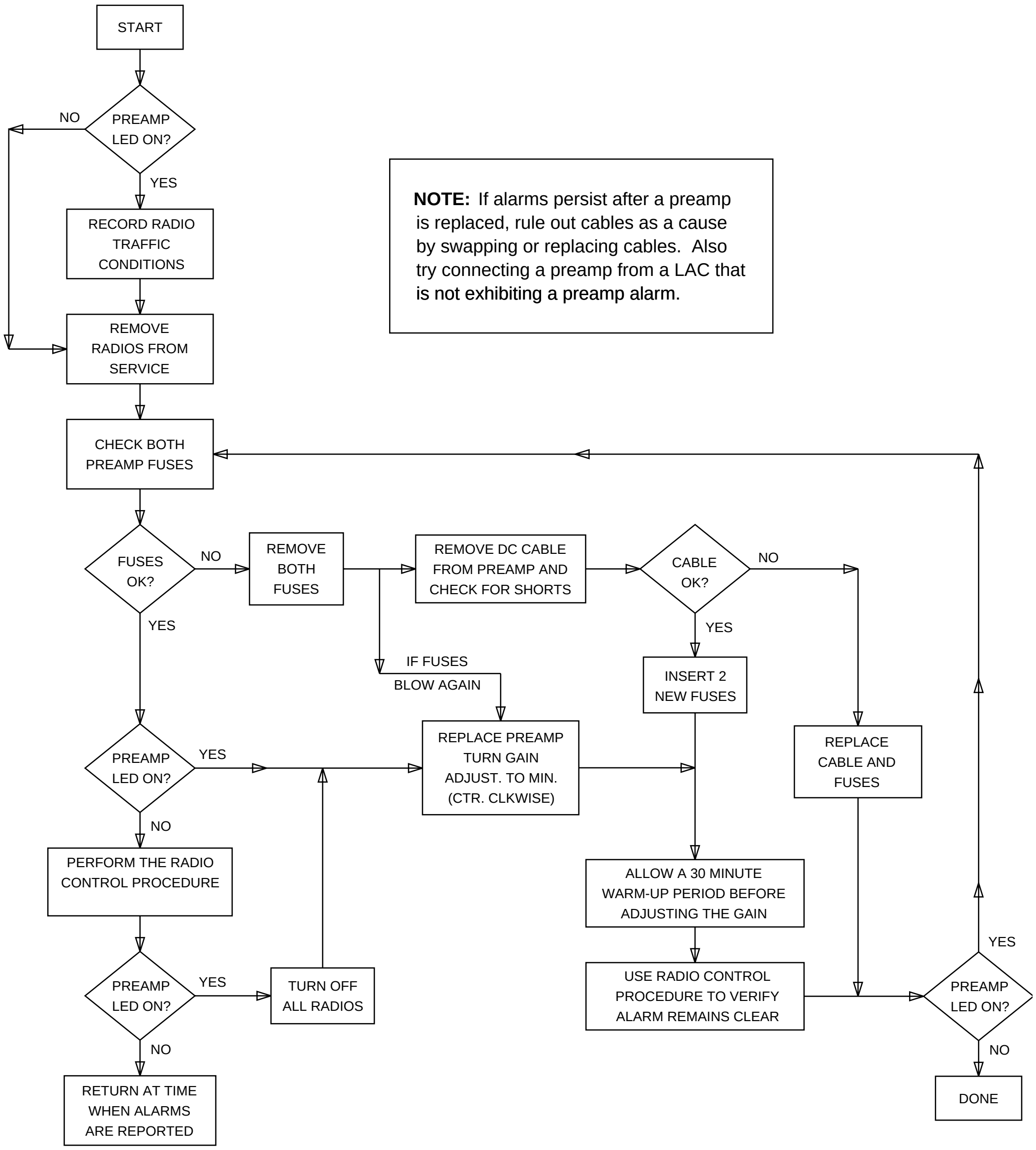


Figure 22-4. Flowchart of the Preamplifier Diagnostic Procedure

Sanity Alarm Procedure

A LAC SANITY alarm is reported to the MSC by the UN166 AFI board in the Radio Control Frame when the alarm status of an LAC cannot be determined. It appears as a MAJOR alarm on the ROP, with the word SANITY after the LAC number, and is listed on the LACSUM report under the heading, MAJS.

Incorrect LAC address settings are a common cause of LAC SANITY alarms. Addressing problems are usually only encountered upon initial LAC installation or when a LAC is changed. LAC SANITY alarms may also be generated when alarm bus circuits on either the UN166 AFI board or on the LAC are damaged.

NOTE:
All LACs in a cell site are connected together on a common alarm bus, with each LAC on the bus assigned a unique identification or "address" number. Since the LACs share a common alarm bus, one faulty cable or alarm circuit, or mis- addressed LAC, can contaminate the bus, causing multiple SANITY alarms, or result in the reporting of false alarms.

Setting LAC Addresses

It is common practice to assign an address to correspond with the position of the LAC in the frame, with the first frame assigned addresses 0,1,2 and 3 and the growth frame assigned 4,5, and 6. Although not recommended, other numbering schemes are also used. If in doubt, check the cell site addresses in the CEQCOM2 database* on the ECP.

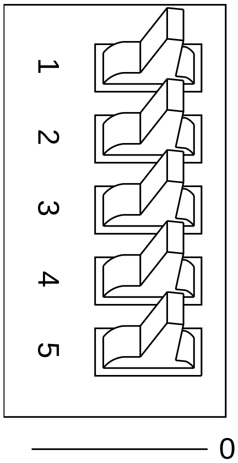
Whenever an LAC is installed in a frame, its alarm address must be set (See Figure 22-5). The address† is set (in binary) from 0 to 31, using the 5 position rocker switch on the AYE1 board, which is accessed via a window in the front of the Linearizer.

Be sure that no address is used more than once, since the data will be corrupted if more than one LAC attempts to "talk" on the bus at the same time.

NOTE:
In recently produced LACs the FAC/FLD switch (See Figure 22-10) was moved to the front of the Linearizer (See Figure 22-11) to allow easier access. LACs with this feature have a 6-position dip switch in place of the 5-position switch. The top switch, labeled "1", is used for the FAC/FLD setting and the bottom 5 switches, labeled 2-6, are used for the address setting. LACs with this feature are clearly marked.

* See AT&T 401-610-036, *AUTOPLEX*® Cellular Telecommunications Systems Data Base Update Guide, for further information.

† Beginning with Series II Cell Site Software Release 4.3, only LAC addresses 0 - 6 are permitted.



LAC Address	Switch Settings				
	SW-1	SW-2	SW-3	SW-4	SW-5
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0

Figure 22-5. Setting the LAC Address

Sanity Alarm Troubleshooting

Since all LACs in the cell site share a common alarm bus, finding the source of SANITY alarms can often be difficult, since a single faulty alarm interface in an LAC or in one of the two UN166 AFI boards can confuse the alarm reporting for all devices attached to the bus. Although the following procedure is most effective when SANITY alarms are continuous, the same steps should be followed to diagnose intermittent SANITY alarms.

Current LAC alarm status may be determined at the cell site by using the LAC Alarm Query System (LAQS) test equipment described in paragraph E. Although it is possible to diagnose LAC SANITY problems without using this equipment, the LAQS system makes the job much easier. Using this equipment is simply a matter of disconnecting the LAF alarm cables from the RCF and then connecting the LAQS system to the LAF(s) or to an individual LAC. See paragraph E for further details.

Symptoms:

One or more LACs are reporting SANITY alarms at the MSC.

Probable Causes:

Incorrect LAC address settings, a damaged UN166 AFI board, a damaged LAC, an improperly installed LAC microprocessor, loose or damaged alarm bus cables or connectors.

Procedure 1: LAQS Test Equipment IS Available.

1. Check that all five breakers on each LAC are ON.
2. Check all LAC addresses, verifying that each LAC has a unique address. Verify with the MSC that the number of LACs shown on the MCRT agrees with the number of LACs in the site. If in doubt about the LAC addressing scheme, check the CEQCOM2 database.
3. Check the alarm bus cabling between frames, making sure that all connectors are properly seated, from J104 on RCF0 to J2 on LAF0, and from J1 on LAF0 to J1 on LAF1.
4. Make sure that the AYD5 Paddle Board is properly seated on the RCC backplane in the Radio Channel Frame.
5. Remove the inactive UN166 AFI board from the Radio Channel Frame.
   a. Using an ohmmeter, measure the resistance between Pin 1 and Pin 8 on the 26LS32 chip on the AFI board. Likewise, measure the resistance between Pins 2 and 8. Both resistance values should be between 4K ohms and 200K ohms. If either of the resistance values is outside this range, there is a problem with the board.
   b. Measure the resistance between Pin 13 and Pin 8 on the 26LS31 chip on the AFI board. Likewise, measure the resistance between Pins 14 and 8. Both resistance values should be greater than 20K ohms. If either of the resistance values is less than 20K ohms, there is a problem with the board.
   c. Replace the AFI board, if necessary, and re-insert it into the frame.
6. Have the operator at the MSC switch active controllers* in the RCF. **Repeat Step 5 for the other UN166 board.**
7. Connect the LAQS test equipment to the LAC alarm bus as described in paragraph E. Verify that all LACs in the site are properly indicated in the Addresses of On-Line LACs section of the main LAQS menu.
8. Select LAQS Option 5, Re-query for Listening LACs, to verify the integrity of the alarm interface. This option will cause the test set to repeatedly search for LACs on the alarm bus, reporting any inconsistent results. This feature is especially useful for detecting intermittent conditions. **Allow the software to run for several minutes before concluding that all LACs are reporting correctly.**
9. **If inconsistencies are reported,** attempt to isolate the problem by disconnecting and re-connecting LAFs and/or LACs from the alarm bus until all inconsistent alarm reporting is eliminated.

* Issue ECP command `SWITCH:Cell,CSC`.

10. Once a problem LAC is isolated, reset its microprocessor by powering it down, waiting 10 seconds, and re-setting the breakers. After re-setting the LAC, bring up two radios and allow at least 2 minutes for any alarms to clear.

CAUTION:
Make sure that all radios are turned off before re-applying power to the LAC.

11. If the LAC continues to report inconsistently after it has been reset, double check its address and inspect the LAC alarm cable and connections (See Figure 22-9). Connect it to the bus by itself and check the integrity of the LAC alarm cable by moving it to another LAC. If the problem moves with the cable, replace the cable. If the problem clears, move the cable back and suspect a problem with the LAC.
12. Power down the suspect LAC and disconnect the alarm cable from the top-most 9-pin D-sub connector at the back of the AYG3 pack (J10) (See Figure 22-6).
    a. Using an ohmmeter, measure the resistance from Pins 1 and 2 to ground on LAC connector J10. (Use the connector shell for ground.) Both resistance values should be greater than 20K ohms. If either value is less than 20K ohms, there is a problem with the LAC.
    b. Likewise, measure the resistance from Pins 3 and 4 to ground. Both resistance values between 4K ohms and 200K ohms. If either of the resistance values is outside this range, there is a problem with the LAC.
13. If the LAC resistance values check out OK, remove the cover over the microprocessor on the side of the AYE1 pack in the LAC. Check for bent pins on the processor chip, or other obvious problems.
14. Once all faulty LACs have been isolated, reconnect the other LAF and/or LACs to the alarm bus. Verify with the MSC that none of the connected LACs are generating alarms and that only the disconnected LACs are generating SANITY alarms.
15. Replace all faulty LACs, making sure to correctly set the address on any new LACs. Verify that all LAC SANITY alarms have been cleared. Use the LAQS equipment, Menu Option 5, to verify the integrity of the LAC alarm bus.

NOTE:
If replacements are not available, leave all defective LACs disconnected from the alarm bus until they can be replaced.

Procedure 2: LAQS Test Equipment IS NOT Available

1. Check that all five breakers on each LAC are ON.
2. Check all LAC addresses, verifying that each LAC has a unique address. Verify with the MSC that the number of LACs shown on the MCRT agrees with the number of LACs in the site. If in doubt about the LAC addressing scheme, check the CEQCOM2 data base on the ECP.
3. Check the alarm bus cabling between frames, making sure that all connectors are properly seated, from J104 on RCF0 to J2 on LAF0, and from J1 on LAF0 to J1 on LAF1.
4. Make sure that the AYD5 Paddle Board (See Figure 22-7) is properly seated on the RCC backplane in the Radio Channel Frame.
5. Remove the inactive UN166 AFI board from the Radio Channel Frame.
   a. Using an ohmmeter, measure the resistance between Pin 1 and Pin 8 on the 26LS32 chip on the AFI board. Likewise, measure the resistance between Pins 2 and 8. Both resistance values should be between 4K ohms and 200K ohms. If either of the resistance values is outside this range, there is a problem with the board.
   b. Measure the resistance between Pin 13 and Pin 8 on the 26LS31 chip on the AFI board. Likewise, measure the resistance between Pins 14 and 8. Both resistance values should be greater than 20K ohms. If either of the resistance values is less than 20K ohms, there is a problem with the board.
   c. Replace the AFI board, if necessary, and re-insert it into the frame.
6. Have the operator at the MSC switch active controllers* in the RCF.
7. Repeat Step 5 for the other UN166 board (See Figure 22-8).
8. Disconnect the alarm cable at J1 of LAF0, so that only LAF0 is connected to the alarm bus. (Expect all LACs in the disconnected LAF to give SANITY alarms at the MSC.)
9. If the LACs in LAF0 stop giving SANITY alarms, there is a problem in LAF1. If the alarms from the LACs in LAF0 persist, there is a problem in LAF0. Connect the problem LAF to the alarm bus, leaving the other LAF alarm cable disconnected.
10. Isolate a faulty LAC or LAC alarm cable by disconnecting LACs from the alarm bus, one LAC at a time. Disconnect the alarm cable from the top-most 9-pin D-sub connector at the back of the AYG3 pack (J10) (See Figure 22-9). A SANITY alarm will be generated for each LAC that is disconnected, but watch for alarms to clear on the remaining LACs. Continue disconnecting LACs until the alarms clear on those LACs still

* Issue ECP command SWITCH:Cell,CSC.

connected, or until all of the LACs have been disconnected. Reconnect each LAC to the alarm bus by itself, one LAC at a time, until all faulty LACs are isolated.

11. Once the LAC which generates SANITY alarms is isolated, reset its microprocessor by powering it down, waiting 10 seconds, and re-setting the breakers. After resetting the LAC, bring up two radios and allow at least 2 minutes for any alarms to clear.

CAUTION:
Make sure that all radios are turned off before re-applying power to the LAC.

12. If SANITY alarms remain after the LAC has been reset, double check its address, and inspect the LAC alarm cable and connections (See Figure 22-9). Connect it to the bus by itself and check the integrity of the LAC alarm cable by moving it to another LAC. If the alarm moves with the cable, replace the cable. If the alarm clears, move the cable back and suspect a problem with the LAC.

13. Power down the suspect LAC and disconnect the alarm cable from the top-most 9-pin D-sub connector at the back of the AYG3 pack (J10) (See Figure 22-10).

    a. Using an ohmmeter, measure the resistance from Pins 1 and 2 to ground on LAC connector J10. (Use the connector shell for ground.) Both resistance values should be greater than 20K ohms. If either value is less than 20K ohms, there is a problem with the LAC.

    b. Likewise, measure the resistance from Pins 3 and 4 to ground. Both resistance values should be between 4K ohms and 200K ohms. If either of the resistance values is outside this range, there is a problem with the LAC.

14. If the LAC resistance values check out OK, remove the cover over the microprocessor, on the side of the AYE1 pack in the LAC. Check for bent pins on the processor chip, or other obvious problems.

15. Once all faulty LACs in the LAF have been isolated, reconnect the other LAF(s) to the alarm bus. Verify with the MSC that none of the LACs in the reconnected LAF(s) are generating alarms and that only the disconnected LACs are generating SANITY alarms. If any LACs in the reconnected LAF(s) generate alarms, repeat Steps 8 through 11 above to find the problem.

16. Reconnect each suspect LAC to the bus, one at a time, verifying that each one generates a SANITY alarm at the MSC and/or causes other LACs to generate alarms.

17. Replace all faulty LACs, making sure to correctly set the address on any new LACs. Verify with the MSC that all LAC SANITY alarms have been cleared.

NOTE:
If replacements are not available, leave all defective LACs disconnected from the alarm bus until they can be replaced.

