NORTEL
NORTHERN TELECOM

EXHIBIT 4

OPERATION AND MAINTENNANCE MANUAL

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CDMA

1900 MHz Outdoor BTS Maintenance and Troubleshooting Guide

NBSS6.2 Standard 01.01 January 1998

NORTEL

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1900 MHz Outdoor BTS Maintenance and Troubleshooting

Guide

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03.01 Preliminary release. Added the following information:

- RF troubleshooting and GPSR troubleshooting procedures.
- Enhanced FRU replacement procedures.
- Operational Testing procedures.
- FRU return procedures.

October 1997

03.02 Preliminary release. Added the following information:

- augmented RF troubleshootingprocedures;
- system cable pinout information.
- STU Markov test procedures.
- channel card re-deployment and removal/replacement procedures (supports CSM Offload feature available with NBSS 6.2);
- Appendix C which correlates CDMA frequency bands and channels with appropriate RFFE PECs.
- Appendix D which maps BCN ports to individual channel cards.
- Appendix E which lists Attributes, Actions and their associated parameters and responses that are used when making STU/BTS Markov calls.

January 1998

01.01 First Standard release.

About this document

This document discusses maintenance and troubleshooting functions related to the Northern Telecom (Nortel) CDMA 1900-MHz Outdoor Base Station Transceiver Subsystem (BTS). The document covers the following topics:

- operating procedures—includes how to open and close the enclosure doors, power down and power up, software loading and RF calibration
- initial and detailed troubleshooting procedures—includes how to troubleshoot hardware alarms, and RF, GPS, and rectifier problems
- removal and replacement procedures
- operational procedures—includes procedures for testing and verifying field replaceable units
- preventative maintenance—includes tasks to perform on a periodic basis to ensure the BTS is operating at its optimum
- technical assistance and equipment return procedures
- built-in test (BIT) result descriptions and suggested resolution actions on failure
- cable pinout information

This publication is written as a guide for cell site maintenance personnel who are responsible for maintaining the 1900-MHz BTS Outdoor. For overview and product familiarization information refer to *1900-MHz BTS Outdoor Technical Overview, 411-2133-100*

Related documents

1900 MHz BTS Theory and Operations Handbook, 411-2133-500

1900-MHz BTS Outdoor Technical Overview, 411-2133-100

BSM User's Guide, NTP-411-2133-103

BSM Configuration Management User's Guide 411-2133-104

CDMA NBSS Software History and Delta for Planners Manual, NTP-411-2133-199

Fault Management and Recovery Guide, 411-2133-545

Verilink Access System 2000 Node Manager User Guide, 411-2133-910

Verilink Access System 2000 T1/E1 CDSU User Guide, 411-2133-911

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Getting started

Tools

The following tools should be available for use during maintenance and troubleshooting.

- standard tool kit
- short step ladder or stool (preferably non-metallic)

Test equipment

The following test equipment should be available for use during maintenance and troubleshooting.

- Ammeter, Volt-Ohm (Clamp-on)
- Digital Voltmeter
  - — Fluke-77 or equivalent
- HP8921 with CDMA Option 600 CDMA Cell Site Test System, and HP83236B PCS Interface (or equivalent test equipment)
- Megger meter
- Fireberd
  - — Model 500 or equivalent

Safety summary

For your safety and the protection of the equipment, observe these precautions when installing, operating, or servicing the 1900-MHz BTS Outdoor equipment.

Follow all warnings and instructions

Follow all warnings and instructions marked on the equipment and included in this manual.

Qualified personnel only

Only technically qualified service personnel are permitted to install, operate and/or maintain the equipment.

Be aware of dangerous voltages

Avoid contact with high voltage areas in this equipment. Because dangerous voltages may be present even after power is disconnected, always allow sufficient time for components to discharge before touching them.

Never insert objects of any kind through openings in the equipment. Conductive foreign objects could produce a short circuit that could cause fire, electrical shock, or damage to the equipment.

Remove rings, watches, and other metallic objects that may cause shock or burn hazards.

ESD Protection

Ensure that proper ESD equipment is used to avoid damage to circuit cards, modules, and other electronic components.

Do not perform service or adjustments alone

Do not attempt internal service or adjustment of equipment unless you are qualified and another person capable of rendering aid and resuscitation is present.

Avoid contact with rotating fans

Use care to prevent external fans from taking in foreign objects, including hair and clothing. Avoid contact with moving fans in any of the equipment shelves.

Use care in handling equipment

Use care when sliding equipment out of racks. Rack-mounted equipment can be unstable. Certain items of the equipment may be heavy. Use care when installing and lifting racks or components.

Danger (electrical shock), Danger, Warning and Caution symbols

Throughout this manual the following warning and caution symbols precede the procedures to which they apply:

DANGER
Electrical Shock
If procedures or instructions are not followed, there is risk of electrical shock.

DANGER
Danger messages
If procedures are not followed, there is risk to your personal health.

WARNING
Warning Messages
If procedures are not followed, there is risk to your personal health.

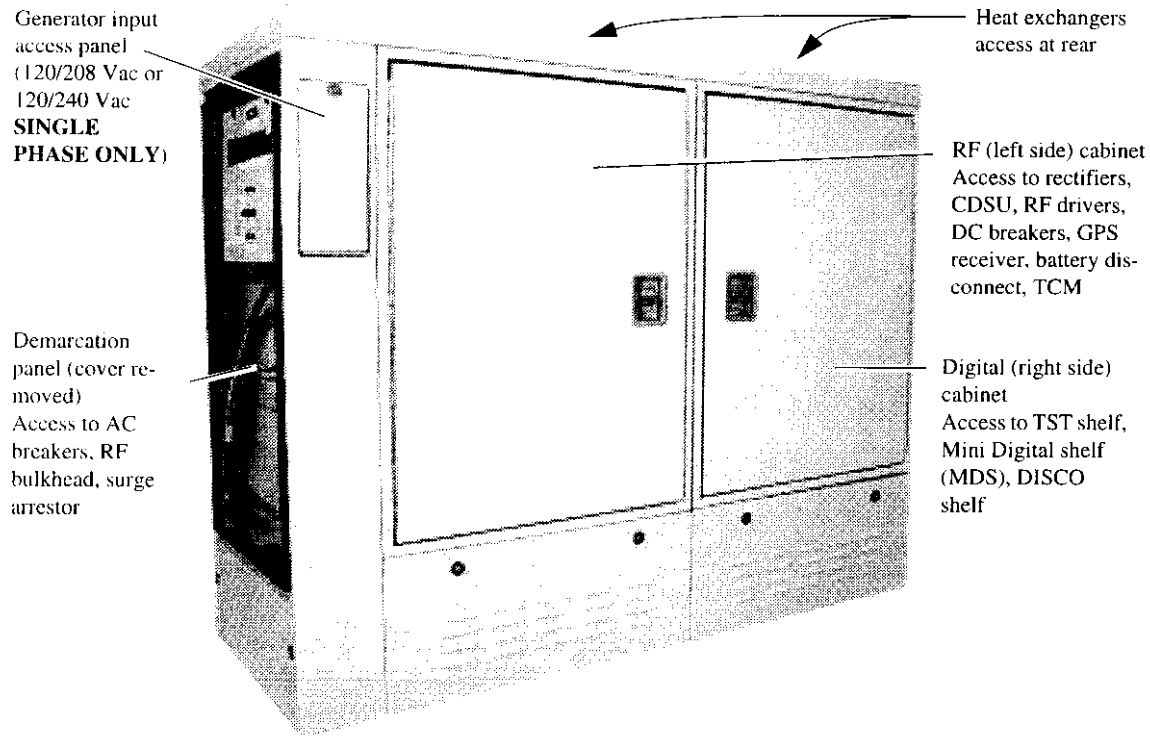
CAUTION
Caution Messages
If procedures are not followed, there is a risk of damage to the equipment.

Operating procedures

This section describes typical operating procedures required for maintaining the BTS. Included are

- opening and closing the Mini BTS doors.
- disabling the door alarms.
- power down/power up procedures.
- software downloading and software initialization.
- RF calibration procedures.
- Gathering CPU usage statistics.

Figure 3-1
1900MHz Outdoor BTS doors and access panels



Opening the doors

Procedure 3-1
Opening the doors

Step	Action
1	Check the weather. Do not work on a cell site when there is a risk of electrical storms (lightning can strike 20 miles from the storm). Do not work on the BTS in the rain or snow; if necessary, erect a tent to keep rain and snow out while you are working on it.
2	Remove any accumulation of snow or dirt on the BTS that might fall into the cabinet when you open the doors.
3	Check the tops of all doors for water. If there is any water on tops of the doors, wipe it off before proceeding.
4	Position yourself so that you can simultaneously operate the tamper-proof latch and the T-handle on the door while leaning against the door with your shoulder.
5	Lean against the door to compress the rubber sealing gasket and take the pressure off of the locking mechanism.
6	Operate first the tamper-proof tool latch and then the T-handle. A label on the door shows which direction to turn the handle. Keep the door between your body and the cabinet interior as you swing it open.
7	Stand back from the cabinet and check the interior for safety hazards such as accumulations of water or dangerous animals or insects. Set the wind latch at the top of the door so that it does not blow closed on you.
8	Locate the intrusion alarm switch and pull its stem until it locks in the out position (you may have to wiggle it a little). See Figure 3-2 and the section *Disabling the intrusion alarm.*
9	When you've finished opening the doors, store the tamper-proof tool outside the cabinet.

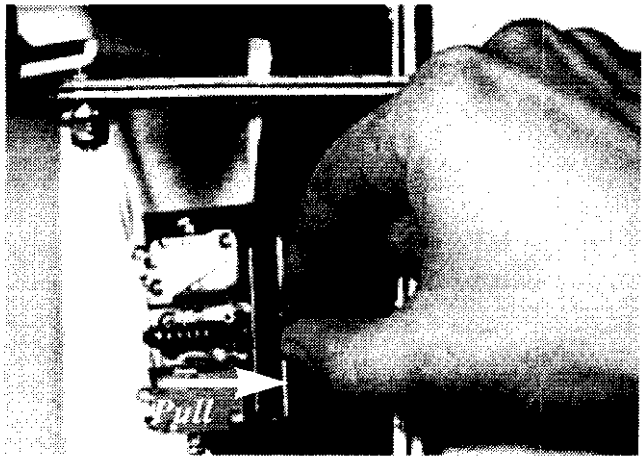
Disabling the intrusion alarm

A Mini BTS intrusion alarm is activated by any of five door switches (one on each door, one on the demarcation panel access, one each on the heat exchangers). To disable the intrusion alarm while the doors are open:

- Locate the switch for each open door:
  - — front doors—the switches are located at the top of the door frame in the corner furthest from the door hinge.
  - — demarcation panel—the switch is located in the lower left frame.
  - — heat exchangers—the switches are located in the frame on the side nearest the center of the BTS.

- Grasp the switch plunger and wiggle it from side to side while pulling steadily on it (see Figure 3-2). The plunger should come out and lock in place. When you have done this for each open door or panel, the intrusion alarm will clear.
- When you close the doors, the alarm will activate momentarily while the switches return to their normal position.

Figure 3-2
Deactivating the intrusion alarm



Closing the doors

Caution
Equipment damage
Do not leave anything on top of the cabinet heaters or inside the cabinet.

Procedure 3-2
Closing the doors

Step	Action
1	Inspect the interior of the cabinet. Check that: • all tools are removed • nothing is placed on top of the cabinet heaters • the panel wrench is stored outside of the cabinet
2	Unlock the wind latches.
3	Swing the door closed and lean on it to compress the rubber gasket.
4	Rotate the T-handle until it can fold down over the lock hasp. Failure to fully rotate the T-handle may allow water, insects or animals to get into the cabinet. You should hear or feel the tamper-proof latch lock into place as you rotate the T-handle.

Mini BTS power down and power up

This section provides procedures which describe how to safely power the Mini BTS down with minimal impact to subscribers, and how to power it back up. Refer to Figure 3-3 and Figure 3-4 for AC and DC breaker locations.

Figure 3-3
BTS rectifiers and DC breakers

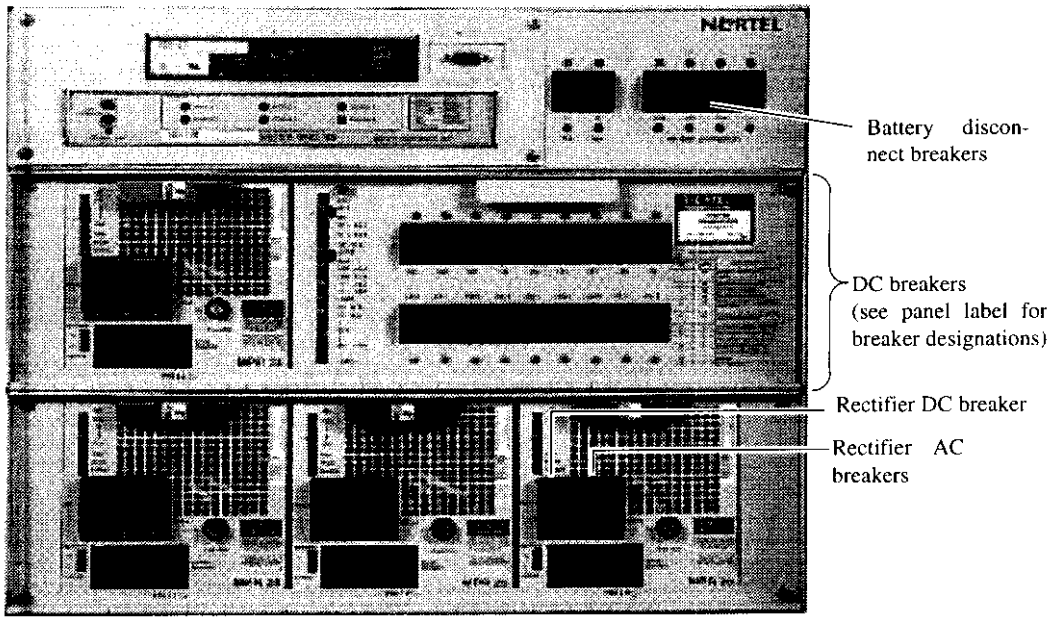
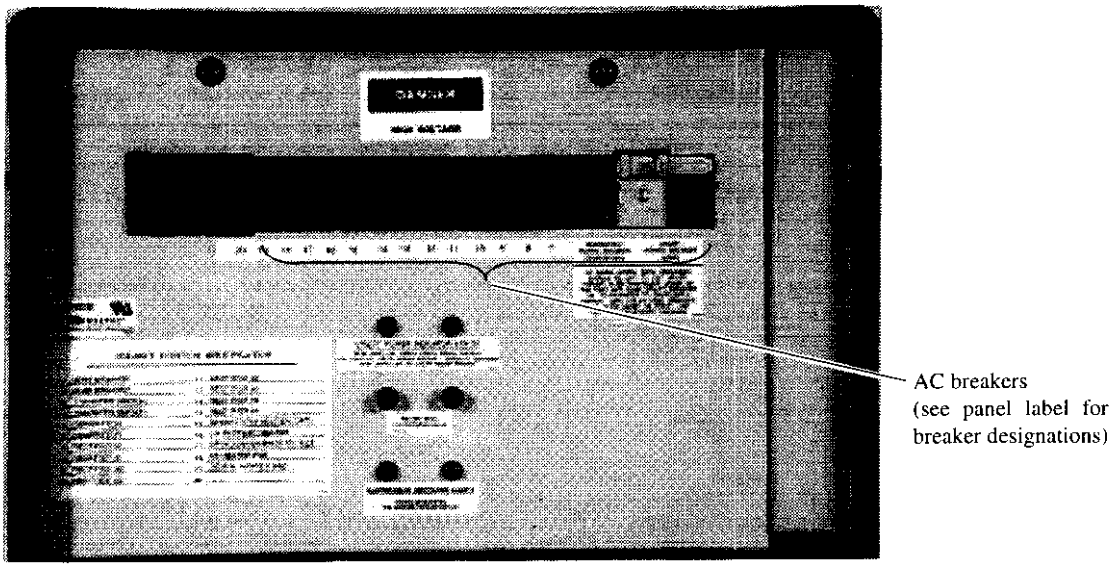


Figure 3-4
BTS demarcation panel—AC breakers



Mini BTS power down procedure

Wilt the Mini BTS before powering down. This will minimize the effects of loss of the site on your mobile subscribers.

Procedure 3-3
Mini BTS power down

Step	Action
1	Ask your BSM operator to wilt the Mini BTS. Also let them know that you will be opening the Mini BTS cabinet.
2	Open the left door until the latch locks, and disable the intrusion switches (see *Disabling the intrusion alarm* on page 3-2).
3	Use a panel wrench to open the demarcation panel cover; put the panel aside.
4	Turn DC circuit breakers CB1 through CB14 OFF (see Figure 3-3).
5	Turn all rectifier DC switches OFF (see Figure 3-3).
6	Turn all rectifier AC switches OFF (see Figure 3-3).
7	At the AC circuit breaker demarcation panel, switch the main AC circuit breaker (CB1 or CB5) OFF (see Figure 3-4).
8	If generator input is used, turn off the generator, and disconnect the generator power input connector and close the generator input panel cover.

Mini BTS power up procedure

The following is the recommended power-up sequence for the Mini BTS.

Procedure 3-4
Mini BTS power up

Step	Action	Observation
1	Verify that all breakers are off (see Figure 3-3 and Figure 3-4).	• The AC circuit breakers on the demarcation panel are in the down position. • The AC and DC breakers on each rectifier are in the down position. • The Battery Disconnect breakers are in the Battery Disconnected position.
2	Turn ON the main AC breaker, position CB1 or CB2 on the demarcation panel.	The AC surge arrestor LEDs should illuminate amber. If the LEDs illuminate red or do not illuminate, first ensure that AC power is present; if it is, replace the surge arrestor MOV modules.
3	Turn ON (in any order) all remaining AC breakers on the demarcation panel.	The battery compartment heater may start in cold environments. Some odor from the battery heater is normal if it has been shut off for a long time.
4	Turn ON AC breaker on each rectifier (one per rectifier, "up" position is closed, order doesn't matter)	The LED numeric load display and the ON/RFA LED on each rectifier should illuminate red. If the LEDs do not illuminate, check that the rectifiers are fully inserted; if they are, replace the rectifier.
5	Turn ON the DC breaker on each rectifier (one per rectifier, "up" position is closed, order doesn't matter).	The ON/RFA LED should change color from red to green.
6	Turn ON the Battery Disconnect breakers.	
7	Turn ON all the DC breakers on the DC breaker panel (see Figure 3-3).	