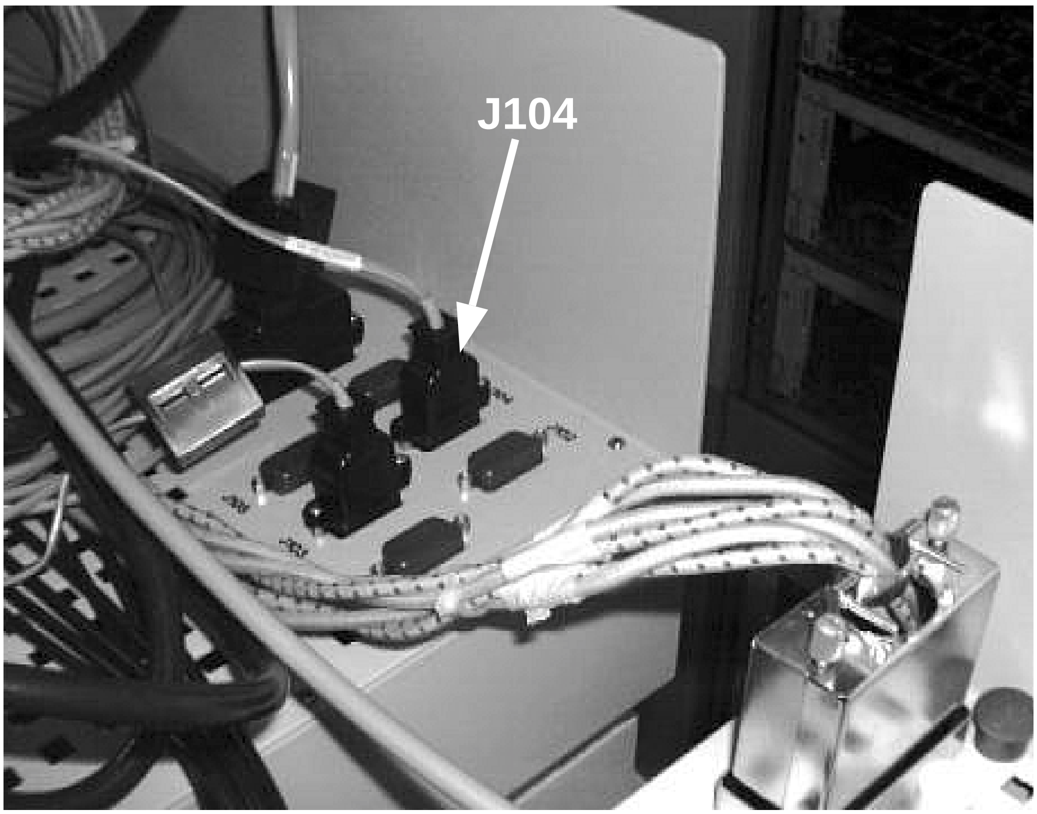


Figure 22-6. Location of the Alarm Cable Connector at Top of the RCF

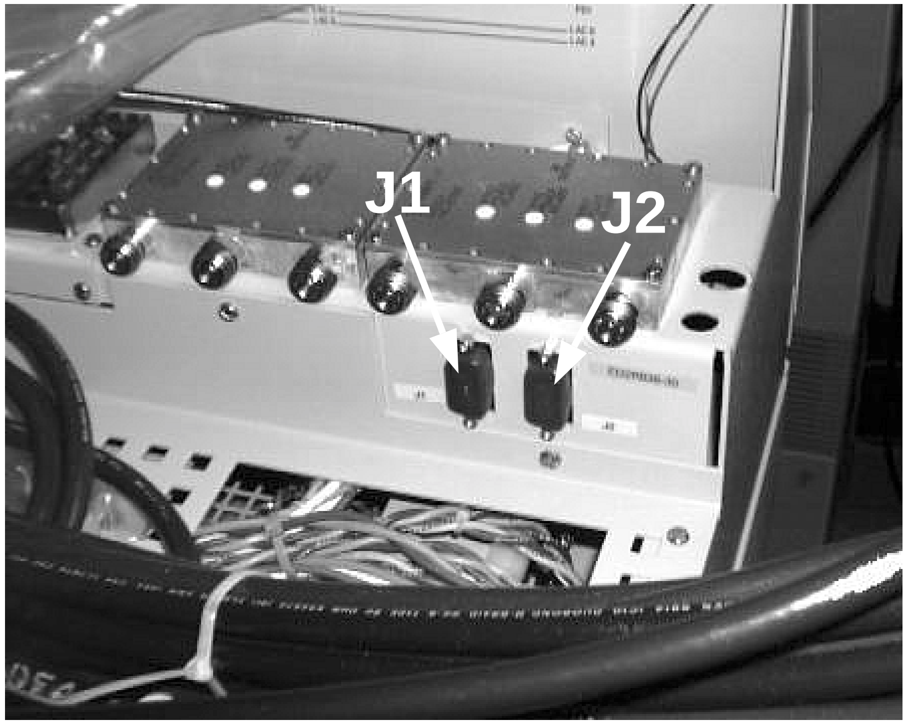


Figure 0-1. **Location of the Alarm Cable Connectors at Top of the LAF**

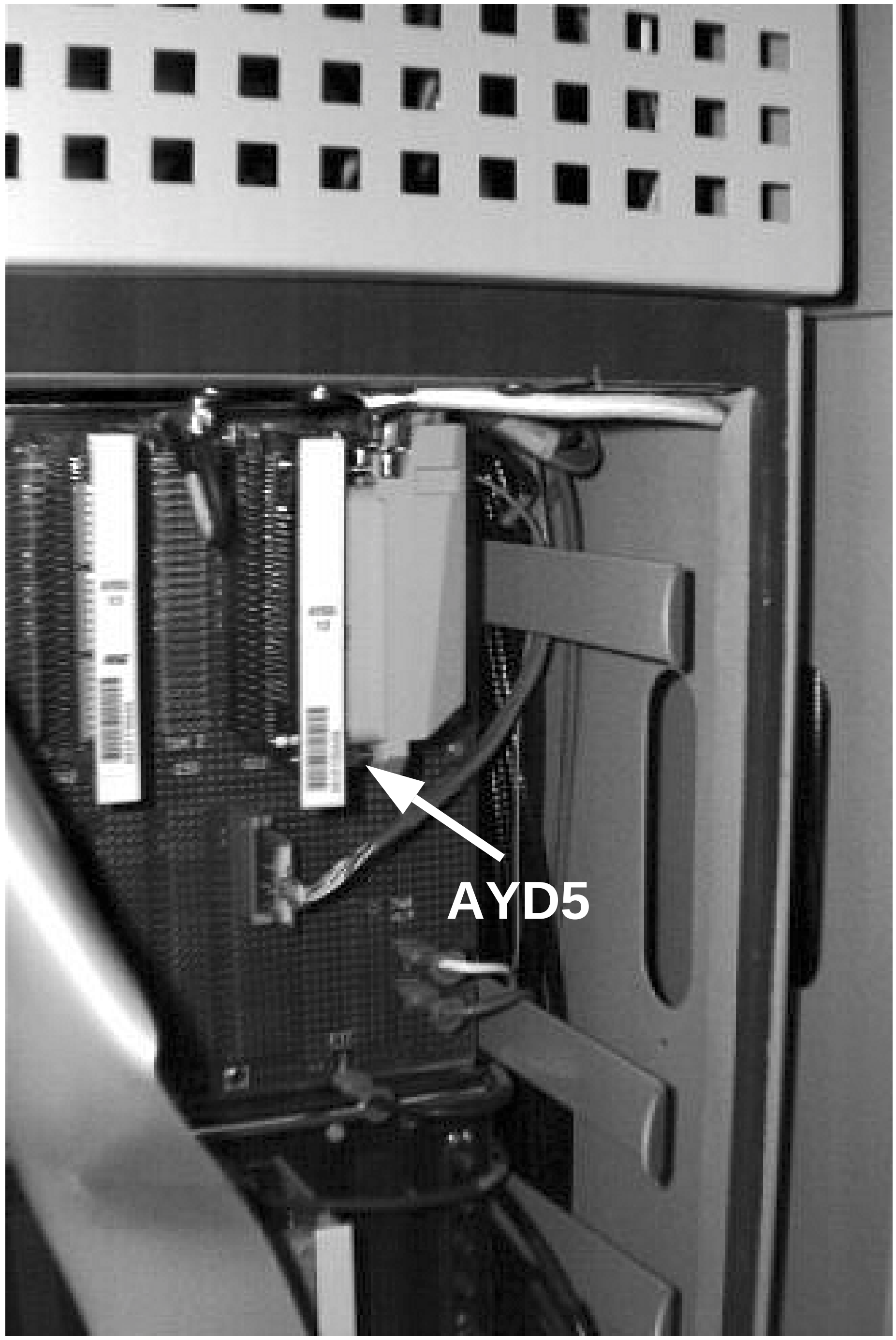
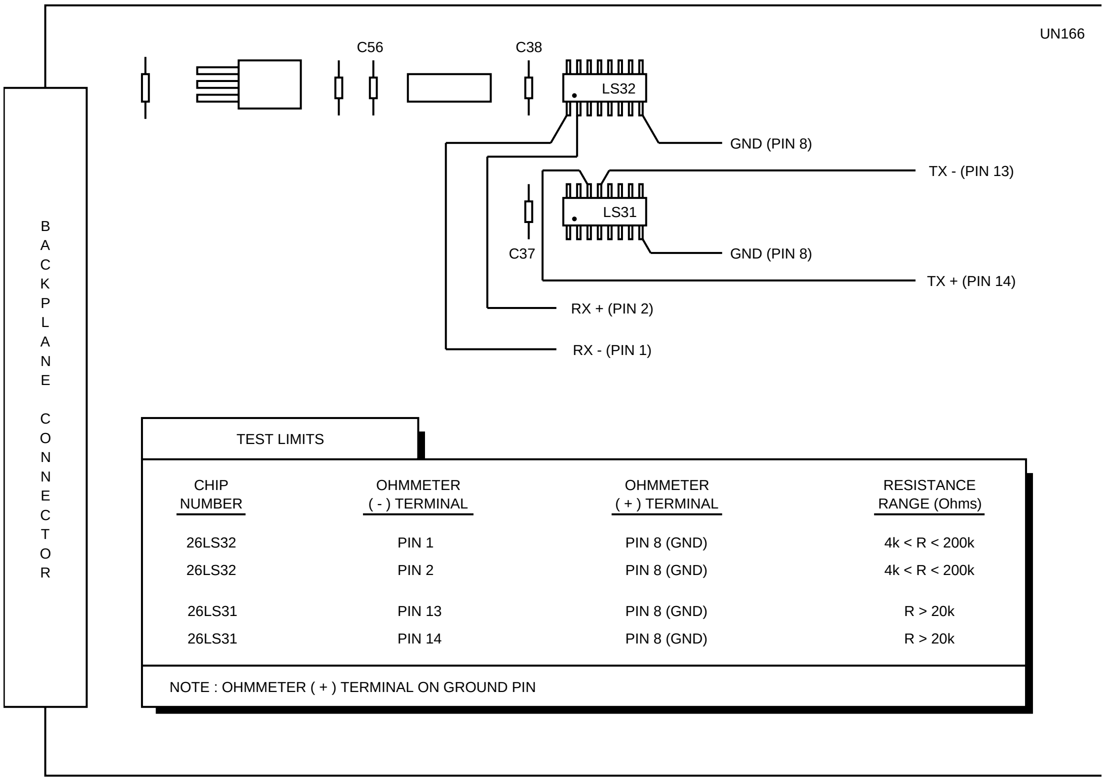


Figure 22-7. Location of the AYD5 Paddle Board on the RCC Backplane



CHIP NUMBER	OHMMETER (-) TERMINAL	OHMMETER (+) TERMINAL	RESISTANCE RANGE (Ohms)
26LS32	PIN 1	PIN 8 (GND)	4k < R < 200k
26LS32	PIN 2	PIN 8 (GND)	4k < R < 200k
26LS31	PIN 13	PIN 8 (GND)	R > 20k
26LS31	PIN 14	PIN 8 (GND)	R > 20k

NOTE : OHMMETER (+) TERMINAL ON GROUND PIN

Figure 22-8. UN166 AFI Board Test Points

Figure 22-9. Location of the LAC Alarm Cable Connector

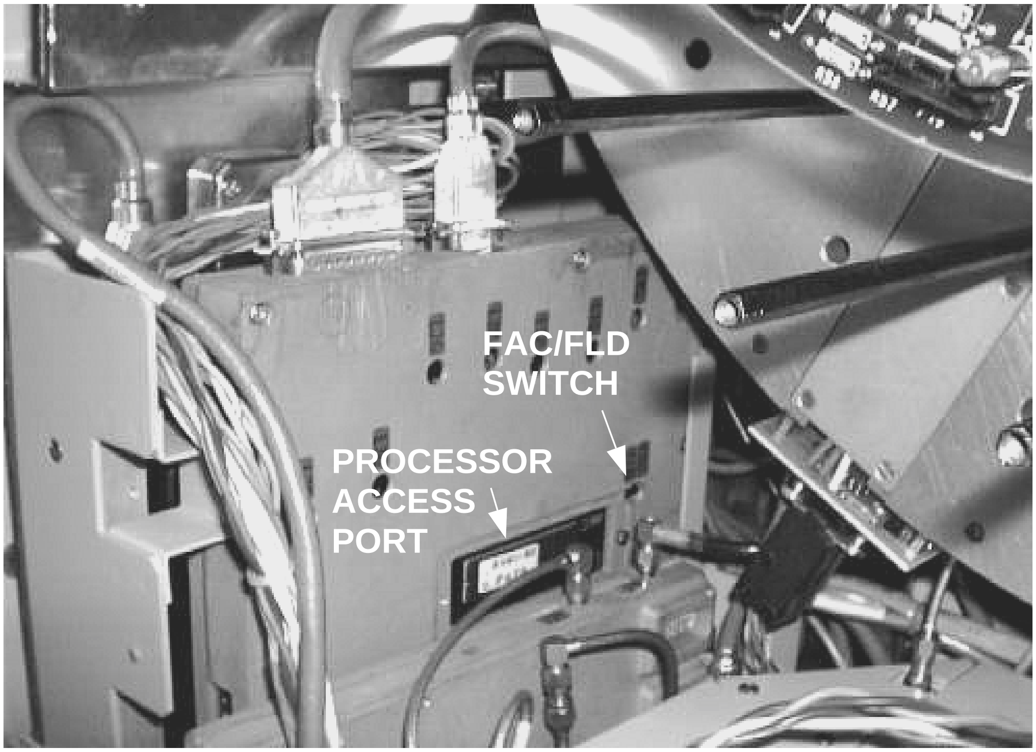


Figure 22-10. Location of the FAC/FLD Switch and Microprocessor Access Port (Cover Removed)

LAM Bias Fault Procedure

NOTE:
This fault condition is reported differently in C-Series LACs than in A/B-Series LACs.

Symptoms:

1. **For C-Series LACs** - Critical Alarm, LINEARIZER and LINEAR AMPLIFIER UNIT LEDS are **both** ON.

   For A/B-Series LACs - Minor Alarm, LINEARIZER LED is ON.

2. All LAM LEDs are OFF.
3. LAC temperature is not excessively high.
4. Critical Alarm does not cycle ON and OFF.

Probable Causes:

1. A short circuit or fault in one of the LAMs or ribbon cable connectors.

2. A short circuit on the circular AYM board.
3. A failure of the power unit within the Linearizer (LZR) that provides 5 volt bias to the LAMs.

Procedure:

1. Have the MSC take all radios on the LAC out of service (all radios OFF).
2. Remove DC power from the LAC by opening its breakers.
3. Disconnect all LAM ribbon cables.
4. Reapply power. If the alarm does not clear, the problem is within the LAC. Replace the LAC.
5. If the alarm clears, suspect a fault in one of the LAMs. Isolate the faulty LAM by reconnecting the LAMs, one at a time, until the alarm returns, identifying the bad LAM. Replace the bad LAM.

Fan Alarm Procedure

Preamp Fan

All preamp fans in the LAF are powered from two of the four 20A DC feeders which supply power to the LAC 0 position in the frame. **Preamp fans will not have power if the breakers to LAC 0 are open.**

CAUTION:
To avoid overheating the preamps, do not power down LAC 0 for more than a few minutes if other LACs are powered. If LAC 0 needs to be powered down for an extended period of time, disconnect the J1 power cable from LAC 0 (LAC 4 in LAF1), and close the ***two*** *20A breakers which supply connector J1.*

Symptoms:

C-Series LACs:

1. Major Alarm
2. LAC LEDS = FANS and PREAMP

A/B-Series LACs:

1. Minor Alarm
2. LAC LEDS = LINEARIZER

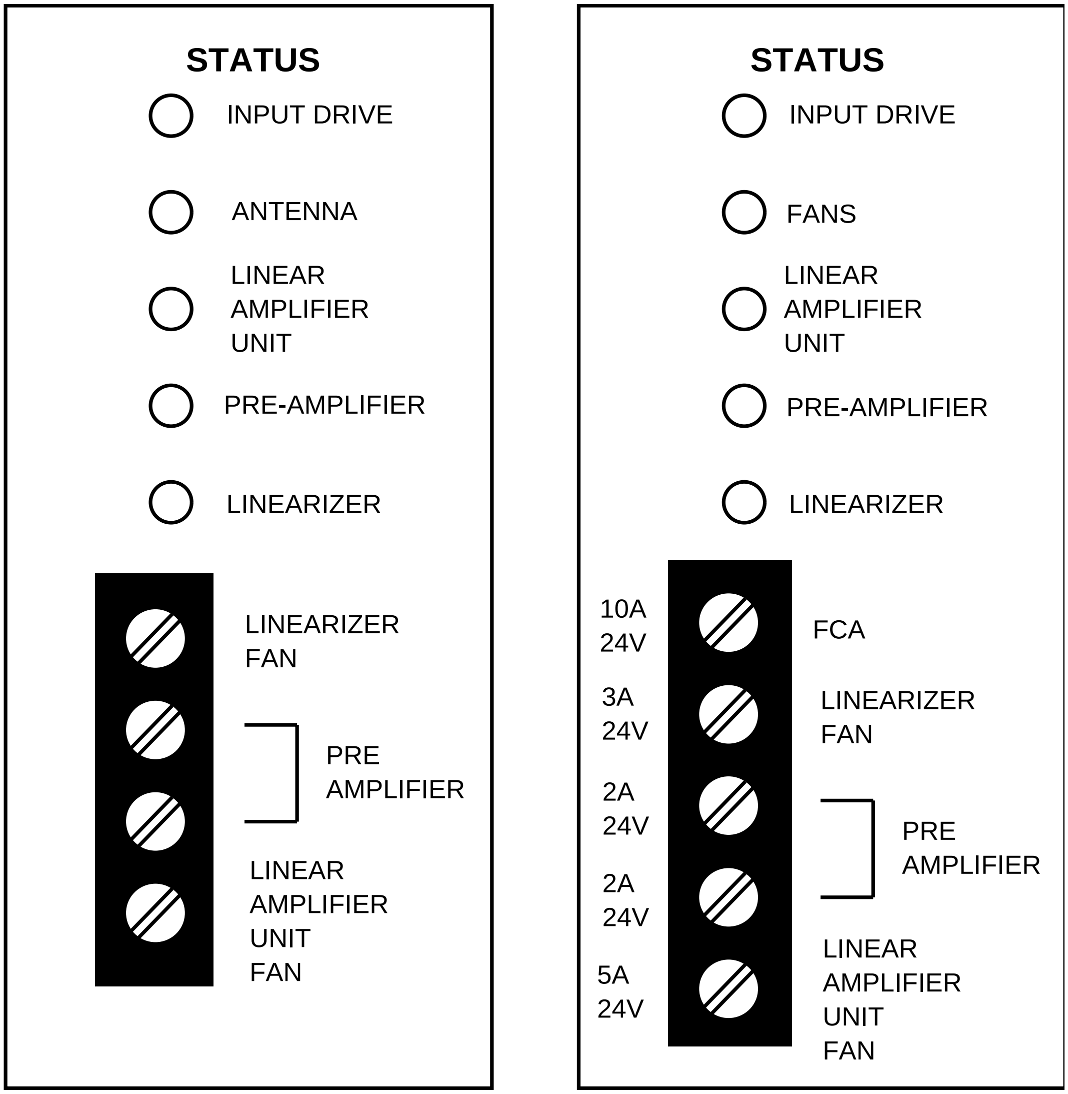


Figure 22-11. View of the Linearizer Faceplate with the Front Grille Removed

Procedure:

1. Check that all 20A breakers feeding LAC 0 (LAC 4 in LAF1) are closed.
2. If a fan is stopped, check its wiring. Check the fan for blockage.
3. Check the 24-volt DC voltage on connector J1 supplying LAC 0. If normal, the fan should be replaced. Replace both preamp fans (see Section 4) at the same time, even if the other fan is working normally.