Software downloading and software initialization

Perform software download after hardware installation, and anytime hardware is removed and replaced. Download is also necessary each time loss of power to the BTS occurs, and batteries have either failed or been depleted. Software for a normally in-service Mini BTS (i.e. one that is not newly installed) will be downloaded via the Base Station Manager (BSM). However, for troubleshooting purposes, software may be downloaded from the Base Station Maintenance Unit (BMU); once a problem has been isolated and fixed, the BTS must be downloaded from the BSM. This section provides procedures for downloading software from BMU.

Software downloading from the BMU

Required Resources

The resources required to complete the procedures outlined in this chapter are listed below.

Materials

The following tools are required for software download:

- Base Station Manager Unit (BMU) computer
  - — Toshiba 6600 (or equivalent)
  - — MICC hardware
  - — BMU Software with BMU Configuration Generator (BCG) software tool loaded
  - — XDM software load
  - — Associated cables
- ESD grounding strap
- ESD approved work surface

Test Equipment

The following test equipment is required for software download:

- Extended Diagnostic Monitor (XDM)
  - — IBM PC 66 MHz (or equivalent)
    - – MICC hardware
    - – XDM software load
    - – Associated cables

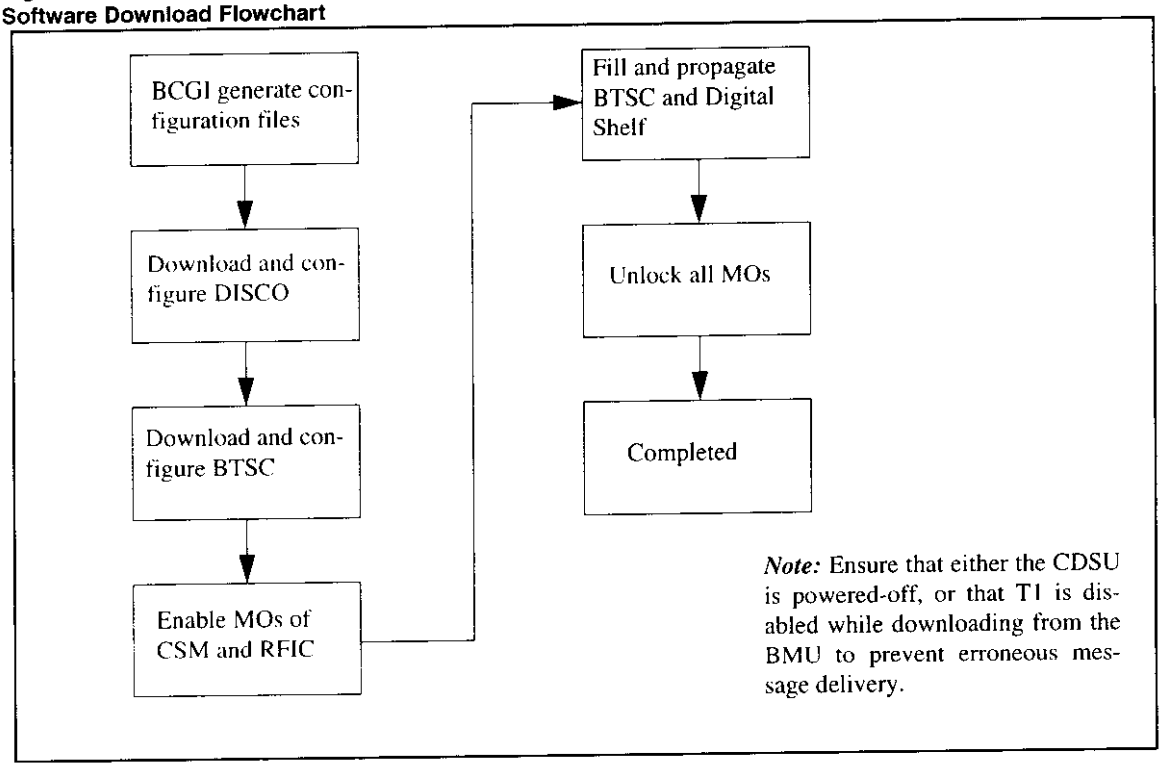
DANGER
Electrical Shock
The 1900 MHz BTS (Outdoor) contains active electrical and power components. Use extreme care when servicing these components. Personal injury may occur.

Caution
Possible equipment damage
Use ESD Precautions when touching the panel, connecting or disconnecting cables, or performing tasks in which the physical contact or close proximity with connector pins is possible.

Software is downloaded to the BTS processors and shelves in the following sequence:

- Generate 1900 MHz BTS configuration files
- Download software to DISCO
- Download software to BTSC
- Enable the managed objects of CSMS RFIC
- Fill and propagate
- Unlock all the managed objects

Figure 3-5
Software Download Flowchart



Initializing the BMU

Perform Procedure 3-5 to initialize the BMU.

Procedure 3-5
Initializing the BMU

Step	Action
1	If the BMU is powered down or if the BMU cable is not connected to the BTS connector, continue to step 2. If the BMU is powered up and connected to the BTS, go to step 5 to begin an OS/2 session.
2	With the BMU power switch turned off, connect the power cable and the mouse. For each Toshiba 6600, the mouse connects to the BMU by pushing the silver clip on the bottom of the mouse outward and clipping it to the side of the BMU.
3	Connect the 25-pin end to the 25-pin port of the BMU and the other end to the 25-pin BTS maintenance unit port labeled J4 on the front of the BTS and above the TST shelf.
4	If a floppy disk is present in the drive of the BMU drive, remove the disk before powering up. During initialization, select the boot choice to boot up with OS2 on the D: hard drive. It should return with a screen of icons, of which BMU and XDM is included. If a fault occurs during initialization, contact your appropriate TAS representative.

BCG file creation

The BCGI tool is used to generate all the necessary1900 MHz configuration files and to download and initialize the BTS. The program uses a point and click interface to generate the configuration files.

Before creating the download files, the cable losses in dB must be determined between the following

- RFFE and the TX at the BTS enclosure
- RFFE and the RX0 and the RX1 a the BTS enclosure

Note 1: You need these values to obtain correct power output. They should include the transmit and both receive diversities. If you don't know what the values are, measure them before beginning the BCGI file creation. Each sector provisioned will require these loss values.

Note 2: The software download files are created using the BCG and the BCGI utilities. Use Procedure 3-6 to create the BTS download files.

Procedure 3-6
BCGI file creation

Step	Action	Observation
1	Click on the BCGI icon	The BCGI product information window appears containing the BCGI version. The version should be noted if download problems occur.
2	Click Continue to continue.	The BCGI Input window-Cell Name window appears.
3	Enter the BTS number according to the site engineering number plan as the Cell Name.	Cell Name is entered.
4	Click OK to confirm.	The BCGI Input Window-Location window appears.
5	Enter site name or address as the location.	The site name or address is entered.
6	Click OK to confirm.	The BCGI Input Window-BTS Type window appears.
7	Select the Outdoor choice.	Outdoor is selected.
8	Click OK to confirm.	The BCGI Input Window-Channel # window appears.
9	Enter the customer specific site CDMA channel number.	Channel number is entered; check the script file if unknown.
10	Click OK to confirm.	The BCGI Input Window-Channel Cards window appears.
11	Enter the total number of channel cards that are provisioned for the site, as well as their Product Engineering Code (PEC) and their locations.	
12	Click OK to confirm.	The BCGI Input Window-Sector window appears.
13	Select the sectors provisioned or Omni if it is an omni sectored cell site.	A three-sectored cell will have the Alpha, Beta, and the Gamma sectors selected.