Linearizer Fan

Symptoms:

C-Series LACs:

1. Major Alarm
2. LAC LEDS = FANS and LINEARIZER

A/B-Series LACs:

1. Minor Alarm
2. LAC LEDS = LINEARIZER

Procedure:

1. Check the LINEARIZER FAN fuse on the front panel of the linearizer. Replace with a new fuse, if blown.
2. If the fuse is good, remove the front grille from the Linearizer and carefully check to see if the fan is turning. The fan is located on the far right side of the linearizer cabinet. Check the fan for blockage.
3. Check the fan wiring for shorts or opens. If none are found, replace the fan (see Section 4).

LAU Fan

Symptoms:

C-Series LACs:

1. Major Alarm
2. LAC LEDS = FANS and LAU

A/B-Series LACs:

1. Minor Alarm
2. LAC LEDS = LAU

Procedure:

1. Check the LINEAR AMPLIFIER UNIT FAN fuse on the front panel of the Linearizer. Replace it with a new fuse, if blown.
2. If the fuse is good, check to see if the fan is turning. Check for blockage. Remove a few LAMs at the top of the LAU and check the DC voltage at the inductor terminals. If the voltage is greater than 22V, replace the fan. If the voltage is less than 22V, check the DC power cabling.

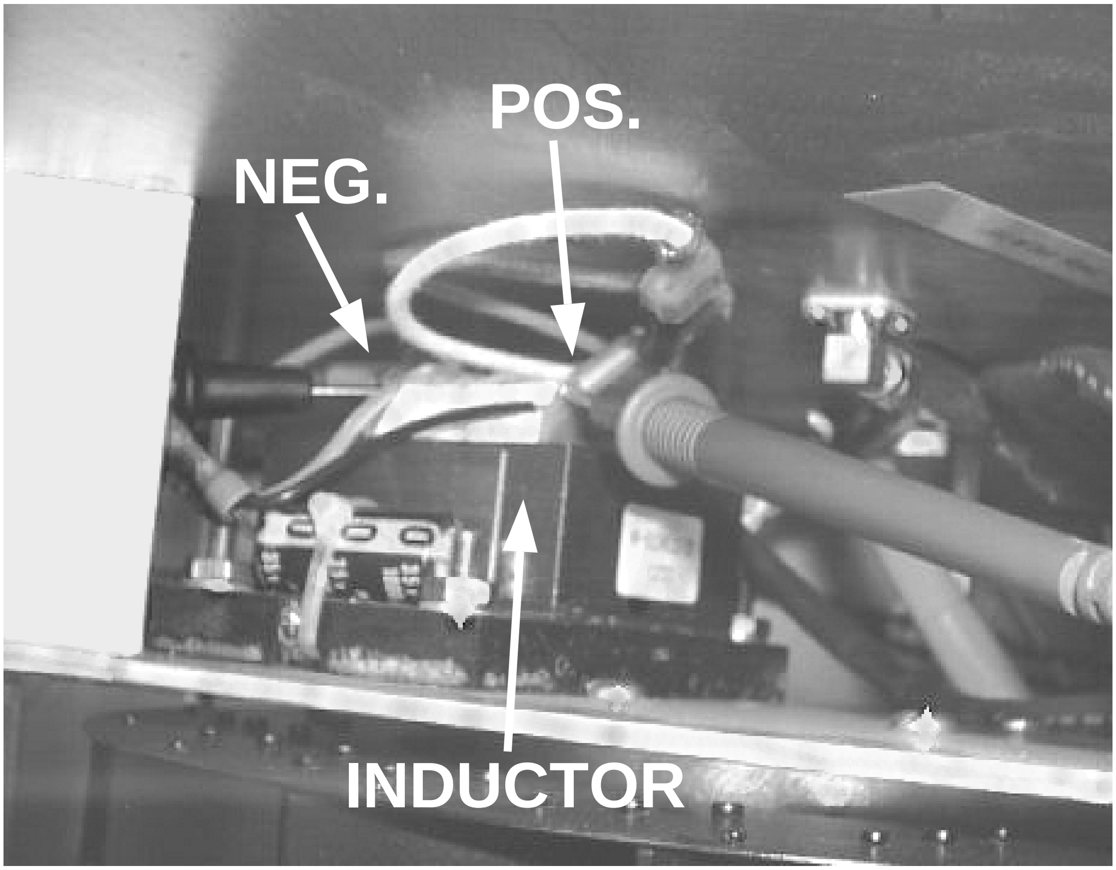


Figure 22-12. Measuring the LAU Fan Voltage

INFO Alarm Procedure

Symptoms:

1. INFO alarms reported at the MSC
2. The INPUT DRIVE LED is ON

Probable Causes:

1. The LAC is being overdriven
2. A damaged UN166 AFI Board

Procedure:

1. During the maintenance period, have the MSC configure all of the radios on the LAC. Using the switch on each radio, turn off all but one and measure the output power of each radio at the J4 antenna connector to be sure that the LAC is operating within its rating of 240 watts for a full-power LAC or 100 watts for a half-power LAC, **taking into account the insertion loss from the LAC output to the J4 antenna connector.**
2. In addition to measuring the output power at the J4 antenna connector, verify that the insertion loss between the LAC and the J4 antenna connector is correct by measuring the power on the output end of the first cable leaving the LAC.

NOTE:
When measuring RF power, always allow margin for measurement uncertainty; for example, assuming an uncertainty of 5%, be sure the power does not exceed 95% of rating. If it is high, readjust the power.

3. If the LAC is operating within its rated output power, suspect a problem with one or both of the UN166 AFI boards.
4. Make sure that the AYD5 Paddle Board is properly seated on the RCC backplane in the Radio Channel Frame.
5. Remove the inactive UN166 AFI board from the Radio Channel Frame.
   a. Using an ohmmeter, measure the resistance between Pin 1 and Pin 8 on the 26LS32 chip on the AFI board. Likewise, measure the resistance between Pins 2 and 8. Both resistance values should be between 4K ohms and 200K ohms. If either of the resistance values is outside this range, there is a problem with the board.
   b. Measure the resistance between Pin 13 and Pin 8 on the 26LS31 chip on the AFI board. Likewise, measure the resistance between Pins 14 and 8. Both resistance values should be greater than 20K ohms. If either of the resistance values is less than 20K ohms, there is a problem with the board.
   c. Replace the AFI board, if necessary, and re-insert it into the frame.
6. Have the operator at the MSC switch active controllers* in the RCF.
7. Repeat Step 5 for the other UN166 board.

* Issue ECP command SWITCH:Cell,CSC.

Thermal Alarm Procedure

Thermal alarms are generated when the temperature of the LAC rises to a level which may cause an LAM failure. This condition will not occur as long as the LAU FAN (See Figure 22-12)and cell site air conditioning are both functioning properly.

Symptoms:

1. MINOR, MAJOR, or CRITICAL alarms at the MSC
2. LAU fan failure
3. Cell site air conditioning failure

Procedure:

1. An LAU fan (See Figure 22-12) failure is the most probable cause of Thermal alarms. An air conditioning failure may result in a low-level (MINOR) Thermal alarm but should not progress to MAJOR or CRITICAL alarms as long as the LAU fan is functioning normally.
2. During normal operation, LAMs may be warm to the touch, but should not be so hot that you cannot leave your hand in contact with them.
3. If the LAU fan and air conditioning are both functioning properly, and the LAMs appear to be too hot, check the output power of the LAC to verify that it is being operated within its rating.

Processor Alarm Procedure

Symptoms:

1. Linearizer (LZR) LED lights.
2. MINOR alarms reported at the MSC.

Probable Causes:

1. FAC/FLD switch is in the wrong (FAC) position.
2. The LAC microprocessor is issuing an alarm.

Checking the FAC/FLD Switch

The FAC/FLD switch is set to the FAC position during LAC production and should be set to the FLD position before leaving the factory. If this switch is in the wrong position it will be evident by a continuously lighted LINEARIZER LED at LAC installation.

1. The FAC/FLD switch is located on the AYE1 circuit pack (See Figure 22-10), which is the 2nd pack from the left in the linearizer. The switch is accessed through an opening located on the side of the pack at the top rear corner, near the microprocessor cover plate. Remove a few

LAMs near the bottom of the LAU and use a flashlight to check the position of the switch. (There are actually two switches, but only the upper one is used.) Insert a scribe, or other pointed tool, into the circular indent in the upper slide switch, making sure that the switch is positioned toward the front of the LAC.

2. If the position is wrong, change it and check to verify that the alarm has cleared. (In some cases it may take a few minutes for the alarm to clear.)

NOTE:
In recently produced LACs the FAC/FLD switch was moved to the front of the Linearizer (See Figure 22-10) to allow easier access. LACs with this feature have a 6-position dip switch in place of the 5-position switch. The top switch, labeled "1", is used for the FAC/FLD setting and the bottom 5 switches, labeled 2-6, are used for the address setting. The top switch should be in the "0" position for field operation. LACs with this feature are clearly marked.

Checking the Version of the Microprocessor Firmware

A/B Series LACs with AYE1 circuit packs prior to Version 7 do not store processor alarm information, making it impossible to tell if the LAC has issued a Processor alarm. If the SERIES number on the AYE1 circuit pack is from 1 to 6 (the label is located on the top front corner of the pack), the microprocessor should be replaced with one having the latest firmware. (If the AYE1 pack does not have a SERIES number label, it is an old version - replace the processor.) Refer to AT&T Engineering Change Procedure ECP-C20144CB for details on how to replace the microprocessor.

NOTE:
The LAC Alarm Query System (LAQS) may display an error message when attempting to communicate with an LAC which does not store processor information.

When upgrading the microprocessor:

1. Be sure to turn off all radios and power down the LAC beforehand.
2. After replacing the microprocessor, be sure to follow the instructions for labeling the AYE1 circuit pack to show that it has been upgraded.
3. Before re-applying power, make sure that all radios are off. Re-apply power first to the Linearizer and then to the LAU.
4. Turn on 2 radios and allow the LAC to adjust for 2 minutes. Bring up all radios. If the alarm repeats, proceed with the next section to query the microprocessor alarm registers to determine if the LAC has issued a Processor alarm.

5. If the alarm remains clear, try other combinations of radios as described in the Radio Control Procedure. Be sure the LAC is not reporting a SANITY alarm at the MSC.

6. After leaving the site, continue to monitor the LAC from the MSC to determine if the alarm has cleared. If the alarm returns, go back to the site and query the microprocessor.

Checking the Microprocessor Alarm Registers

The LAC's microprocessor stores the current LAC alarm status as well as information about what caused Processor MINOR alarms. To access this information, the LAF frames must be disconnected from the alarm bus and connected to a FITS computer via a customized IEEE-488 to RS-422 Converter. Even though this will result in SANITY alarms at the MSC for all LACs, this procedure will not interfere with live traffic at the cell site. **An LAC should not be replaced for MINOR alarms unless it has issued a Processor alarm.**[*]

To read the LAC Processor alarm registers, connect the FITS computer to the LAC alarm bus and run the LAQS software. After reading the Processor Alarm Registers, refer to the following sections for corrective actions. Refer to Paragraph E for detailed instructions on using the LAQS software.

* Except for A/B-Series LACs with a LAM Bias Fault (see LAM Bias Fault procedure).

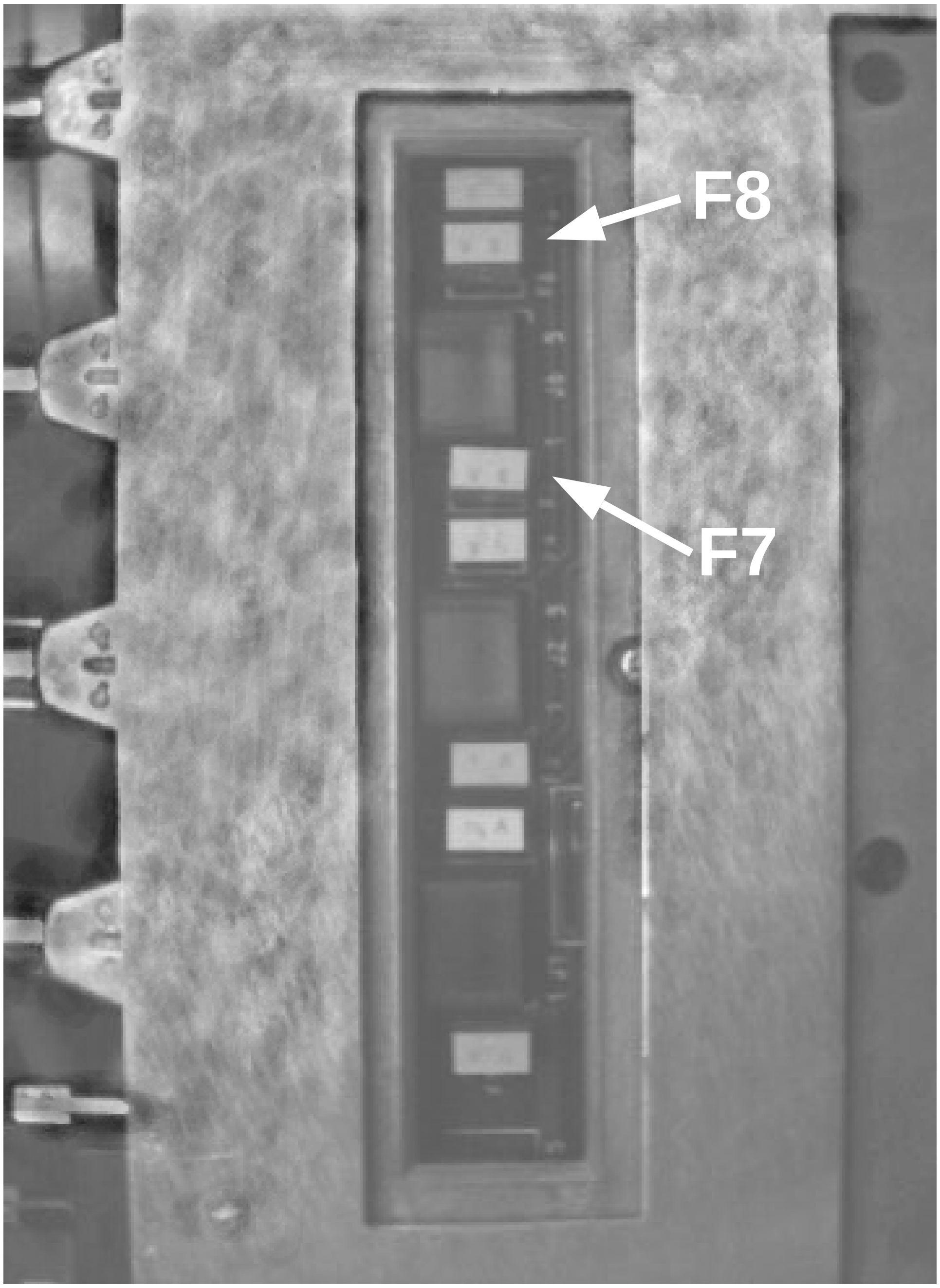


Figure 22-13. Location of AYG3 Circuit Pack Fuses F7 and F8 (Cover Plate Removed)

CAUTION:
The information stored in the Processor Alarm Registers is lost when the LAC is powered down. Therefore, do not turn off the LAC prior to checking the alarm registers.

Microprocessor Alarm Registers - Corrective Actions

NOTE:
For 10-LAM LACs, verify that the LAC is configured with a 2-dB attenuator on the AYF4 circuit pack J35 connector. For 20-LAM LACs, verify that the attenuator is **not** installed. See the LAC Removal/Installation Procedures

NOTE:
Intermittent Processor Alarms:

Intermittent Processor alarms are generally not service affecting, but may lead to a service affecting condition if they persist. A small number of Processor alarms is not usually cause for concern, since they may occur, occasionally, as a result of transient traffic conditions.

Symptoms:

1. Intermittent MINOR alarms reported at the MSC.
2. Alarms in any Processor Alarm Register.
3. Other alarm procedures have failed to uncover problems.

Procedure:

1. Reset the Processor Alarm Registers by using the LAQS software or by powering down the LAC. Refer to Paragraph E for a description of the LAQS software.
2. Continue to monitor the LAC from the MSC for intermittent MINOR alarms.
3. If intermittent MINOR alarms continue to be reported, return to the site and read the Processor Alarm Registers again.
4. If the total number of Processor alarms is greater than or equal to the number of MINOR alarms reported since the last site visit, the problem is internal to the LAC. Replace the LAC.
5. If the number of MINOR alarms reported since the last site visit is greater than the number of Processor alarms, suspect a problem with one of the LAMs. Perform the Radio Control Procedure to isolate the bad LAM.
6. Reset the Processor Alarm Registers before leaving the site.

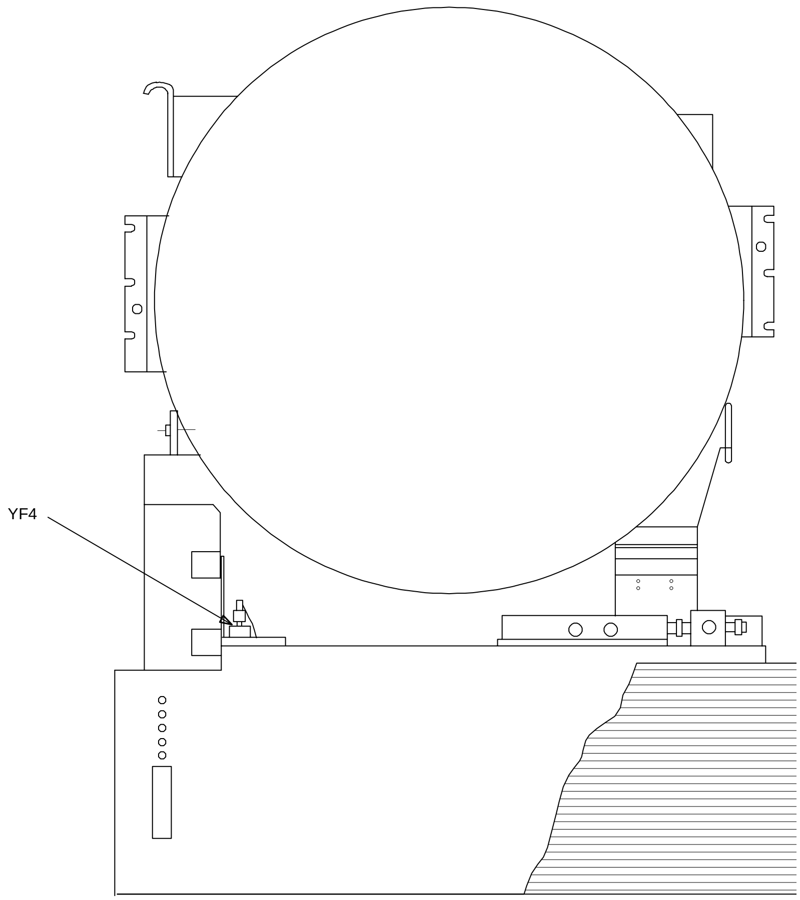


Figure 22-14. Linear Amplifier Circuit (LAC), Front View

CAUTION:
Be sure to re-connect all alarm bus cables before leaving the cell site. Verify that the alarm bus is functioning properly by checking with the operator at the MSC to be sure that no alarms are being generated.