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Procedure 3-6
BCGI file creation (continued)

Step	Action	Observation
14	Click OK to confirm.	The BCGI Input Window-PN Offsets widow appears.
15	Enter the PN Offsets of the provisioned sectors in decimal numbers. The PN Offsets are engineered on a site specific basis.	The provisioned sector's PN Offsets are input; check the script file if unknown.
16	Click OK to confirm.	The BCGI Input Window-RF Cable Attenuations window appears.
17	Enter the values in dB for the Alpha sector. RX path 0-enclosure to RFFE RX path 1-enclosure to RFFE TX path-enclosure to RFFE	If the cable loss measurements have been measured, the actual loss is entered in dB (RX path 0 and RX path 1 should have the same loss at the TX path). If they have not been measured, then they will need to be measured before BCG file creation.
18	Click OK to confirm.	The BCGI Input Window-RF Cable Attenuations window appears.
19	Enter the values in dB for the Beta sector. RX path 0-enclosure to RFFE RX path 1-enclosure to RFFE TX path-enclosure to RFFE	If the cable loss measurements have been measured, the actual loss is entered in dB (RX path 0 and RX path 1 should have the same loss at the TX path). If they have not been measured, then they will need to be measured before BCG file creation.
20	Click OK to confirm	The BCGI Input Window-RF Cable Attenuations window appears.
21	Enter the values in dB for the Gamma (C) sector. RX path 0-enclosure to RFFE RX path 1-enclosure to RFFE TX path-enclosure to RFFE	If the cable loss measurements have been measured, the actual loss is entered in dB (RX path 0 and RX path 1 should have the same loss at the TX path). If they have not been measured, then they will need to be measured before BCG file creation.
22	Click OK to confirm	The BCGI Input Window-BTU/STU window appears.
23	Select Yes to indicate that the STU is supported.	Yes is selected.
24	Click OK to confirm.	The BCGI Input Window-Connection window appears.
25	Select the BCN option.	BCN is selected.
26	Click OK to confirm.	The BCGI Input Window-Battery window appears.
27	Select the number representing the total number of battery strings connected.	The number of battery strings connected is selected.
28	Click OK to confirm.	The BCGI Input Summary Window is displayed.
29	Verify the information is correct. To change any item, select Prev to step to the appropriate input screen.	Information is verified.
30	Click on Click here for more sector information.	The cable loss information is displayed.

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Procedure 3-6
BCGI file creation (continued)

Step	Action	Observation
31	Verify the information is correct. To change any item, select Prev to step to the appropriate input screen.	Information is verified.
32	Click on 'Go Back to Main Summary Window'.	Returns to the BCGI Input Summary Window.
33	Click on Generate the scripts.	Confirmation window appears indicating that the process has completed.
34	Click OK to confirm.	
35	Click on the OS/2 window icon and the d:bmu2413 directory prompt. Verify that the BCG files with the prefix 'XXX' were created.	BCG files with the prefix 'XXX' were created.

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XDM monitoring

If you use the XDM to monitor the download process, follow Procedure 3-7.

Procedure 3-7
XDM monitoring

Step	Action
1	The XDM and XDM Lite operations are monitoring utilities to verify that the software download operations are functioning properly.
2	Position the XDM computer in a convenient location to the BMU and run the XDM cables from the equipment racks to the XDM computer area.
3	The XDM cable will be initially connected to the front of the BTSC number 1 located in position A12. Connect it to the port labeled XDM.
4	Connect the other end of the XDM cable to the computer. The cable will connect to the PC Milti Interface Communication Card's (MICC) 25 pin connector.

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Procedure 3-7
XDM monitoring (continued)

5	The process of using the XDM monitoring system involves: a. Connecting the XDM cable b. Entering the XDM Lite software utility c. Recycling the power to the MDS and TST shelf d. Verifying the XDM is communicating by observing the XDM screen to verify the packets are loading. e. Exiting the XDM Lite f. Reconnecting using the XDM Connection/Connect/Target Sync function to monitor additional windows. g. Move the XDM cable from the BTSC to the cards in sequence (see 'i' below) to monitor the progress and status of each card's load. See paragraph I for the sequence of loading the XDM cable. h. Monitor the Test Debug, Error, Default windows to assist in troubleshooting. — Test Debug Windows-Shows status of Bit (Built-in) tests — Error window-displays errors that occur as load progresses — Default window-Displays messages that can be helpful in troubleshooting ***Note:*** Many of the windows are available throughout the loading which shows the status of a sector, various MOs, the GPSR, etc. i. The sequence of loading and moving the XDM cable is as follows: i. BTSC XDM Port-for BTSC, DISCO, and TFU ii. Once complete, as evidenced by the illumination of the green Active LED on BCNIC #2, move the cable to the CSM5 card. iii. CSM5's Lite XDM screen will display AIS Child ready for download and Exec Address. iv. Continue monitoring the Lite session ***Note:*** You may view the results of the bit test performed on the CSM cards by disconnecting from the Lite session and reconnecting to the full Connect session after AIS Child ready for download is displayed. v. When the ACC card's active LED illuminates green, move the XDM cable to the TCC card #1. ***Note:*** Remember to disconnect prior to moving the XDM cable. j. If any problems occur, attempt to isolate the fault to the card or cable level and replace the item, then reinitiate the process.

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BTS downloading

CAUTION
Equipment Damage
Ensure that the J4 RFFE for each sector provisioned is terminated with a 30 dB 50 watt attenuator or to the site TX antennas (refer to Procedure 3-8).

Procedure 3-8
BTS downloading preparation

Step	Action
1	If the XDM is used, ensure that the XDM cable is connected to the BTSC XDM port and the 25 pin MICC port of the XDM PC.
2	Ensure that the BMU cable is connected from the BMU MICC port to the 25 pin BTS maintenance unit port labeled J4 on the front of the Outdoor BTS, above the TST shelf.
3	Follow the procedures described in Procedure 3-9 for loading the BTS through the BMU and monitoring through the XDM utilities. The GPS receiver must be in the lock mode before download begins. For stand alone BMU loading, the CDSU must be powered down or the data cable must be unplugged from the CDSU. If RF calibration is being done, the HP437B power meter and each RFFE need to be warmed up for 30 minutes before stable readings can be taken. Ware up time required may vary but 30 minutes is recommended. The HP437B power meter and the RFFEs may warm up during the download.
4	When monitoring is complete, contact the BSM operator and if warranted, request a download from the BSM. Remember to power up the CDSU and/or replace the T1 cable to enable maintenance from the BSM. Verify that the T1 is cross connected properly by observing a green LED on the CDSU when the T1 is cross connected. Have the BSC disconnect the T1 routing to the BTS and ensure that the green LED turns red. This will verify that no loopbacked circuits exist between the BSC and the BTS.
5	For maintenance from the BSM, before leaving the site, ensure that the T1 cable is connected to the rear T1 port on the CDSU.

BMU downloading

Perform software downloading after hardware installation and anytime that hardware is removed and replaced.

Note: The procedures below include the use of an XDM computer to monitor the download in progress. This is optional. If you do not use the XDM, ignore those steps which reference it.

Procedure 3-9
BTS downloading

Step	Action	Observation
1	Once the XDM cable is properly connected to the BTSC as described in Procedure 3-8 (if the XDM is used), double click on the XDM icon at the XDM PC.	The XDM server window appears. Disconnected appears in the lower left corner of the window.
2	Select Connection from the XDM top menu bar.	The connection options are displayed.
3	Select Lite.	The XDMSlite options are displayed.
4	Select Target Sync	The XDMSlite.exe window opens and is ready for monitoring.
5	Reset the MDS and TST shelf by powering down the shelves and reapplying power. For stand alone BMU loading, leave the CDSU shelf powered down.	The XDM screen scrolls up to two minutes and the AIS Child Ready for Download should appear at the scroll completion. (This event takes place approximately 7 minutes after powering-up.)
6	With the BMU mouse, double click on the icon labeled BMU or type BMU from the [for example D:\bmu2413\bin] working directory.	
7	From the BMU main window menu bar, select BTS Configuration.	The Configuration tool list is displayed.
8	Click on the Select BGI File.	The BMU Configuration File Dialog box opens.
9	If RF calibration is performed, select the XXXRCP.BGI download file. Otherwise, select the XXXALL.BGI download file for standard downloading.	The XDM window scrolls as the MDS is downloaded. Complete download will take approximately 40 minutes depending upon the number of CSMs and sectors.
10	Periodically monitor the figure below shown on the BMU during downloading. During the downloading, follow steps 12 through 23 for XDM monitoring.	A Node Initialization Protocol (NIP) and then an Application Download Protocol (ADP) will be performed. The bar will graph the percentage complete of the download. ***Note:*** If the first bar does not display any progress, ensure that the BMU cable is connected at both ends and then restart. Also ensure that the BTS has been powered-up for at least 10 minutes.
11	During the MDS download, also monitor the XDMlite and the XDM Connect Session screens.	The XDMlite screen scrolls as the MDS continues to be downloaded. When the Exec Address notification is displayed, go to step 12.

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Procedure 3-9
BTS downloading (continued)

Step	Action	Observation
12	On the XDM, disconnect from the Lite session and reconnect to the full session via Connection, Connect, and Target Sync.	Observe the download continues on the BTSCs, ATMs, BCNICs, and FRCs. When the Active LED on BCNIC #2 illuminates green, go to step 14.
13	While in the Connect session, activate the Test Debug, Error, and Default windows for BIT (Built-in Test) failures, errors, and faults.	Observe the results displayed in these windows. These windows are only seen while in the Connect session.
14	Disconnect the XDM from the full session (via Connection and Disconnect) and move the XDM cable from the BTSC to Channel Card #5 (CC%). Reconnect to a Lite session via Connection, Lite, and Target Sync.	Observe the download. When the XDM Lite window displays Exec address, go to step 15.
15	Move the XDM cable along the provisioned channel cards. Begin with slot A5, then A6, then continue to A1, A2, A3, and/or A4. Remember to invoke the Disconnect function and reconnect using Lite and Target Sync each time.	Verify the scrolling of the XDMLite and the XDMConnect screens as each CSM card is downloaded.
16	When the download of all of the channel cards is complete, move the cable from the channel cards to the TCC card in slot A2 of the TST shelf. The download is considered complete when the TCC's Active LED illuminates green.	The cable is connected to the TCC card in slot A2 of the TST shelf.
17	Monitor the download of the TCC cards, alternating from Lite to Connect when Exec Address is displayed.	Continue to monitor the Test Debug, Error, and Default windows from additional reports. Also, monitor the BMU for information as instructed beginning in step 18.
18	Periodically monitor the BMU Main Window at the BMU.	'Processing the BQM script file <>' and the 'Completed BQM script file <>' will detail the different files executed. File errors and names will be noted here. Downloading is not complete until Completed BGI script file \XXXALL.BGI' or the RF TX Calibration (if running the XXXRCP.BGI file) window appears.
19	Monitor the BMU QMIP Response Window.	Scroll through the window for successful create, action, and event messages.