Continuous Register 1 and Register 3 Processor Alarms:

Symptoms:

1. Continuous LINEARIZER LED.
1. Numerous Processor alarms.

Suspect:

1. A blown fuse on the AYG3 circuit pack.
2. A blown FCA fuse on the front panel of the Linearizer.

Procedure:

1. Before checking any fuses, inhibit call processing and turn off all radios on the LAC. Open all 5 breakers which feed the LAC.
2. For Register 3 alarms, check the FCA fuse on the front of the Linearizer. Replace it with a 32V/10A AGC style fuse if blown.
3. On newly built LACs, there is a window on the left side of the Linearizer sheet metal which allows access to a row of fuses in the AYG3 circuit pack.Remove the screws holding the LAC in the frame and carefully pull it out on the slides. Carefully pry off the spring-loaded fuse cover on the side of the AYG3 pack, exposing a row of seven fuses in sockets.
4. Use a pair of needle-nose pliers to pull out F8, the second fuse from the top, and F7 the third fuse from the top. They are both 3A Buss PC fuses with part number BK/PCB-3. If either of these fuses is blown, replace **both** of them with Bussman BK/PCE-5 fuses. **Be careful not to drop a fuse into the casting.**
5. Reset the circuit breakers (with all radios off). **Reset the breaker supplying the Linearizer first.**
6. Turn on 2 radios and wait 2 minutes to allow the LAC to adjust.
7. Exercise the LAC with various numbers of radios, as described in the Radio Control Procedure to confirm that the alarm condition does not re-occur.

CAUTION:
The other AYG3 fuses should not be replaced in the field. If one of these fuses blows, it may have been caused by a short circuit inside the Linearizer. If any of these fuses fails, the LAC should be replaced.

Other Continuous Processor Alarms:

Symptoms:

1. Continuous LINEARIZER LED.

2. Numerous Processor alarms.

Procedure:

1. Be sure to rule out problems with the FCA and AYG3 fuses, as described above.
2. If the LINEARIZER LED is continuously lighted and the LAC has issued a large number of Processor alarms, then the LAC should be replaced.

The LAC Alarm Query System (LAQS)

The LAC's microprocessor stores the current LAC alarm status as well as information about what caused Processor MINOR alarms. The LAQS system is a testing tool which connects to the LAC alarm bus, allowing the user to communicate directly with the LAC. To access this information, the LAF frames must be disconnected from the alarm bus and connected to a FITS computer via a customized RS-232 to RS-422 Converter. Even though this will result in SANITY alarms at the MSC for all LACs (during the time that the alarm cable is disconnected), this procedure will not interfere with live traffic at the cell site.

CAUTION:
The information stored in the Processor Alarm Registers is lost when the LAC is powered down. Therefore, do not turn off the LAC prior to connecting the LAQS system.

NOTE:
Contact your AT&T Account Executive for information on how to obtain the following equipment.

Required Equipment:

- Any Computer With a 9-Pin Serial Interface
- LAWX Interface Kit (ED3R102-30 G1).

Installation:

1. Disconnect all LAF frames from the alarm bus by removing the connector at J104 on the top of the RCF frame. This will result in SANITY alarm reports at the MSC for all LACs while the cable is disconnected.
2. Connect the RS-422 cable from the converter box to the free alarm bus connector on the last LAF frame: J1 on LAF0 if equipped with only one frame, J2 on LAF1 if equipped with two frames.
3. Connect the FITS computer to the converter box with the IEEE-488 cable.

CAUTION:
Don't forget to reconnect the J104 connector at the top of the RCF prior to leaving the site.

Running the LAQS Software

After connecting to the alarm bus, run the LAQS program. The software should be installed in the C:\LAQS directory. Type in the following DOS commands:

cd C:\LAQS

LAQS

The computer will display a menu similar to the following:

LAQS - Linear Amplifier Query System

Addresses of On-Line LACS: 0 1 2 3
Currently Selected LAC: 0

OPTIONS MENU
----
1) Show Alarm Status of On-Line LACs
2) Show Error Registers of Current LAC
3) Clear Error Registers of Current LAC
4) Select Another Available LAC
5) Re-query for Listening LACs
6) Set Options
r) Refresh Screen
x) Exit Program
Enter Command:

When initially loaded, the LAQS software searches for LACs connected to the alarm bus and displays their addresses on the line entitled "Addresses of On-Line LACS:". After the software is loaded, Option 5 can be used to initiate another search for LACs.

The Currently Selected LAC: defaults to the first LAC found when the LAQS program is started. This LAC is the one which will respond to menu Options 2 and 3. The currently selected LAC can be changed by selecting menu Option 4.

NOTE:
If the LAC addresses shown do not correspond to the LACs which are installed in the site, if error messages are displayed, or if the LAQS system does not operate as expected, there may be a SANITY problem with one or more of the LACs. See the Sanity Alarm Procedure. Also, check to make

sure that the LAC has the proper firmware version installed, as explained in the Processor Alarm Procedure.

Description of LAQS Menu Options

1. Show alarm status of On-Line LACs

   Selecting this option will cause the software to continuously display the alarm status of the LACs attached to the alarm bus. This option can be used to monitor the LAC alarm status in a cell site while performing maintenance.

   Selecting this option in a site with four alarm-free, 20-LAM LACs would cause the following lines to be displayed:

```
LAC Address    Alarm Status: 4 LACs On-Line
-----------    ----------------------------
0                  No Alarm
                   20 LAM Configuration
               Input Overdrive Warning - Non-Active
1                  No Alarm
                   20 LAM Configuration
               Input Overdrive Warning - Non-Active
2                  No Alarm
                   20 LAM Configuration
               Input Overdrive Warning - Non-Active
3                  No Alarm
                   20 LAM Configuration
               Input Overdrive Warning - Non-Active
```

   Press any key to return to main menu...

2. Show Error Registers of Current LAC

   Selecting this option will cause the software to display the contents of the microprocessor alarm registers in the currently selected LAC. Selecting this option would display the following screen:

   Would you like to re-query the LAC Error Registers (y/n)?

   The response indicates the number of times that the LAC has issued a processor alarm under each of 13 categories. In this case, all registers show a Count of 0, indicating that the LAC did not issue a processor alarm.

Retrieving Error Registers.....

Error Registers	Count
---------------	-----
Register 1	0
Register 2	0
Register 3	0
Register 4	0
Register 5	0
Register 6	0
Register 7	0
Register 8	0
Register 9	0
Register 10	0
Register 11	0
Register 12	0
Register 13	0

3. Clear Error Registers of Current LAC

   Selecting this option will clear the contents of the error registers in the LAC microprocessor. The following line will be displayed:

   Clear Error Registers of the LAC at Address #0 (y/n)?

NOTE:
The LAC Error Registers may also be cleared by powering down the LAC.

4. Select Another Available LAC

   This option will change the Currently Selected LAC number at the top of the main LAQS menu. This LAC is the one which will respond to menu Options 2 and 3. The following line will be displayed:

   Enter the Address of the LAC you would like to select:

   After an address is selected, the main LAQS menu will be updated to show the newly selected LAC.

5. Re-query for Listening LACs

This command will cause the computer to continuously search for LACs connected to the alarm bus. This command is useful for diagnosing LAC alarm bus problems. The following lines will be displayed:

ON-Line LAC Addresses

LAC #0

LAC #1

LAC #2

LAC #3

Press any key to return to main menu:

Finding On-Line LACs ....

6. Set Option and

   This command will display the following options:

   1. Set Upper LAC Address Limit

      This option allows the user to limit the address that the LAQS software searches to find on-line LACs.

   2. Set Serial Port [0 1]

      This command allows the user to select the PC serial port connected to the converter box.

      r. Refresh Screen

      This option will clear the screen and re-display the option menu.

      x. Return to Main Menu

      This option will exit the option menu and display the main menu.

r)Refresh Screen

This option will clear the screen and re-display the main LAQS menu.

x)Exit Program

This option will exit the LAQS program.

Differences Between A/B-Series and C-Series LACs

This section describes the differences in alarm reporting between A/B-Series and C-Series LACs. A description of LAC LED indicators and field replaceable fuses is also provided.

C-Series LACs provide improved power circuitry and alarm indications. **C-Series LACs are most easily distinguishable from A/B-Series LACs by the presence of the 10/20 LAM Switch on the circular power distribution (AYM) board on the LAU.**

For additional information, consult Lucent Technologies Customer Information Bulletin 196A, "Improved "C" Linear Amplifier Circuit Features."

Differences in Alarm Reporting Between A/B-Series and C-Series LACs

Although all LACs issue the same types of alarms, there are differences between C-Series and A/B-Series LACs which affect how failures are reported under the various categories of alarms (MINOR, MAJOR, and CRITICAL), as well as which LAC LEDs are lit under various trouble conditions. These differences are summarized below:

Table 22-2. LAC Alarms

	1C LAC		**1A/1B LAC**	
Trouble Condition	Alarm	LEDs	Alarm	LEDs
LAM Failures	MINOR	LAU+LAMs	Same as 1C	
	MAJOR	LAU+LAMs		
	CRITICAL	LAU+LAMs		
Preamp Alarm	MAJOR	PREAMP	Same as 1C	
Processor Alarm	MINOR	LZR	Same as 1C	
Thermal Alarm	MINOR	LAU	Same as 1C	
	MAJOR	LAU		
	CRITICAL	LAU		
Input Overdrive	WARNING	INPUT OD	Same as 1C	
LAU Fan Alarm	MAJOR	LAU+FANS	MINOR	LAU
LZR Fan Alarm	MAJOR	LZR+FANS	MINOR	LZR
PREAMP Fan Alarm	MAJOR	PRE+FANS	MINOR	LZR
+5V LAM Bias Power	CRITICAL	LAU+LZR	MINOR	LZR
FCA Fuse Blown	MAJOR	LZR	MINOR	LZR

Visual Alarm Indications

As an aid in troubleshooting, alarm and status information is provided in the form of visual LED indicators on the LAC. Five status LEDs are located on the faceplate of the Linearizer (LZR) cabinet and twenty LEDs are located around the circumference of the donut-shaped AYM power distribution board on the LAU, one for each of the LAM positions.

NOTE:
These LEDs, by themselves, do not provide sufficient information for troubleshooting LAC problems. Knowledge of the LAC alarm history, as well

as the present LAC alarm status, is necessary in order to properly diagnose LAC related problems.

Linearizer Faceplate LEDs

There are five LEDs on the front faceplate of the Linearizer; four of them are labeled the same on all LACs, even though the conditions under which they light are somewhat different for C-Series LACs than for earlier vintages, as described above.

The position of the LEDs and their labels is shown below, followed by a description of their functions.

C-Series LACs	A/B-Series LACs
• Input Drive	• Input Drive
• Fans	• Antenna - (Unused)
• Linear Amplifier Unit	• Linear Amplifier Unit
• Pre-amplifier	• Pre-amplifier
• Linearizer	• Linearizer

Input Drive - The RF input to the LAC from the Preamplifier is too high.

Fans - Provided on C-Series LACs and used to indicate a fan failure. The associated **LED** is also lighted to indicate which fan has failed; either the LAU, LZR, or Pre-Amplifier fan.

NOTE:
The preamp fan alarm is associated with LAF position 0 only.

Antenna - Present but unused on A/B-Series LACs.

Linear Amplifier Unit (LAU) - Indicates a failure in the LAU; either the LAU fan, LAM failure(s), or a high temperature condition, which can generate either a MINOR, MAJOR, or CRITICAL alarm, depending on temperature level. It is also lighted in the case of a LAM bias voltage problem, which might be due to a power supply failure or due to a fault in one of the LAMs or its associated power connector.

PRE-AMPLIFIER - Any failure associated with the Preamplifier; either the preamp fan (LAF position 0 only), one of the two preamp fuses, or the preamp itself (a failure in one side of the internally redundant amplifier, including loss of power, is detected).

LineariZeR (LZR) - Indicates a failure in the Linearizer; either the LZR fan, an internal power supply failure, a blown FCA (Final Correction Amplifier) fuse, or a problem related to the microprocessor (Processor alarm).

Linear Amplifier Unit (LAU) LEDs

Associated with each LAM on the circular AYM power distribution board in the LAU (Linear Amplifier Unit), is a fuse and an LED which is lighted whenever a loose or blown fuse or a failed LAM is detected. A MINOR, MAJOR, or CRITICAL alarm is issued depending upon how many LAMs have failed and whether the LAC is equipped with 10 LAMs or 20 LAMs. **In order to detect a failed LAM, at least one radio with a LAC output power of at least 15 watts must be applied to the LAC. However, no RF is needed to detect a blown fuse.**

Below is listed the number of failed LAMs required to generate a specific type of alarm for a LAC equipped with either 10 or 20 LAMs.

Table 22-3. LAM Failure Table

No. of LEDs Lighted	10 LAMs	20 LAMs
1	Minor	Minor
2	Major	Minor
3	Major	Major
4	Major or Critical	Major
5	Critical	Major
6	Critical	Major or Critical
More than 7	Critical	Critical

CAUTION:
For LACs equipped with 10 LAMs, each empty slot must be equipped with a good fuse to avoid false alarms. ***Do not remove fuses from empty LAM positions*** even though doing so may not result in an immediate alarm indication.

Field Replaceable Fuses

All fuses in the LAC are mounted in the AYG3 circuit pack in the Linearizer. There are two different types of field replaceable fuses:

- AGC style fuses mounted in fuse holders, which are accessed by removing the grille from the front panel of the Linearizer. These are glass fuses which can be visually inspected.

- PK/PCB style circuit board mounted fuses on the AYG3 circuit pack. On recently manufactured LACs these fuses can be accessed through a cover plate on the left side of the Linearizer. These fuses can only be checked with an ohmmeter.
- Before checking any Linearizer fuses, inhibit call processing and turn off all radios on the LAC. Open the 30 amp LAC circuit breaker which feeds the Linearizer.

Linearizer Faceplate Fuses

Beginning with the 1C LAC, an extra fuse (marked "FCA") was moved from the inside of the AYG3 circuit pack to the front panel of the Linearizer, allowing it to be changed in the field.

The position of the fuses and their labels on the front panel of the Linearizer are shown below, followed by a description of their functions.

C-Series LACs	A/B-Series LACs
• FCA	
• Linearizer Fan	• Linearizer Fan
• Pre-amplifier	• Pre-amplifier
• Pre-amplifier	• Pre-amplifier
• Linear Amplifier Unit Fan	• Linear Amplifier Unit Fan

FCA - Protects the Final Correction Amplifier in the Linearizer. This fuse may be blown if the LAC is overdriven. This fuse is only accessible on C-Series LACs.

Linearizer Fan - Protects the fan in the Linearizer. This fuse may blow if the fan fails or if it becomes blocked.

Pre-Amplifier - There are 2 preamplifier fuses, one for each of the two redundant RF power paths in the preamp. These fuses may blow if a preamp fails or there is a short in the preamp power cable. If one of these fuses fails, they should both be replaced.

Linear Amplifier Unit fan - Protects the fan in the Linear Amplifier Unit. This fuse may blow if the fan fails or if it becomes blocked.

AYG3 Circuit Pack Fuses

On newly built LACs, there is a cover plate on the left side of the Linearizer sheet metal which allows access to a row of socketed fuses on the AYG3 circuit pack.

F8 and F7, the second and third fuses from the top, protect the LAC drive circuitry during a severe overload condition, one fuse for each of the two redundant RF power paths inside the driver. They are both 3A Buss PCB fuses with part number BK/PCB-3. If either of these fuses is blown, replace both of them with BK/PCB-5 fuses by Bussman. **Be careful not to drop a fuse into the casting.**

CAUTION:
The other fuses under the cover plate should not be replaced in the field. If one of the other fuses blows, it may be caused by a short circuit inside the Linearizer. If any of these other fuses fails, the LAC should be replaced.

LAC Alarm Detection and Reporting System - Technical Description

This section provides a technical description of how LAC alarm information is transmitted between the LAC and the MSC over the alarm interface bus, and how the alarms are reported at the MSC.

LAC Alarm Reporting

Each LAC in the cell site transmits one of four alarm levels to the MSC: **NORMAL, MINOR, MAJOR,** or **CRITICAL** and **10/20 Configuration Status** (indicating how many LAMs the LAC is equipped with). In addition, a **WARNING** alarm is transmitted if a LAC overdrive condition is detected. A **SANITY** alarm is transmitted by the UN166 AFI board if a LAC fails to respond to a status query.

This alarm information can be viewed at the MSC in a number of formats, each of which provides a different level of detail. These are: the Maintenance CRT (MCRT), the Receive-Only Printer (ROP), the LAC alarm summary report (LACSUM), and the detailed LAC alarm report (LACALM).

The MCRT and ROP outputs are described below. For details on the LACSUM and LACALM reports, refer to paragraphs A and B.

Alarm Scanning

The UN166 AFI board, located in the Radio Channel Frame (RCF), queries each of the LACs over the RS-422 LAC alarm bus under control of the UN524 Core Processor board. Each allowable LAC address is queried every 2 seconds for alarm status updates.

Four bits are transmitted for each of the LACs in the cell. Two bits are used to indicate the LAC alarm state (NORMAL, MINOR, MAJOR, or CRITICAL), one bit is used for 10/20 Configuration Status, and one bit is used for RF Overdrive WARNING. Each query takes approximately 25 msec and is repeated twice in succession for each of the allowable LAC addresses.

NOTE:
Prior to Cell Site Software Release 4.3, 32 addresses were reserved for LACs. With the introduction of Release 4.3, that number was reduced to 7, numbered 0 through 6.

Alarm Status Registers

Status registers on the AFI board store the current alarm information for each LAC. In addition to alarm state, 10/20 configuration, and WARNING, a register is also reserved for a SANITY alarm. A SANITY alarm is set if a LAC address which is supposed to be equipped fails to respond to a status query.

Each alarm status register can store 8 bits of information. Since the four possible LAC alarm levels require 2 bits per LAC, each alarm status register contains alarm status for 4 LACs. LAC warning registers handle 8 LACs per register (1 bit per LAC) as do LAC configuration and LAC sanity registers. The registers are continuously scanned and any changes in state are reported to the MSC and printed out on the ROP.

NOTE:
On the ROP output, the status registers are referred to as offsets rather than registers.

Each of the alarm status registers is assigned a number. Since the number of allowable LAC addresses changed from 32 to 7 with the introduction of Series II Cell Site Software Release 4.3, the address numbers of the LAC alarm status registers also changed. The alarm status register numbers associated with the LACs, for software versions before and after Release 4.3, are summarized below:

Table 22-4. LAC Alarm Register Addresses

	After Release 4.3	**Prior to Release 4.3**
	Register Addresses (LACs 0 through 6)	Register Addresses (LACs 0 through 31)
Alarm Status	11 and 12	11 through 18
Sanity	19	19 through 22
Warning (Overdrive)	23	23 through 26
10/20 LAMs	27	27 through 30

Maintenance CRT (MCRT):

The MCRT terminal* in the MSC serves as the primary interface between the cellular system and the system operator. It is used for most administrative and diagnostic tasks and may be used to display status information for all cells serving the MSC. If the MSC receives an alarm from any piece of equipment or sensor in the system, that alarm state will appear at the top of the screen. The operator may then call up a visual display which indicates the cell site which issued the alarm.

The operator may then display another screen showing the alarm status of all equipment in that particular cell site. This screen will display a flag indicating the particular piece of equipment in the cell which issued the alarm. If a LAC is generating the alarm, the operator may then display another screen to determine which LAC in the cell is in alarm.

The MCRT only shows which piece of equipment is generating an alarm. It does not show LAC alarm levels, WARNINGS, SANITY, or 10/20 configuration and shows no history. The MCRT, therefore, cannot be used to find the root cause of a LAC alarm.

However, since the MCRT display is updated with current alarm information every 4 seconds, the system operator can use it to monitor the current alarm status of a LAC while in communication with maintenance personnel at a cell site.

ROP Messages for the LAC

As discussed above, the ROP prints out a message every time there is a change in the alarm status of a LAC. This information is automatically provided to the ECP by the cell site core software, which polls the registers in the AFI board once every 4 seconds.

In ROP terminology, a "**NORMAL**" condition exists when a LAC is not generating any alarms, and no SANITY or overload WARNING conditions exist. "**OFF NORMAL**" indicates that the LAC is issuing an alarm.

A message is printed only when a change in one of the alarm states occurs, and periodically, once an hour, when the ECP actively queries each cell site for its alarm status. Therefore, if an alarm condition remains continuous, it will be reported by the ECP once an hour. Paragraphs A and B describe how to determine if a LAC alarm is continuous.

* For a detailed description of MCRT operation, see AT&T 401-610-151, AUTOPLEX® Cellular Telecommunications Systems Daily Operations Guide.

LAC alarm message on the ROP:

The LAC alarm message on the ROP contains 5 lines. The first line gives an indication of the alarm level, the time at which the alarm was printed (in minutes past the hour), and the number of the cell site which generated the alarm. Alarm levels are indicated by a single asterisk for **MINOR (*)**, two asterisks for **MAJOR (**)**, and an asterisk with a C in front for CRITICAL (C*). A SANITY alarm is also tagged as a MAJOR alarm (**), printing out SANITY after the LAC number, as in example 3 below. This is why SANITY alarms are labeled MAJS on the LACSUM report.

On the second line, the "OFFSET" and "BIT" numbers indicate which of the storage registers described previously has changed. The BIT number, together with the OFFSET number, can be used to identify the specific LAC which issued the alarm. The BIT number can be ignored, however, since the LAC number is given directly in line 3. The OFFSET number is used to determine whether the change in status involved alarm level, sanity, 10/20 configuration, or an overdrive warning.

The third line indicates which LAC issued the alarm. The fourth line shows whether the alarm has just been issued (OFF NORMAL) or has just cleared (NORMAL). The last line shows the date and time at which the alarm was **printed** on the ROP along with a number used to uniquely identify the event.

NOTE:
Since the printing of alarm information by the ECP has a low priority relative to call processing activities, the time at which the alarm was printed on the ROP may lag the time at which the alarm was initially reported by the cell site.

Three examples of ROP messages are shown below:

Table 22-5. Example 1: A MINOR alarm was printed at 11:29 PM on LAC 2 in Cell 222:

*** 29 REPT: CELL 222 ALARM SCANNING**
SCAN POINT: OFFSET 11, BIT 4
ALARM: LAC ALARM 2
STATE: OFF NORMAL
06/01/93 23:29:48 #834867

Table 22-6. Example 2: An RF Overdrive WARNING was printed at 11:58 PM on LAC 2 in Cell 54:

58 REPT: CELL 54 ALARM SCANNING
SCAN POINT: OFFSET 23, BIT 2
ALARM: LAC ALARM 2
STATE: OFF NORMAL
06/01/93 23:58:04 #836035

Table 22-7. Example 3: A SANITY Alarm was reported at 12:20 AM on LAC 2 in Cell 54:

****20 REPT: CELL 54 ALARM SCANNING**
SCAN POINT: OFFSET 19, BIT 2
ALARM: LAC 2 SANITY
STATE: OFF NORMAL
06/01/93 00:20:04 #836036

Linear Amplifier Circuit Removal/ Installation Procedures

General

These procedures provide for removing a J41660CA LAC and installing another into the J41660C LAF. The LAC consists of a Linearizer and an LAU).

Drawings

The following drawings may be helpful:

- SD2R265-02 - Linear Amplifier Circuit
- SD2R311-01 Modular Linear Amplifier Circuit
- SD2R266-02 - Linear Amplifier Frame

- SD2R271-02 - Series II Cell Site
- J41660C-2 - Linear Amplifier Frame
- J41660CA-2 - Linear Amplifier Circuit
- J41660CA-3 - Modular Linear Amplifier Circuit
- ED2R839-30 - Linear Amplifier Unit
- ED2R840-30 - Linear Amplifier Module

Tools

The following tools are required:

- Small screwdriver
- Large screwdriver (3/8-inch by 10-inch)
- Screw-holding screwdriver (1/4-inch by 14-inch)
- 1/4-inch wrench
- 5/16-inch wrench.

Removal Procedure

The first equipped LAC is always in LAF0. The following gives the location of the installed LACs:

- LAF0, LAC0 - lower front unit
- LAF0, LAC1 - lower rear unit
- LAF0, LAC2 - upper front unit
- LAF0, LAC3 - upper rear unit
- LAF1, LAC4 - lower front unit
- LAF1, LAC5 - lower rear unit
- LAF1, LAC6 - upper front unit.

Perform the following procedures:

CAUTION:
All preamp fans are powered from two of the four 20A DC feeders which supply power to the LAC 0 position in the frame. Preamp fans will not have power if the breakers to LAC 0 are open. To avoid overheating the preamps, do not power down LAC 0 for more than a few minutes if other LACs are powered. If LAC 0 needs to be powered down for an extended period of time, disconnect the J1 cable from LAC 0 (LAC 4 in LAF 1), and close the ***two*** 20A breakers which supply connector J1.

1. At the cell site power plant, set the circuit breakers for the affected LAC to OFF in the following sequence — CB4, CB3, CB2, CB1, and CB0.
2. Remove the LAMs and/or dummy modules from the LAC.
3. Remove the screws securing the LAC to the frame.
4. Pull the LAC out to its fully extended and locked position.

CAUTION:
Use extreme care when handling coaxial cables. Damage to these cables could result in system degradation.

5. Disconnect cables.
6. Remove the LAU locking pins.

CAUTION:
Two persons are required to remove the LAC.

7. Remove the LAC.

Installation Procedure

Perform the following procedures:

CAUTION:
Two persons are required to install the LAC.

CAUTION:
An antistatic wrist strap must be worn when handling equipment.

1. Make sure that the slides are fully extended and locked in place, then mount the LAU to the guides.
2. Insert the locking pins.
3. Connect all the cables that were disconnected in the removal procedure.

CAUTION:
Use extreme care when pushing the LAC into place to ensure that no cables are pinched.

4. Release the slides and push the LAC into place.

5. Secure the LAC to the frame using the screws removed in the removal procedure.

NOTE:
The LAMs are not pre-mounted on the LAU. A full-power LAC requires 20 LAMs; a half-power LAC requires 10 LAMs plus 10 dummy modules. Standoffs for mounting the LAMs are provided.

6. Insert standoffs in all 20 positions on the LAU and secure with a 1/4-inch wrench. **Do not over-tighten.**

NOTE:
Every position on the LAU must have a LAM installed. For a half-power LAC, the dummy modules must be placed in the odd-numbered positions.

7. Slide the LAM or dummy module onto the position 1 standoff and tighten the thumbscrew.
8. Connect the cable from the LAM to the AYM circuit.
9. Verify that the slot is fused with a 5-ampere fuse.
10. Repeat Steps 7 through 9 for the remaining LAMs.

Table 22-8. Linear Amplifier Circuit Cable Connections

LAF	LAC	W#	Comcode	Plug Jack	CKT	Function
0	0	W41	846492403	P19	LAU	PWR LAU
0	0	W42	846492403	P20	LAU	PWR LAU
0	0	W43	846492429	P1	LZR	PWR LZR
0	0	W44	846492312	J7	LZR	PWR PRE-AMP
0	0	W45	846492346	J36	LZR	PRE-AMP RF OUT
0	0	W107	[redacted]	HY1-2	LZR	TO AIF
0	0	W47	846492338	J10	LZR	ALARMS
0	1	W51	846492361	P19	LAU	PWR LAU
0	1	W52	846492460	P20	LAU	PWR LAU
0	1	W53	846492379	P1	LZR	PWR LZR
0	1	W54	846492528	J7	LZR	PWR PRE-AMP
0	1	W55	846492577	J36	LZR	PRE-AMP RF OUT
0	1	W108	[redacted]	HY1-2	LZR	TO AIF
0	1	W47	846492338	J10	LZR	ALARMS

Table 22-8. Linear Amplifier Circuit Cable Connections (Contd)

LAF	LAC	W#	Comcode	Plug Jack	CKT	Function
0	2	W61	846492486	P19	LAU	PWR LAU
0	2	W62	846492601	P20	LAU	PWR LAU
0	2	W63	846492494	P1	LZR	PWR LZR
0	2	W64	846492544	J7	LZR	PWR PRE-AMP
0	2	W65	846492585	J36	LZR	PRE-AMP RF OUT
0	2	W109	[redacted]	HY1-2	LZR	TO AIF
0	2	W47	846492338	J10	LZR	ALARMS
0	3	W71	486492486	P19	LAU	PWR LAU
0	3	W72	486492601	P20	LAU	PWR LAU
0	3	W73	486492510	P1	LZR	PWR LZR
0	3	W74	486492569	J7	LZR	PWR PRE-AMP
0	3	W75	486492593	J36	LZR	PRE-AMP RF OUT
0	3	W110	[redacted]	HY1-2	LZR	TO AIF
0	3	W47	846492338	J10	LZR	ALARMS
1	4	W41	846492403	P19	LAU	PWR LAU
1	4	W42	846492403	P20	LAU	PWR LAU
1	4	W43	846492429	P1	LZR	PWR LZR
1	4	W44	846492312	J7	LZR	PWR PRE-AMP
1	4	W45	846492346	J36	LZR	PRE-AMP RF OUT
1	4	W115	[redacted]	HY1-2	LZR	TO AIF
1	4	W47	846492338	J10	LZR	ALARMS
1	5	W51	846492361	P19	LAU	PWR LAU
1	5	W52	846492460	P20	LAU	PWR LAU
1	5	W53	846492379	P1	LZR	PWR LZR
1	5	W54	846492528	J7	LZR	PWR PRE-AMP
1	5	W55	846492577	J36	LZR	PRE-AMP RF OUT
1	5	W116	[redacted]	HY1-2	LZR	TO AIF
1	5	W47	846492338	J10	LZR	ALARMS
1	6	W61	846492486	P19	LAU	PWR LAU
1	6	W62	846492601	P20	LAU	PWR LAU
1	6	W63	846492494	P1	LZR	PWR LZR
1	6	W64	846492544	J7	LZR	PWR PRE-AMP

Table 22-8. Linear Amplifier Circuit Cable Connections (Contd)

LAF	LAC	W#	Comcode	Plug Jack	CKT	Function
1	6	W65	846492585	J36	LZR	PRE-AMP RF OUT
1	6	W117	[redacted]	HY1-2	LZR	TO AIF
1	6	W47	846492338	J10	LZR	ALARMS

Set Linear Amplifier Circuit Address

Perform the following procedures:

1. Locate switch 1 on the Linearizer AYE1 circuit board. This switch consists of five rocker switches. The lower rocker (5) is the least significant bit.
2. Set the switches as follows:

Table 22-9. LAC Switch Settings

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	
0	0	0	0	0	LAC0
0	0	0	0	1	LAC1
0	0	0	1	0	LAC2
0	0	0	1	1	LAC3
0	0	1	0	0	LAC4
0	0	1	0	1	LAC5
0	0	1	1	0	LAC6
0 = OFF (Right) 1 = ON (Left)					

NOTE:
In recently produced LACs the FAC/FLD switch was moved to the front of the Linearizer to allow easier access. LACs with this feature have a 6-position dip switch in place of the 5-position switch. The top switch, labeled "1", is used for the FAC/FLD setting and the bottom 5 switches, labeled 2-6, are used for the address setting. LACs with this feature are clearly marked.

Power Up

Perform the following procedures:

1. Verify that all radios connected to the LAC are turned OFF.

2. At the cell site power plant, set the circuit breakers for the affected LAC to ON in the following sequence — CB0, CB1, CB2, CB3, and CB4.
3. Verify that cooling fans are operating properly.
4. Have the MSC bring up 2 radios connected to the LAC and **wait at least 2 minutes** for any alarms to clear.
5. Verify that all LEDs are off on the Linearizer.
6. Verify that all LEDs are off on the LAU AYM circuit board.
7. Make sure that all radio switches are turned ON before leaving the site.

20-LAM LAC Versus 10-LAM LAC

When LACs are shipped from the factory, they are configured as full-power (20-LAM) LACs. If they are to be installed as low-power (10-LAM) LACs, an in-line SMA attenuator must be installed in series with a coaxial cable in the Linearizer and, on C-Series LACs, the 10/20 switch on the front of the circuit AYM board must be changed to the 10 position. To change back to a 20-LAM LAC, the in-line attenuator must be removed and the switch returned to the 20 position. A label (CONVERSION RECORD) is provided on the front face of the Linearizer cabinet on C-Series LACs and should be marked with the date of any 10/20 conversion. A suitable label should also be placed on any A/B-Series LACs which are converted.

NOTE:
Any new C-Series LACs shipped from the factory as replacements will not have attenuators. The attenuators may be obtained from AT&T as a spare part, Comcode 406825794 or 406822064. Any new C-Series, half-power LACs ordered will have the attenuator shipped loose as part of J41660CA-1, List 3 or J41660CA-2, List 4.

Convert a 20-LAM LAC to a 10-LAM LAC

Parts Required:

- 2-dB in-line SMA attenuator, Lucas Aerospace part number 4H-02 (AT&T Comcode 406825794), or Meca part number 665-02-1 (AT&T Comcode 406822064). (Use only one of the parts specified, since physical dimensions are important.)

Tools Required:

- 5/16-inch SMA torque wrench - OMNI SPECTRA part number 2098-2075-54 (AT&T Comcode 901212464).
- 1/4-inch open-end wrench.

Perform the following procedures:

1. At the cell site power plant, set the circuit breakers for the LAC being converted to OFF in the following sequence - CB4, CB3, CB2, CB1, and CB0.
2. Remove 4 LAMs from the lower left quadrant of the LAU.
3. Locate the AYF4 circuit pack which is the third pack from the left in the Linearizer, and the SMA connector, J35, on the top of the pack nearest the front. (The connector toward the rear connects to the preamp.) A coaxial cable with a right-angle end-connector is connected to J35. Care must be taken to prevent damage to the coaxial cable, particularly at the joint between the cable and the connector.
4. While holding the right-angle connector with the 1/4-inch wrench, use the 5/16-inch wrench to disconnect the cable.