-sheet 2 of 4-

Procedure 3-9
BTS downloading (continued)

Step	Action	Observation
20	When the BMU indicates the download is completed, check the XDM windows while the XDM is connected to the TCC.	Verify the following from the Alpha TCCRCA Calibration window: Sector ID-indicates sector Administration State-Unlocked Operational State-Enabled Usage Stage-Idle HPA State-Enabled (Red) CDMA Center Freq-(Site frequency) TFU Source-TFU 1 Transmit Power-0 dB/16
21	Check the BTSC and the DISCO front panel LEDs.	Verify the following LEDs are on: Slot A12-Power, Enabled, Active (BTSC1) Slot A13-Power (BTSC2) Slot A14-Power, Enabled, Active (ATM1) Slot A15-Power (ATM2) Slot A16-Power, Enabled, Active (BCN1) Slot A17-Power, Enabled, Active (BCN2) Slot A18-Power, Enabled (BCN3)
22	Check the TFU front panel LEDs.	Verify that the following LEDs are on: Slot A9-Power, Enabled, Active (FRC) Slot A10-Power (FRC) Slot A11-Blank (SAC)
23	Check the Channel and Analog Common card front panel LEDs.	Verify the following LEDs are on: Slot A1-Blank Inserted Slot A2-Blank Inserted Slot A3-Blank Inserted Slot A4-Blank Inserted Slot A5-Power, Enabled, Active Slot A6-Power, Enabled, Active Slot A7-Power, Enabled, Active

-sheet 3 of 4-

Procedure 3-9
BTS downloading (continued)

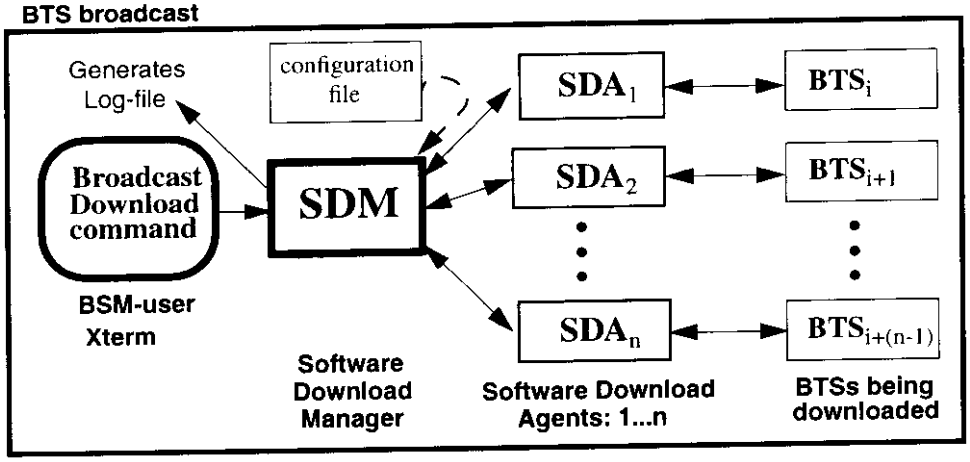
Step	Action	Observation
24	Check the TST front panel LEDs.	Verify the following LEDs are on: Slot A1-Power, Enabled, Active (STU) Slot A2-Power, Enabled, Active (TCC1) Slot A3-Power, Alarm* (TCC2) Slot A4-Power, Enabled, Active (Upconv.) Slot A5-Power, Enabled (Receiver) Slot A6-Power, Enabled, Active (Upconv.) Slot A7-Power, Enabled (Receiver) Slot A8-Power, Enabled, Active (Upconv.) Slot A9-Power, Enabled (Receiver) *The indicator is normally displayed with the software release used at the time of publication of this procedure.
25	Reconnect the XDM to the BTSC in slot A12.	
26	From the XDM top tools bar, select Windows.	Displays the windows that are available for monitoring.
27	Select GPS Receiver Status	Verify the following: Operational State-Enabled Operational Mode-Normal Position Status-Position Hold Satellite State-Sufficient Hardware Status-Normal Last GPS Time-Counting up
28	Reconnect the XDM to the TCC.	
29	From the XDM top tools bar, select Windows.	Displays the windows that are available for monitoring.
30	Select the Transmit Power window.	Verify transmit power.
31	Select the TFC Status window.	Verify the following: FRC State Odd/Even-Alternating odd/even FS-Locked 10 MHz-Present 1 PPS-Present Sys_Clk-Present 1 PPS Count-Counting up Op State-TFC Enabled Admin State-TFC Unlocked

-sheet 4 of 4-

Broadcast download for BTSs (NBSS6.2)

This NBSS6.2 feature lets you download the BTS load onto several targeted BTSs through a single command entered on the BSM (see Figure 3-6). After execution of the download command, a report on the success or the failure of each BTS download is summarized in an ASCII log-file.

Figure 3-6
BTS broadcast



Overview

The Broadcast Download Tool (BDL) uses the BSM cliapp interface to download software onto target subsystems. For each subsystem, a separate cliapp is started to run CLI script(s) specific to that subsystem.These cliapps run independently of each other but under control of the BDL tool. The tool generates log-files in /opt/bsm/log/bdload directory for each subsystem attempted for software download.

Downloading a subset of the targeted BTSs occurs simultaneously (up to an engineering limit), and until an attempt to download all targeted BTSs has been completed. During the download of each BTS, the tool uses the existing download scripts specific to the BTS in download, and the options obtained from the user-supplied configuration file to download the BTS. The progress of each BTS download is displayed on the user Xterm. An ASCII log-file for each BTS targeted for download is generated. In addition, download success or failure information on each BTS is summarized in a separate log-file.

Due to capacity constraint, only a maximum number of cliapps can be run in at any given time. This engineering limit also limits the maximum number of simultaneous downloads of software.

This tool is written in EXPECT scripting language and is packaged in the BSM load under WBSMUTIL package.

Software download description

This tool provides a command-line interface to the user to initiate the broadcast download. When the command is entered on the user Xterm, it starts up a limited number of specific BTS download attempts. Each of which uses a set of BTS specific download script(s) whose filenames are provided by the user in the configuration file. These many attempted BTS download(s) execute simultaneously. The next BTS in the user specified list of BTSs is attempted for download as soon as any of the BTS download attempt exits with success or failure, and until all of the BTSs in the list have been attempted for download. In other words, the pipelined simultaneous download of BTSs continues until all of the BTSs specified in the configuration file have been attempted for download.

During the download of each BTS, a single ASCII log-file corresponding to each BTS is generated separately. This file contains the screen output generated at the execution of the BTS download script and is stored in the log directory. At the end of the broadcast download session, a single summary log-file for the entire broadcast download containing success or failure of each attempted BTS download is generated and stored in the log directory. To invoke download you may enter Ctrl-C hot key in the main window. This will execute the broadcast download command and will cause the entire broadcast download session to be exited immediately after cleanup. During the simultaneous download of several BTSs:

- if any BTS download script fails and halts the execution of that script, the download attempt for that BTS is exited immediately and a download attempt for another BTS (from the list of BTSs in the configuration file pending attempt for download) is started. An entry of FAILURE is made in the summary log-file against the BTS that was exited in this manner.
- if the BTS download script does not provide for halting on an error condition, this tool will not detect the error condition or failure of the script and will not exit the download attempt until it is timed out by the broadcast download tool.
- a temporary working directory '/opt/bsm/log/bdload/temp' will be created during the execution of the tool implementing this feature and will exist until the tool exits the execution. This directory and its contents will be erased both at the start, and at the end of the execution of the tool and must not be erased during the execution of the tool.

Logs

Existing logs remain unchanged, however a separate ASCII log-file containing display output for each BTS targeted for download will be generated in '/opt/bsm/log/bdload' directory.

Additionally, success or failure of each BTS attempted for download will be recorded in an another log-file 'bdownload.log', as a summary of the

complete broadcast download attempt and will be stored again in the '/opt/bsm/log/bdload' directory.

These log-files remain in the '/opt/bsm/log/bdload' directory until the next time broadcast download tool is started, at which time any files in that directory are deleted automatically. If you need to keep these files for some reason, move them from '/opt/bsm/log/bdload' directory before starting the next download session. Log-files in '/opt/bsm/log/bdload' directory must not be moved or erased during the execution of the tool implementing this feature.