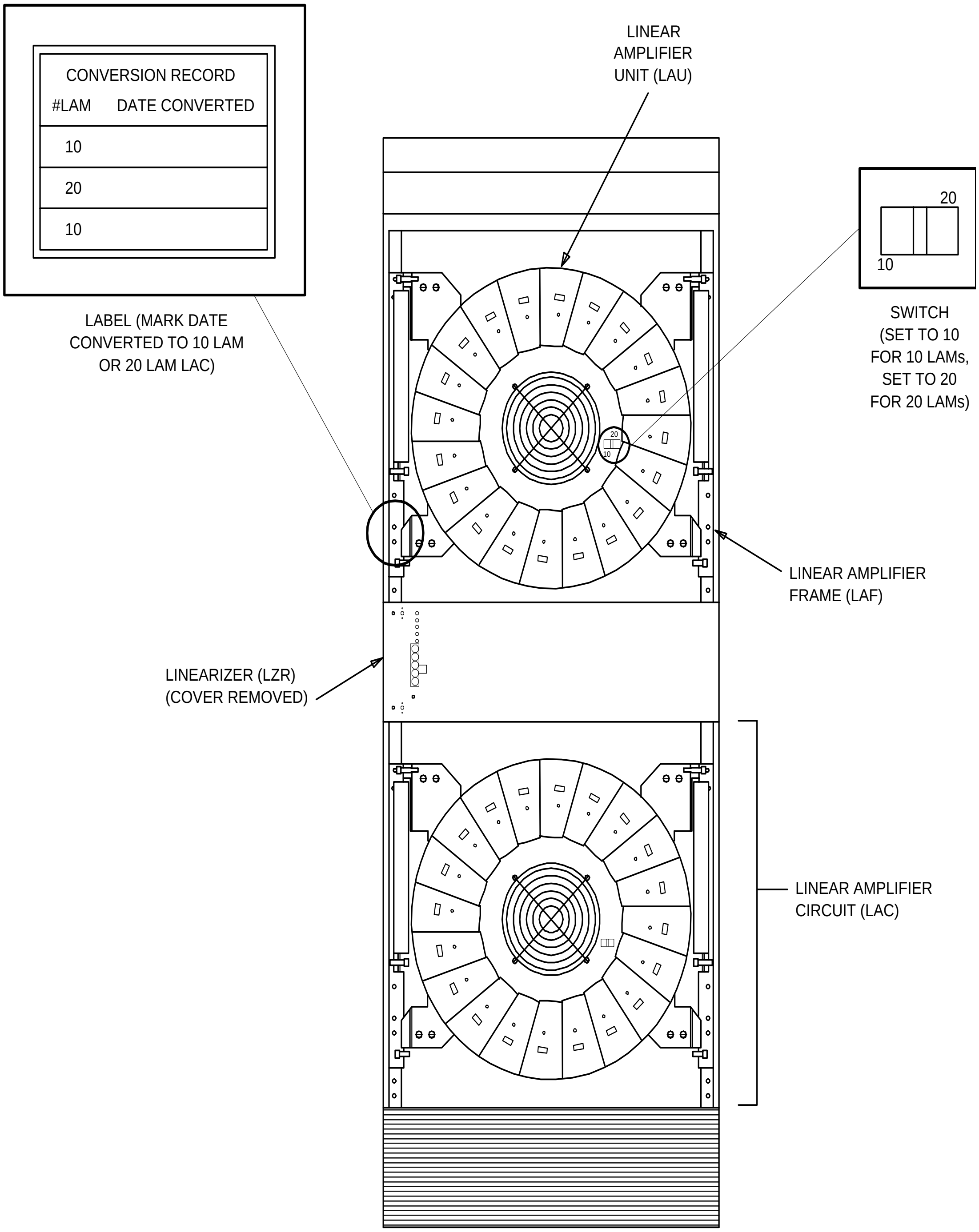


Figure 22-15. Linear Amplifier Frame (LAF) (Doors Removed)

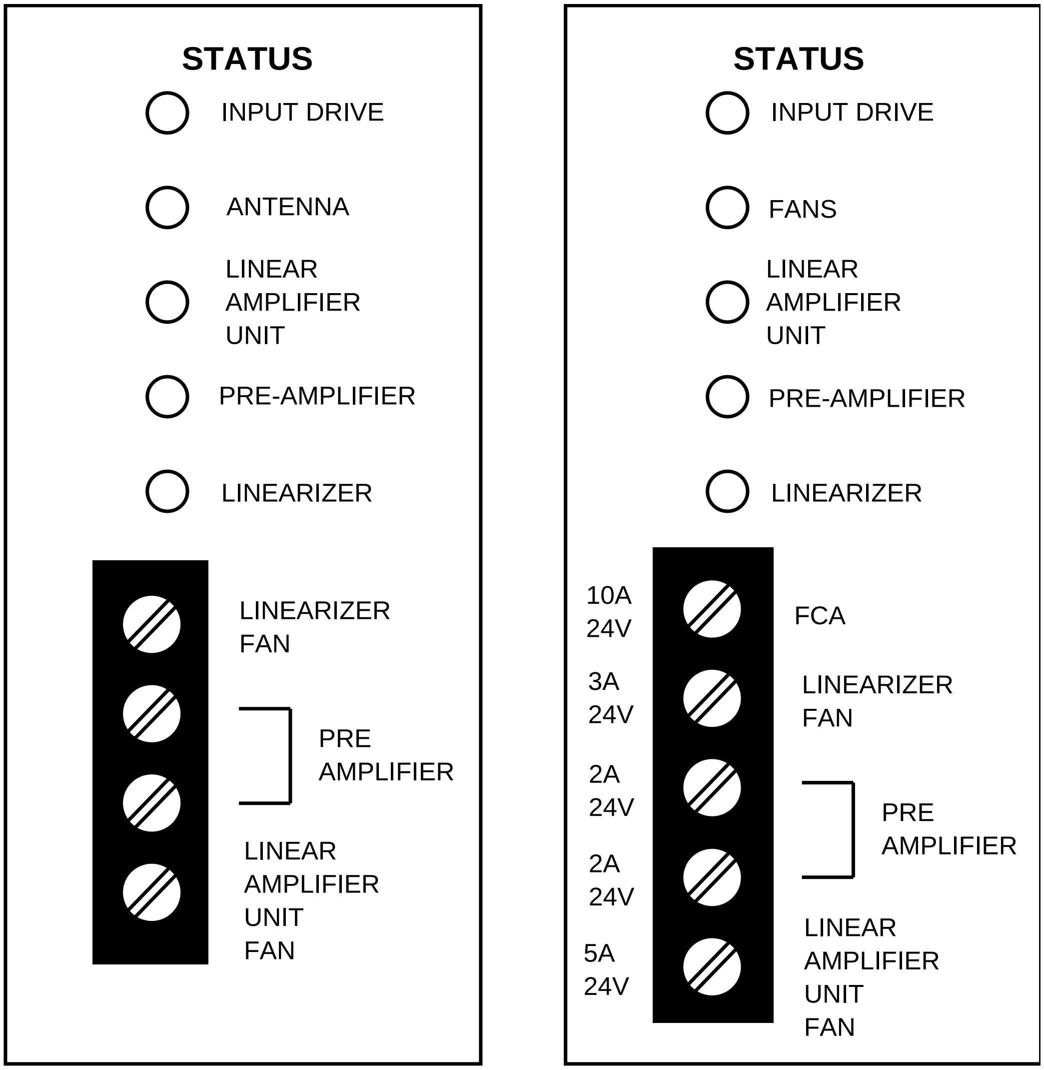


Figure 22-16. Linear Amplifier Unit

5. Install the 2-dB, in-line attenuator (specified above) on the J35 connector. Tighten to 7 inch-pounds using the 5/16-inch wrench.
6. Reconnect the cable and tighten using the torque wrench and the 1/4-inch open-end wrench to prevent the right-angle connector from twisting and stressing the joint between the cable and the connector.
7. Remove all LAMs from the odd-numbered positions on the LAU and replace them with “dummy,” non-active LAM modules (ED-2R880-30, Group 1). Install active LAMs in all even-numbered locations.

8. On C-Series LACs, change the setting of the 10/20 switch on the face of the circular AYM board on the LAU from the 20 to the 10 position. Make sure the switch is firmly in position.
9. With a permanent marking pen, record the date in the appropriate space on the Conversion Record label located on the front face of the Linearizer cabinet.
10. Follow the power-up procedure described in Paragraph G.

Convert a 10-LAM LAC Back to a 20-LAM LAC

Parts Required:

- 2-dB SMA in-line attenuator, Lucas Aerospace part number 4H-02 (AT&T Comcode 406825794), or Meca part number 665-02-1 (AT&T Comcode 406822064). (Use only one of the parts specified, since physical dimensions are important.)

Tools Required:

- 5/16-inch SMA torque wrench - OMNI SPECTRA part number 2098-2075-54 (AT&T Comcode 901212464).
- 1/4-inch open-end wrench.

Perform the following procedures:

1. Following a procedure similar to the one described previously for converting from 20 to 10 LAMs, remove the in-line attenuator connected between the braided RF cable and connector J35 on the AYF4 circuit pack (added when the LAC was converted from 20 to 10 LAMs), and reconnect the cable. Tighten connections to 7 inch-pounds using the torque wrench.
2. On C-Series LACs, change the setting of the 10/20 switch on the face of the circular AYM board on the LAU from the 10 to the 20 position. Make sure the switch is firmly in position.
3. With a permanent marking pen, record the date in the appropriate space on the Conversion Record label located on the front face of the Linearizer cabinet.
4. Install active LAMs in all 20 positions on the LAU.
5. Follow the power procedure described in Paragraph G.

Linear Amplifier Circuit Fans Removal/ Installation Procedures

The following procedures provide the instructions required for replacing the fan types listed below:

- LAU (Central) fan
- Pre-amp fans (2)
- Linearizer fan.

The fan spare parts kits listed below are required.

- LAU (Central) fan kit - 847011699
- Pre-amp fan kit - 847011681
- Linearizer fan kit - 847011681.

NOTE:
Both pre-amp fans should be replaced at the same time. This requires two pre-amp fan kits.

To order these kits, refer to AT&T 401-610-120, ***AUTOPLEX*** *Series II Recommended Spare Parts, Tools, and Equipment.*

LAU (Central) Fan Replacement

Included in 847011699 kit:

- LAU (Central) fan (1)
- Protectors for RF connectors (40).

Tools needed:

- Slotted screwdrivers
- Pliers
- 7/16-inch nut driver.

To replace the central fan, perform the following steps:

1. To turn power off, identify LAC position — if the LAC is located in the lower, front quadrant of the frame, perform Steps 1a, 1b, and 1c, then proceed directly to Step 2. If the LAC is ***not*** located on the lower, front quadrant of the frame, perform Steps 1d and 1e and then proceed to Step 2.
   a. Turn off circuit breaker to the linearizer of the LAC. Do NOT turn off the other four circuit breakers to that LAC, so that pre-amp fans remain powered.
   b. Pull LAU fan fuse.
   c. Disconnect 24V power to that LAC by disconnecting two sets of free-hanging power connectors. (These are located in the vicinity of the LAC.) You may need to slide the LAC forward to access these connectors.
   d. Turn off circuit breaker to the linearizer to that LAC, then turn off the four circuit breakers to the LAU.
   e. Pull LAU fan fuse.

2. To remove the Linear Amplifier Modules (LAMs) counter-clockwise from position 13 to position 4, perform steps a through e on each of the 10 LAMs.

CAUTION:
The LAMs may be hot

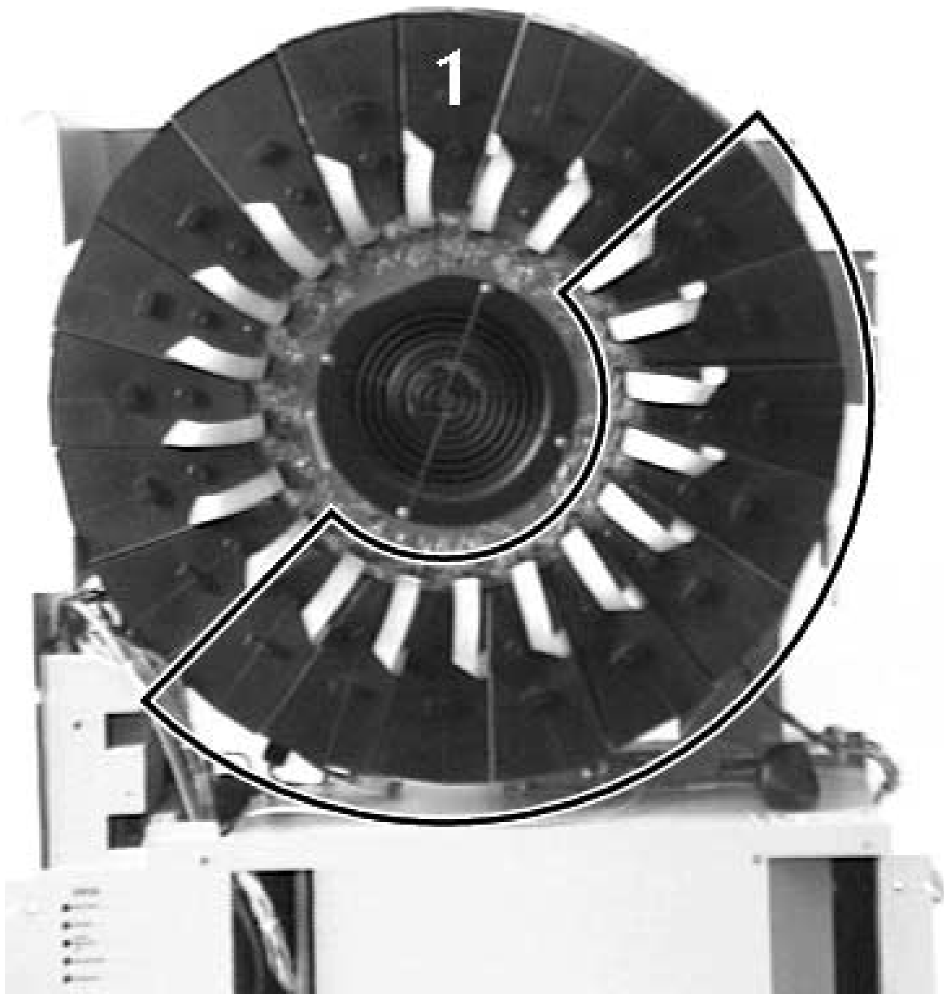


Figure 22-17. LAM

a. 2a. Disconnect the ribbon cable from the printed circuit board (donut).

Figure 22-18. Disconnect the ribbon cable from the printed circuit board (donut)

b. Unscrew the LAM from its standoff.

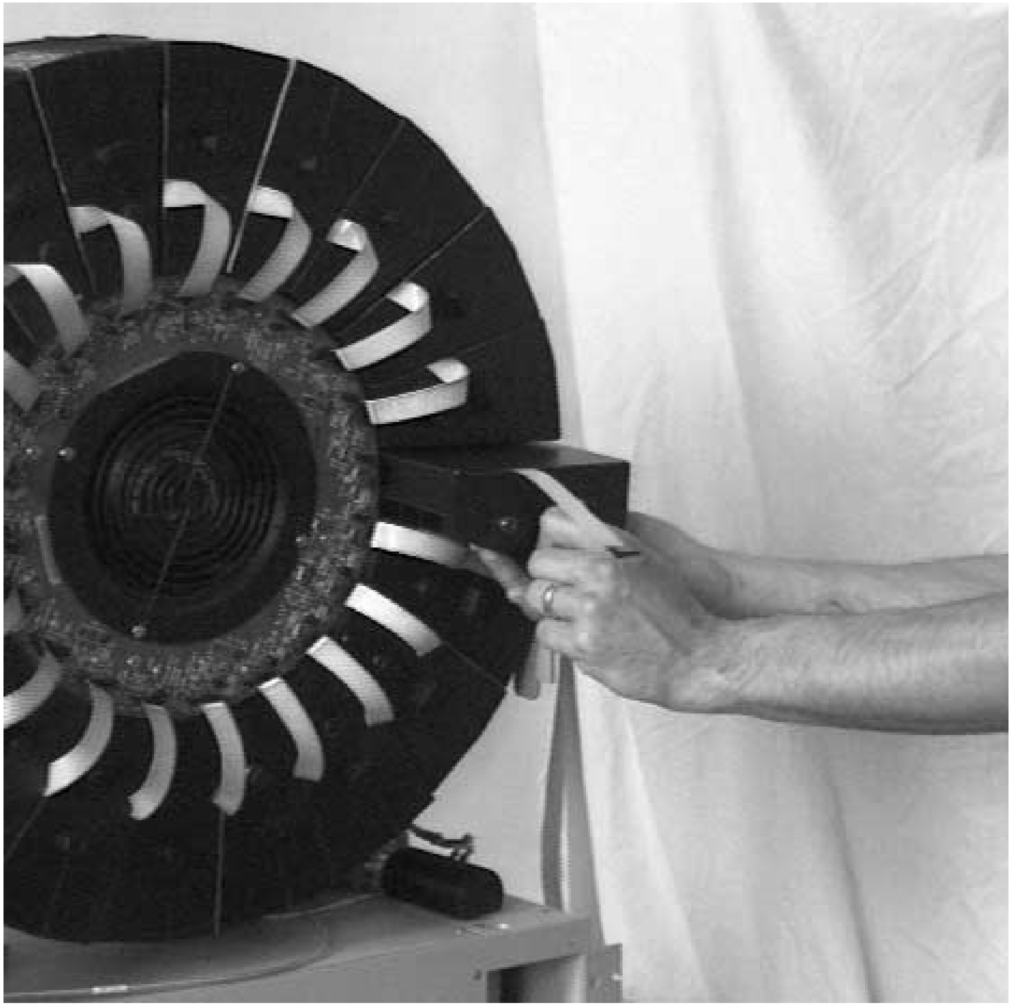


Figure 22-19. Unscrew the LAM from its standoff

c. Pull firmly.

d. Protect the RF connectors on each LAM with protective sleeves included in the kit.

Figure 22-20. RF connectors on each LAM

e. Set LAM aside.

3. Disconnect the remaining ribbon connectors from the donut board.

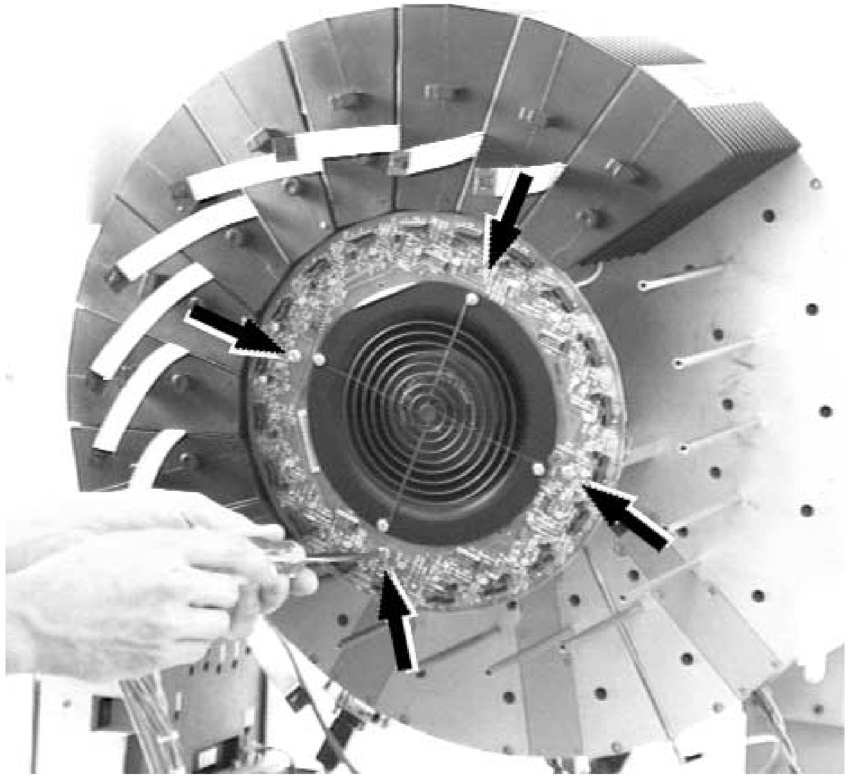


Figure 22-21. Disconnect the remaining ribbon connectors from the donut board

4. Remove the printed circuit board (donut) from the standoffs. Save screws.

NOTE:
Standoffs may loosen while attempting to loosen screws. If this should occur, use pliers to hold standoffs stationary while backing out the screws.