Syntax of the configuration file

Syntax for the required configuration appears in Table 3-1:

Table 3-1
BTS broadcast configuration file syntax

Name of BTSs to be downloaded	Name of directory where BTS download script is located	Name of BTS script file(s) Separated by tab or space(s)
Name of BTS_1	full pathname to bts_1 scriptdir	bts script file(s)$_1$
Name of BTS_2	full pathname to bts_2 scriptdir	bts script file(s)$_2$
...	...	...
Name of BTS_n	full pathname to bts_n scriptdir	bts script file(s)$_n$

Example of the configuration file:

```
BTS_7  /opt/bsm/cct/cct_kc   kc.BTS7.minibts.init.cli
BTS_6  /opt/bsm/cct/cct_kc   kc.BTS6.biu.init.cli   kc.BTS6.bts.init.cli
BTS_9  /opt/bsm/cct/cct_kc   kc.BTS9.minibts.init.cli
BTS_3  /opt/bsm/cct/cct_kc   kc.BTS3.minibts.init.cli
```

The command must be executed from a writable directory. In this example BTS_6 has 2 download scripts. One script is for the back-haul unit and the other is for the rest of the BTS. All other BTSs have only one download script each. If there is more than one download script associated with a BTSs, include each file name in the configuration file in the order of their intended execution.

Examples of command syntax

```
/opt/bsm/bdload/bdownload <tab> -ckc_config.cfg
```

In this example, all of the BTSs listed in the configuration file 'kc_config.cfg' in the '/opt/bsm/bdload/config' directory, will be attempted for download. This will be accomplished by using the BTS download scripts available from the directory indicated in the configuration file.

```
/opt/bsm/bdload/config <tab> bdownload.cfg
```

In this example, all of the BTSs listed in the configuration file 'bdload.cfg' in the '/opt/bsm/bdload/config' directory, will be attempted for download. This will be accomplished by using the BTS download scripts available from the directory indicated in the configuration file.

```
/opt/bsm/bdload/bdownload --h
```

In this example, the tool will output the usage information on the user Xterm window and will exit the tool immediately.

Table 3-2 lists the new and modified directories impacted by this feature.

Table 3-2
New/modified directories

DIRECTORY NAME	NEW, CHANGED OR DELETED	NEW NAME (if renamed)	TARGET	RES/ NONRES
/opt/bsm/bdload	New	N/A	N/A	N/A
/opt/bsm/log/bdload	New	N/A	N/A	N/A
/opt/bsm/log/bdload/temp	New	N/A	N/A	N/A
/opt/bsm/bdload/config	New	N/A	N/A	A/A

Parameter definitions

Broadcast download parameter definitions are detailed in Table 3-3.

Table 3-3
Parameter definitions

PARAMETER	VALUE	DEFINITION
-c<CONFIG FILE>	For example: `-c/opt/bsm/bdload/config/bdload.cfg`	Configuration file constructed and supplied by the user is **required**. Optionally, a user-defined configuration **file name** with full path may be provided on the command-line. By default the configuration file name is bdload.cfg located in '**/opt/bsm/bdload/config**' directory. If the user enters only the configuration file name on the command line, then the file will be searched in the default directory for the configuration file, i.e. '/opt/bsm/bdload/config' directory. Syntax for the configuration file is provided in the next section.
<HELP OPTION>	-help -h -h	This command provides usage information for this tool.

Restrictions/limitations

- The number of BTSs that can be downloaded simultaneously is limited so as not to overtax BSM resources.
- For each targeted BTS, BSM generated scripts for broadcast download must be available and the download scripts must be error-free.
- The tool implementing this feature will not work with the BTS scripts that require manual interaction.
- User-defined configuration files are required and these files must be error-free.
- During the execution of the tool implementing this feature, neither the directory '/opt/bsm/log/bdload/temp' nor its contents must be removed.
- The command must be executed from a writable directory.
- Compliance with command-line interface is required.

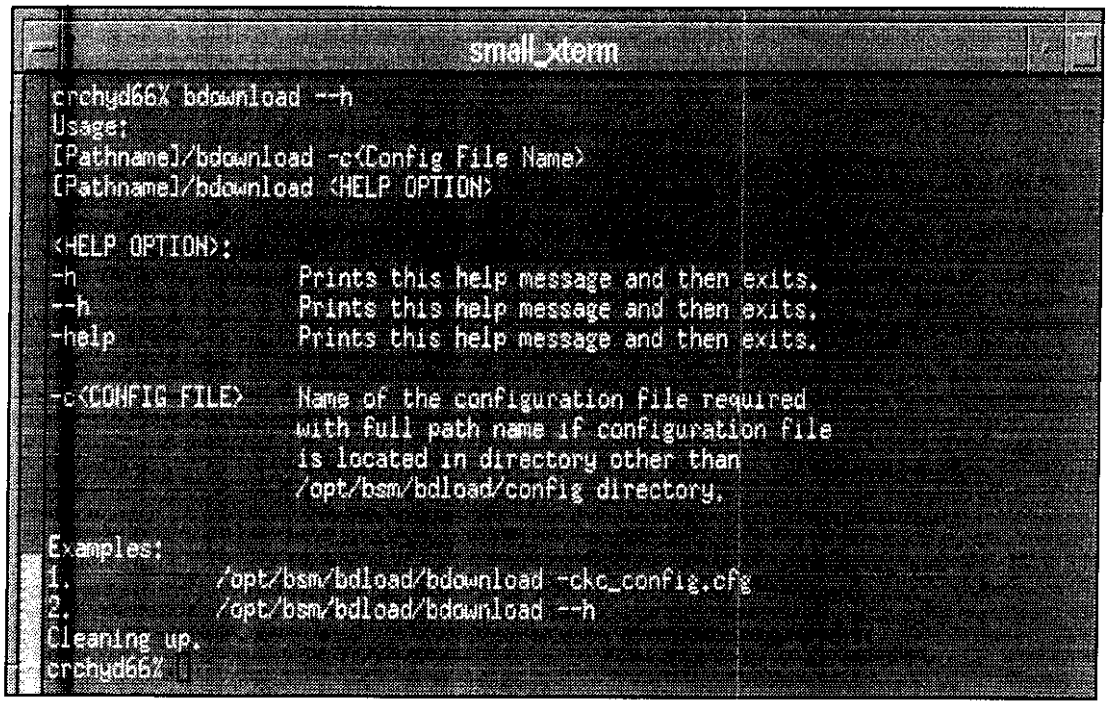
Responses

In this section, typical responses, as displayed on the screen output, resulting from the two variants of the broadcast download commands are provided in the form of the screen captures.

Response of the helper command

The helper command, `bdownload --h`, provides complete usage information on the user Xterm. The captured screen output as shown in Figure 3-7 contains the usage information displayed on the screen when a helper command is entered on the command line in a user Xterm.

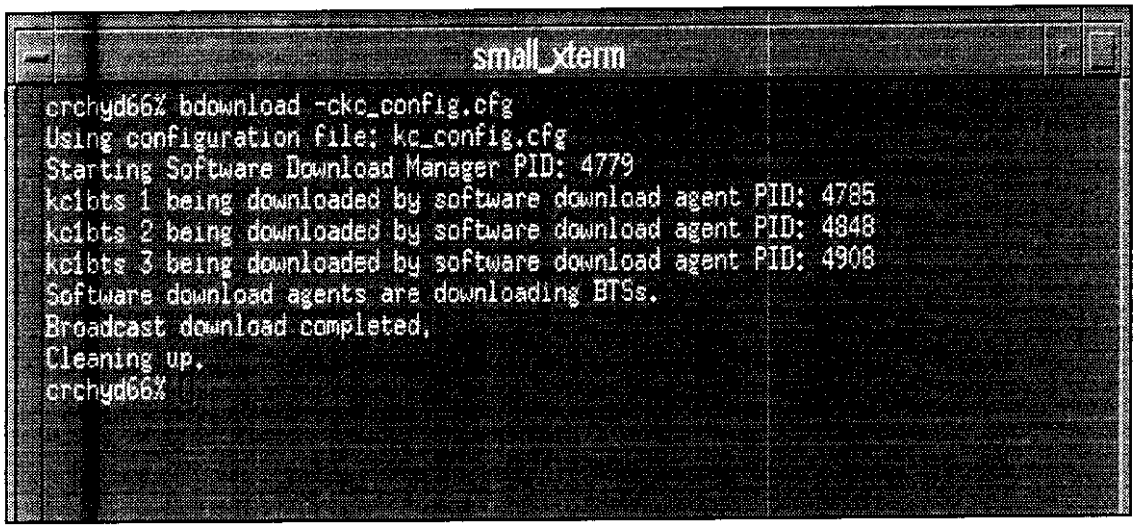
Figure 3-7
Usage information for the bdownload tool



Response of broadcast-download command

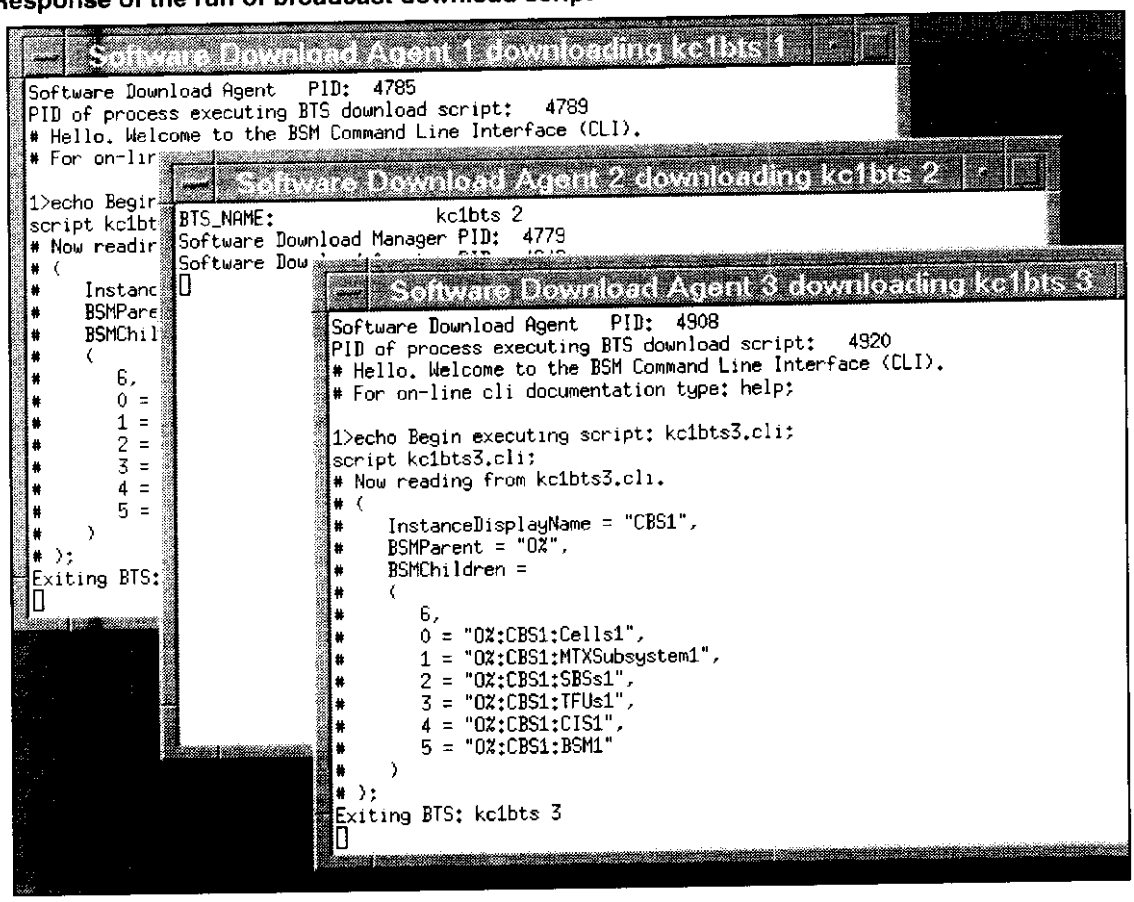
The broadcast download command provides general information on the screen output about the progress of the download for the BTSs. A screen capture of the main window running the broadcast download is shown in Figure 3-8.

Figure 3-8
Broadcast download script in main window



At the same time, the broadcast download command initiates several individual BTS download activities in other Xterms driven by the command in the main window. A capture of the screen output of run of three such XTERMs, in the example, is shown in Figure 3-9.

Figure 3-9
Response of the run of broadcast download script



The tool generates an ASCII file in the '/opt/bsm/log/bdload' directory for each BTS attempted for download. In addition, an ASCII file, 'bdownload.log', containing overall summary report of success or failure of each BTS attempted for download is also generated in the same directory.

Performing BTS broadcast

Procedure 3-10 and the five figures that follow, show the process required to perform BTS broadcast downloads.

Procedure 3-10
Performing BTS broadcast

Step	Action
1	Construct a configuration file in the /opt/bsm/bdload/config directory. The syntax of the configuration file is: BTS name full pathname to BTS script dir BTS script file(s)
2	Make sure BSM is unlocked, enabled, and providing service.
3	Open an xterm window on the on the X-window terminal and run the 'bdownload' command as indicated in the following figures.