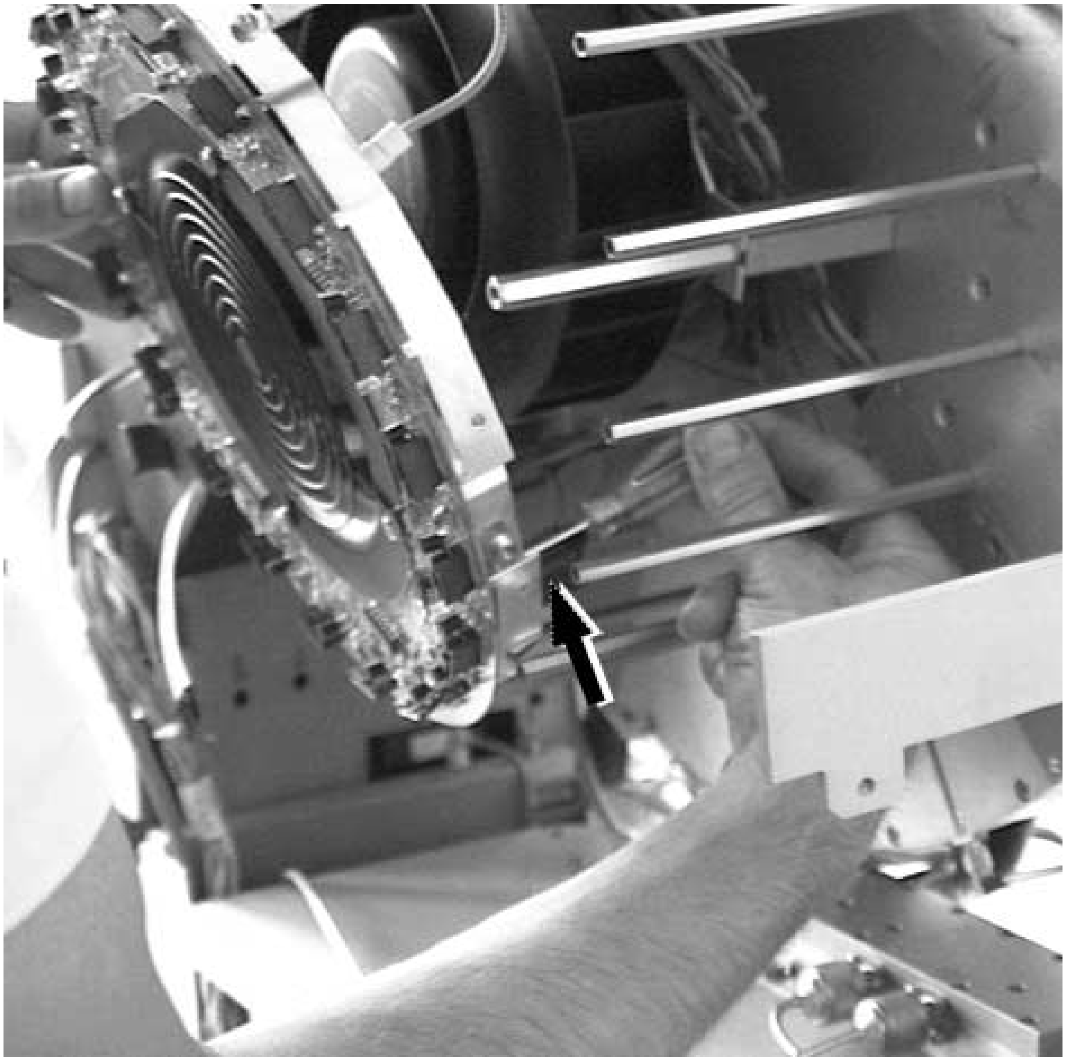


Figure 22-22. Remove the printed circuit board (donut) from the standoffs

5. Disconnect D-Shell connector located behind the donut board.

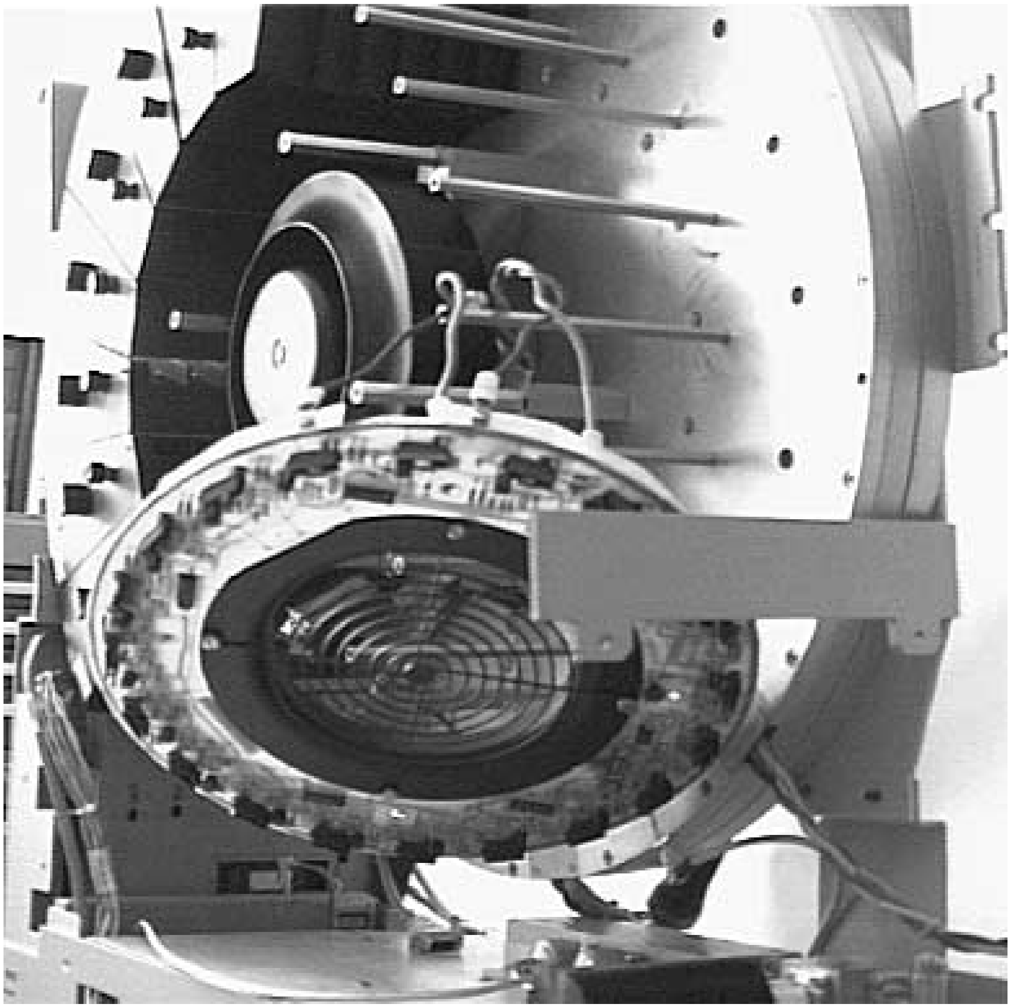


Figure 22-23. Disconnect D-Shell connector located behind the donut board

6. Carefully push the printed donut board to the right side.

NOTE:
If you are having trouble pushing it to the side, check to clear all cabling.

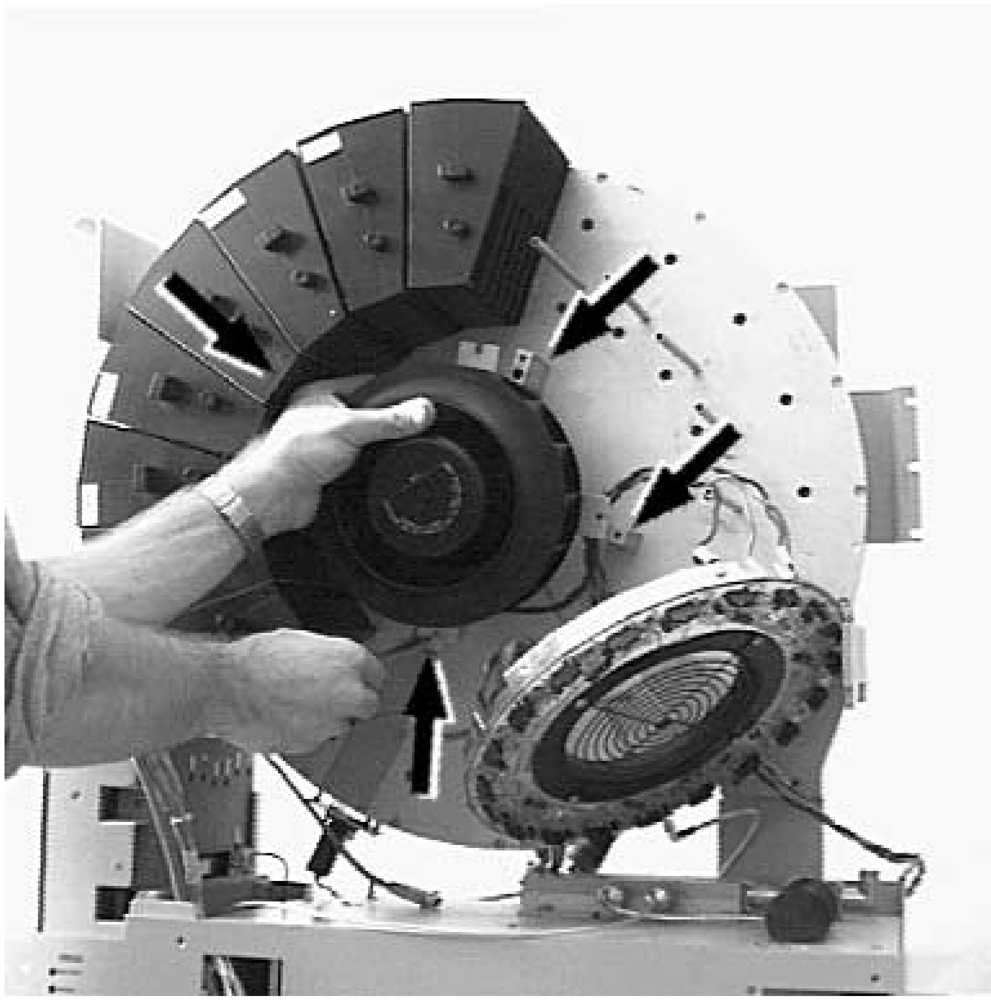


Figure 22-24. Push the printed donut board to the right side

7. Remove and save silver standoffs and washers which hold the fan assembly in place with a 7/16-inch nut driver.

NOTE:
You must support the fan once the last standoff is loosened.

Figure 22-25. Remove and save silver standoffs and washers

8. Disconnect cabling leading to the large, round splitter/combiner plate using pliers at each connection. The red and blue cable connections are at the inductor. The white cable connection is free-hanging.

NOTE:
If no inductor is present, the red, blue, and white cable connections are all free-hanging.

9. Discard the old fan assembly and replace with new fan assembly.
10. Connect cabling to the new fan assembly (white cable to white cable, blue cable to the same side of inductor as the other blue cable, and red cable to same side of inductor as the other red cable).

NOTE:
If there is no inductor, cable connections should be made red to red, white to white, and blue to blue.

11. Mount new fan assembly with silver standoffs and washers using 7/16-inch nut driver.
12. Connect D-Shell connector behind the donut board.
13. Mount the donut board.
14. Mount LAMs one at a time. Protective sleeves should be removed at the last possible moment.
15. Connect all ribbon cables to the donut board.
16. Replace LAU fan fuse.
17. Restore power to that LAC. Make sure the four LAU circuit breakers are ON before turning on the linearizer circuit breaker.

Pre-Amp Fan Replacement

Included in 847011681 kit (two kits required):

- Pre-amp fans (1 per kit)
- Splices (3 per kit).

Tools needed:

- Slotted screwdrivers
- Wire cutters
- Pliers
- Heat gun (for splicing).

To replace the pre-amp fan, perform the following steps:

1. To turn power off, turn off ALL breakers to the frame that house the pre-amp fans. For each LAC, turn off linearizer circuit breaker first and then turn off the four LAU circuit breakers.
2. Open the Frame Interface Assembly (penthouse) door by first loosening two screws and then lifting.

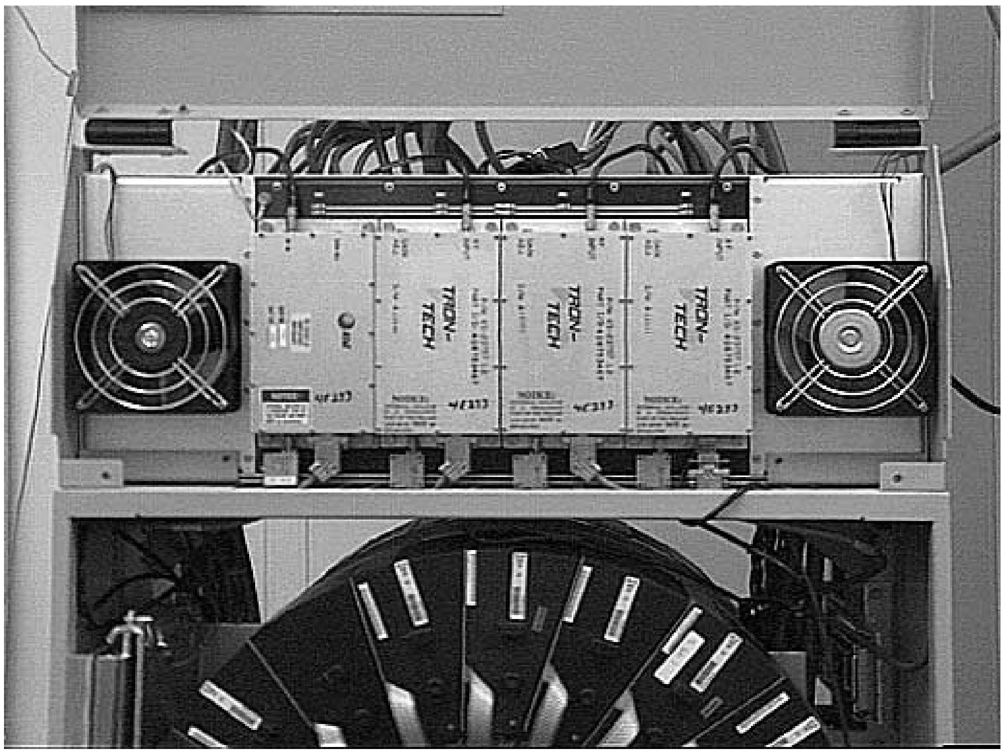


Figure 22-26. Cut the three cables (black, red, blue) to each fan

3. Cut the three cables (black, red, blue) to each fan approximately 6 inches from the fan itself.

NOTE:
Pre-amplifier fans are replaceable in pairs.

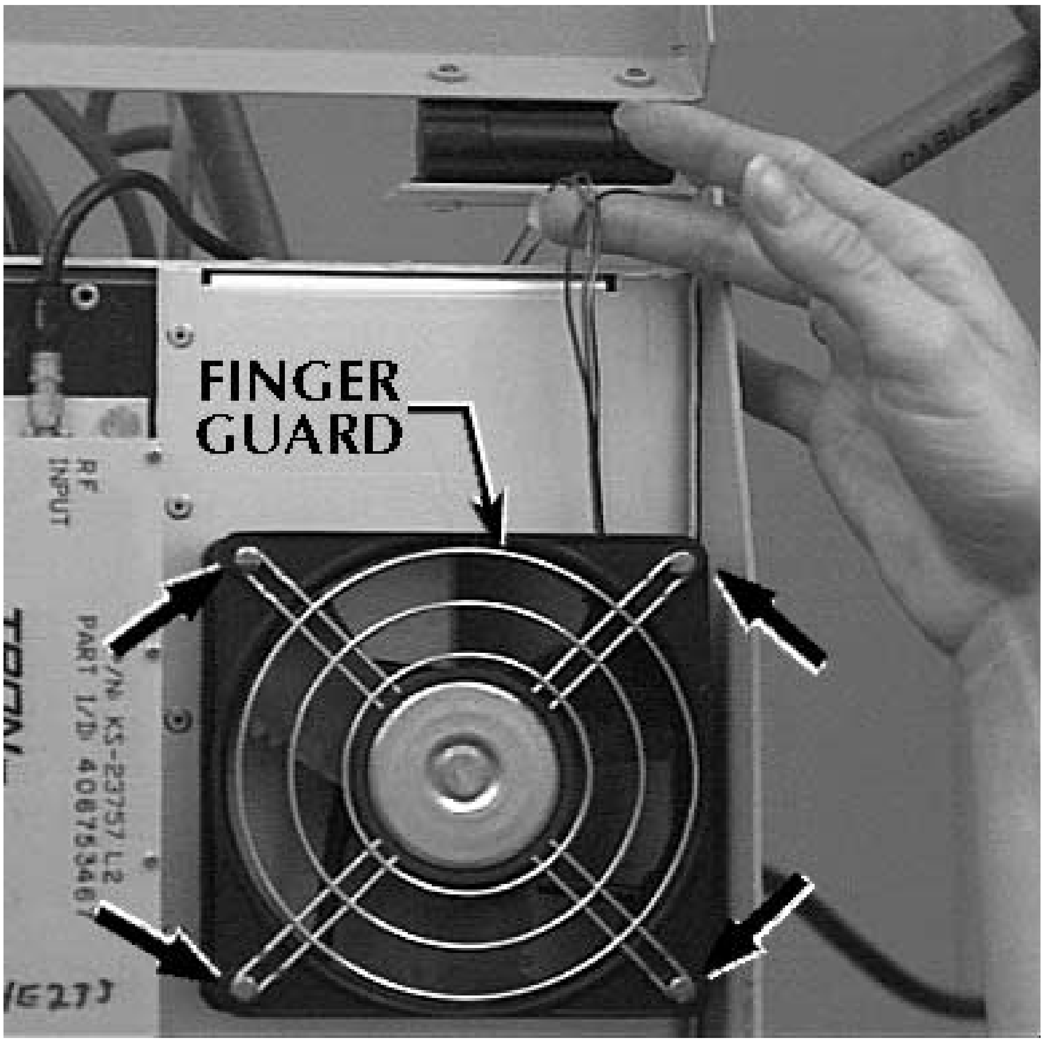


Figure 22-27. Remove both fans

4. To remove both fans, remove the four screws that hold each fan and finger guard in place. Save finger guards and screws.
5. Discard old fans and replace with new fans.
6. Fasten new fans with finger guards onto linear amplifier frame.

NOTE:
Air should go in (intake) the left fan and out (exhaust) the right fan. See marking on fan label for airflow direction.

7. Splice cabling (red to red, black to black, and blue to blue) for both fans using heat gun.
8. Close the penthouse door and tighten screws.
9. Restore power to the frame. For each LAC, turn on the four LAU circuit breakers first, then the linearizer circuit breaker.

Linearizer Fan Replacement

Included in 847011681 kit:

- Linearizer fan (1)
- Splices (3).

Tools needed:

- Slotted screwdrivers
- Wire cutters
- Pliers
- Heat gun (for splicing).

To replace the linearizer fan, perform the following steps:

1. To turn power off, identify LAC where the malfunctioning linearizer fan resides.

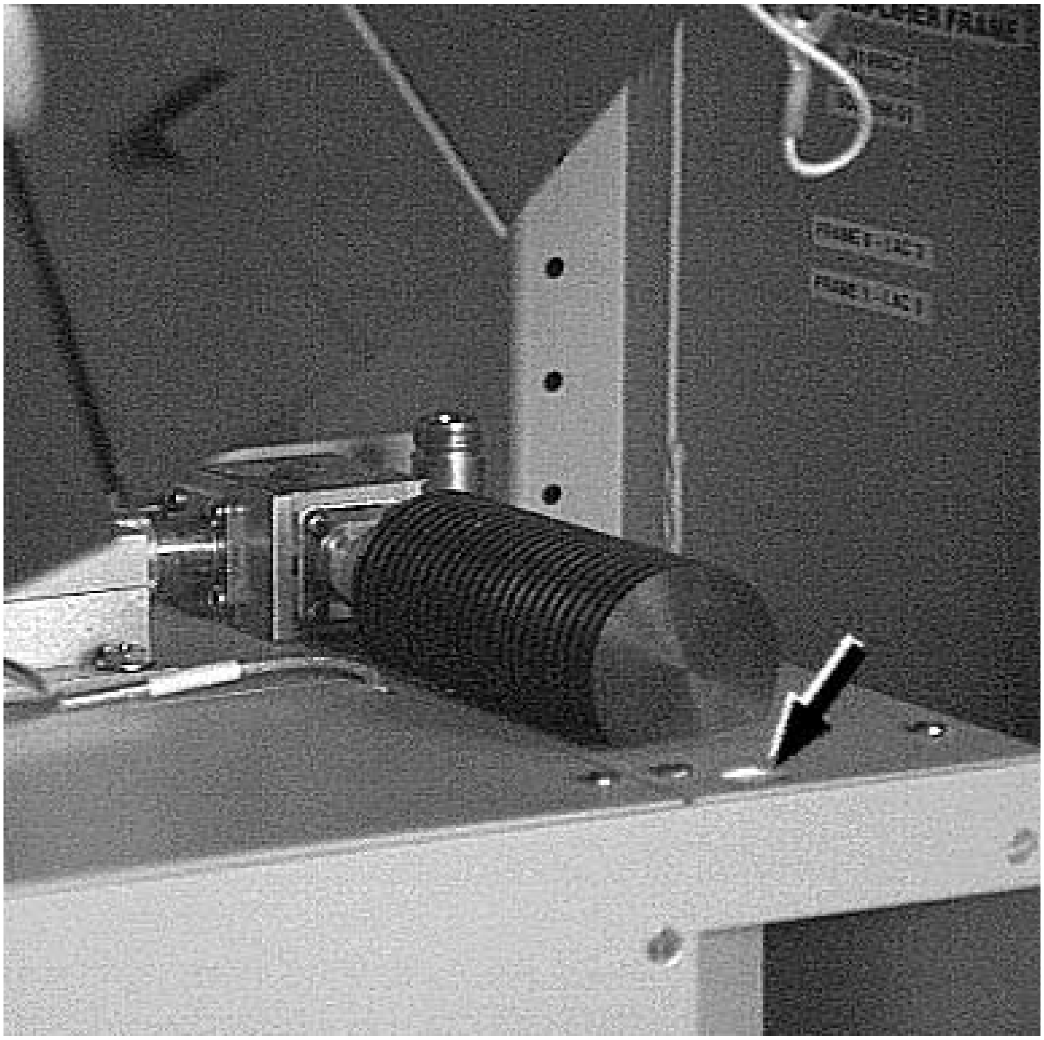


Figure 22-28. Identify LAC where the malfunctioning linearizer fan resides

2. Locate a screw that holds the fan in place (as shown above) and proceed to Step 3. If you cannot locate it, the fan is not field replaceable. Notify your AT&T representative.
3. Turn off the circuit breaker to the linearizer with the malfunctioning linearizer fan.

4. Pull the linearizer fan fuse.

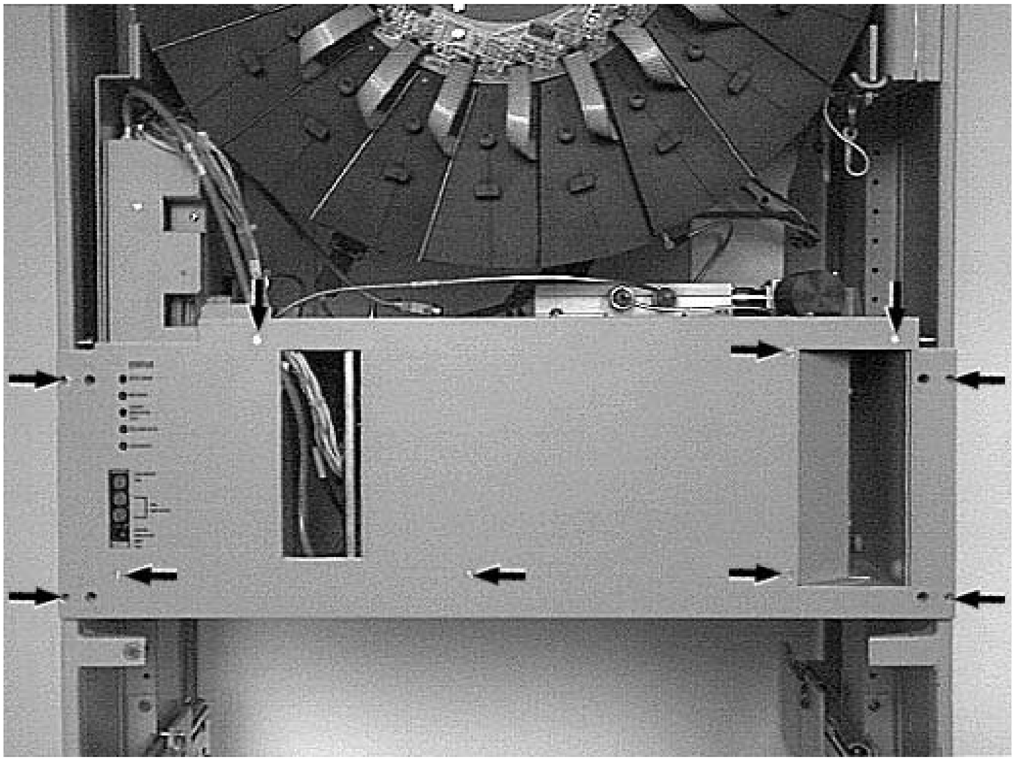


Figure 22-29. Linearizer fan fuse

5. Remove the linearizer faceplate. Save the faceplate and nine flat-head screws.

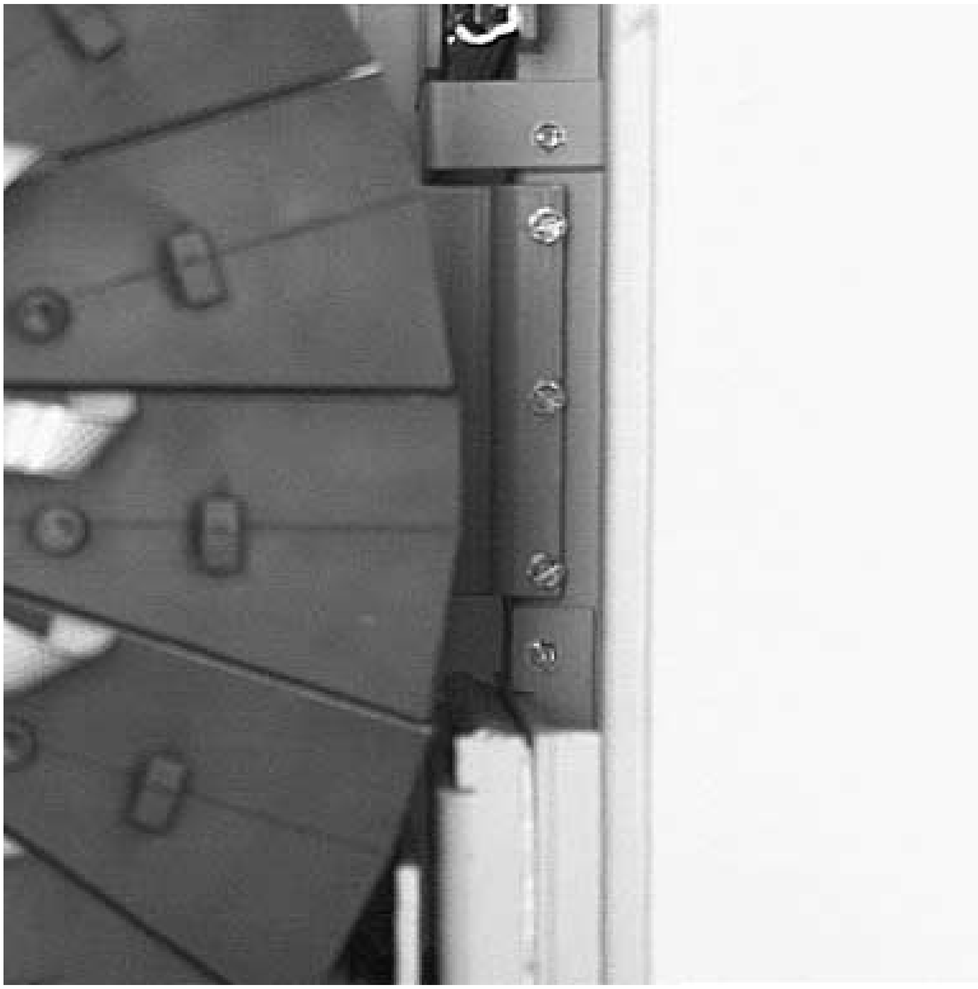


Figure 22-30. Linearizer faceplate

6. Remove and save screws which mount the LAC to the frame.
7. Slide LAC forward.
8. Remove and save the two screws, which secure the fan mounting plate, from the back of the linearizer.

9. Remove and save the two screws, which secure the fan mounting plate, from the top of the linearizer.

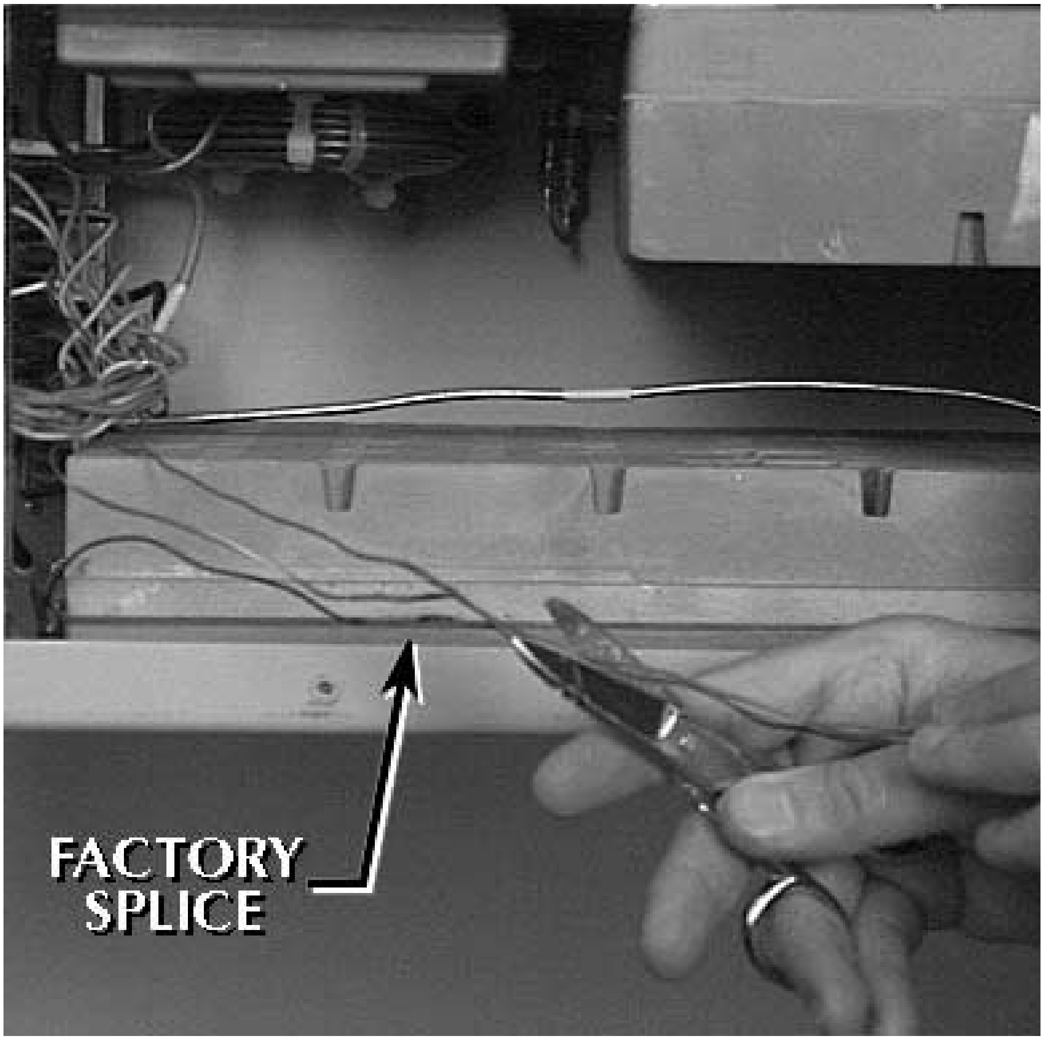


Figure 22-31. Fan Mounting Plate

10. Cut cabling to the right of any existing splice.

CAUTION:
The circuit packs may be hot.

11. Slide the fan assembly out.

12. Remove the fan from its sheet metal mounting plate. Save the screws, finger guards, and plate. Take note of the positioning of fans and finger guards.

13. Discard old fan and replace with new fan.

14. Fasten the new fan and finger guards onto the mounting plate.

NOTE:
Air should flow to the left. See marking on fan label for air flow direction.

15. Splice cabling by color (red to red, black to black, blue to blue) using heat gun.

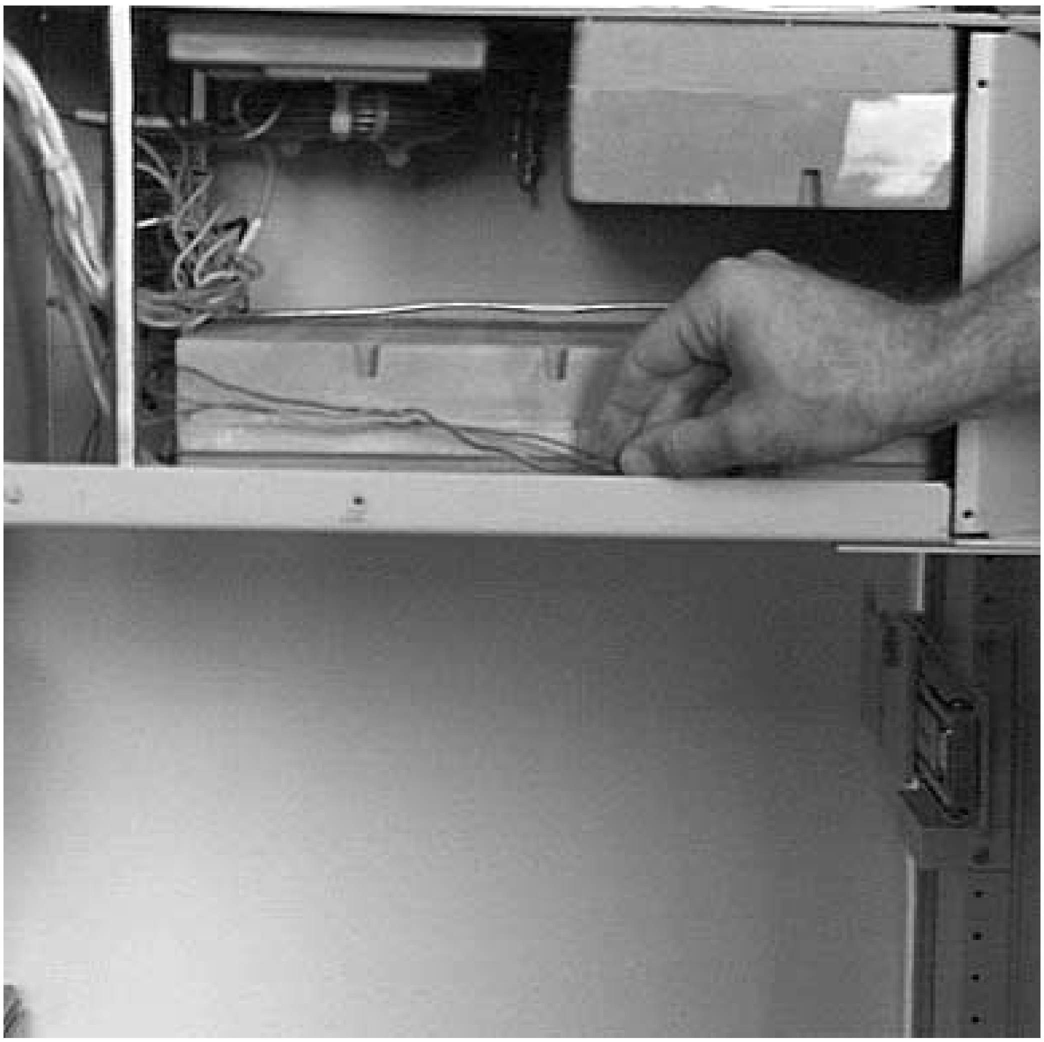


Figure 22-32. Cabling by Color (Red To Red, Black To Black, Blue To Blue)

16. Lay all cabling into the trough.
17. Slide the fan assembly into place and replace two screws at the top and two screws at the rear of the linearizer.
18. Slide the LAC back inside and replace the screws that mount the LAC to the frame.
19. Replace linearizer faceplate.
20. Replace linearizer fan fuse.
21. Restore power.