Figure 3-10
Selecting and entering the configuration file

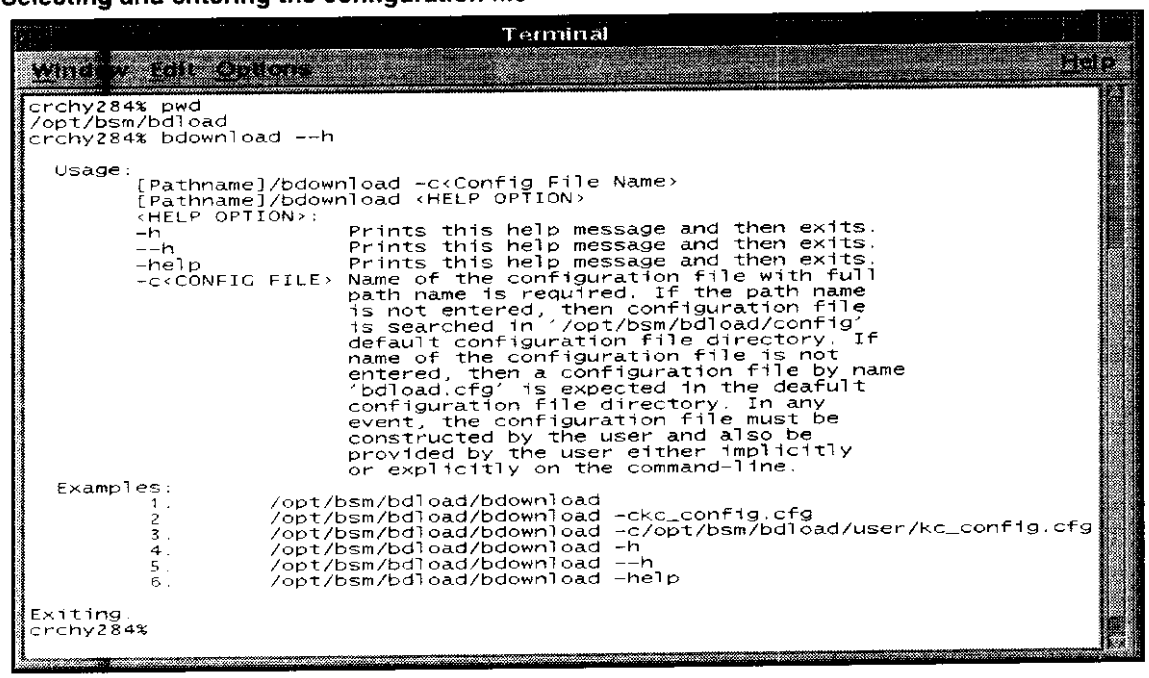


Figure 3-11
Broadcast software is downloaded to BTSs

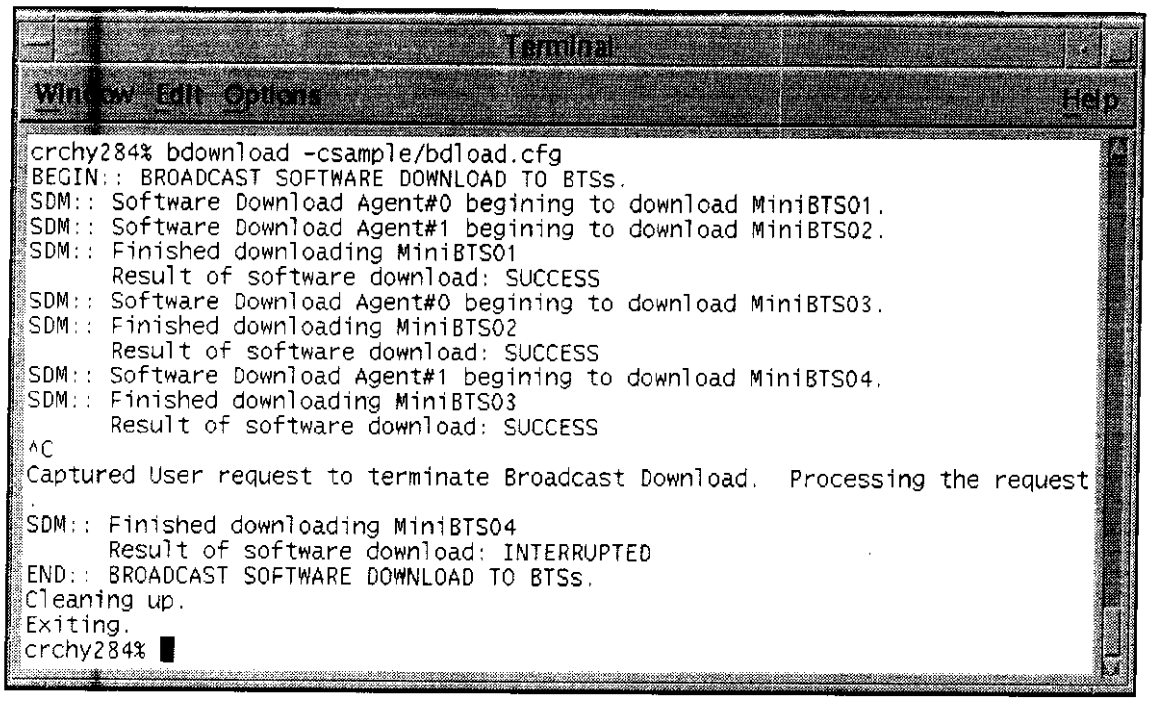


Figure 3-12
Starting subsystem specific CLI scripts

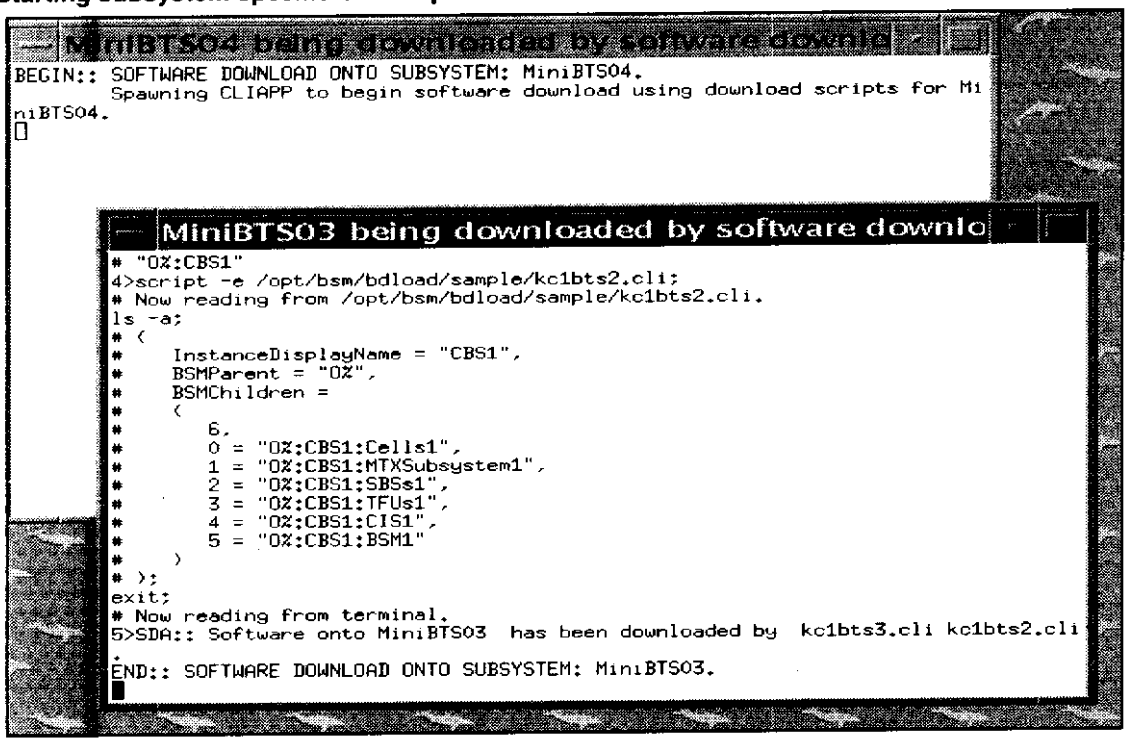


Figure 3-13
Monitoring broadcast download progress

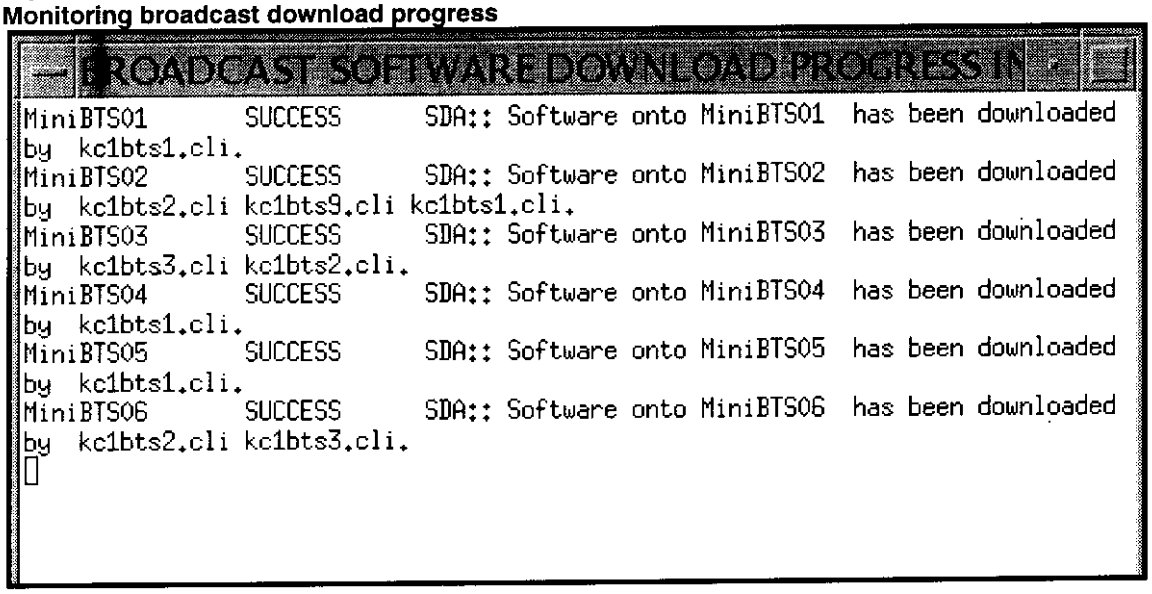


Figure 3-14
Determining broadcast download results

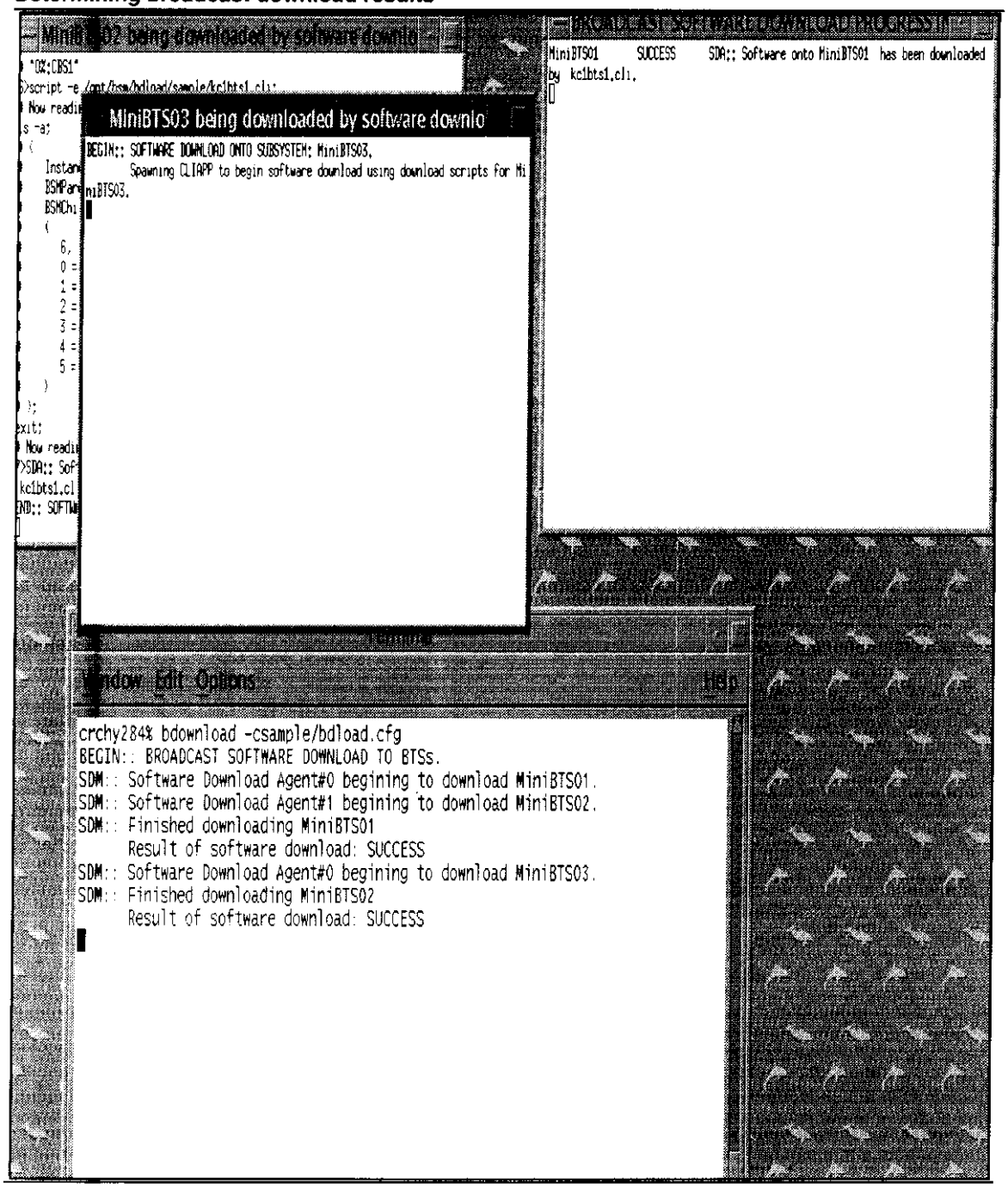


Figure 3-15
Exiting broadcast download

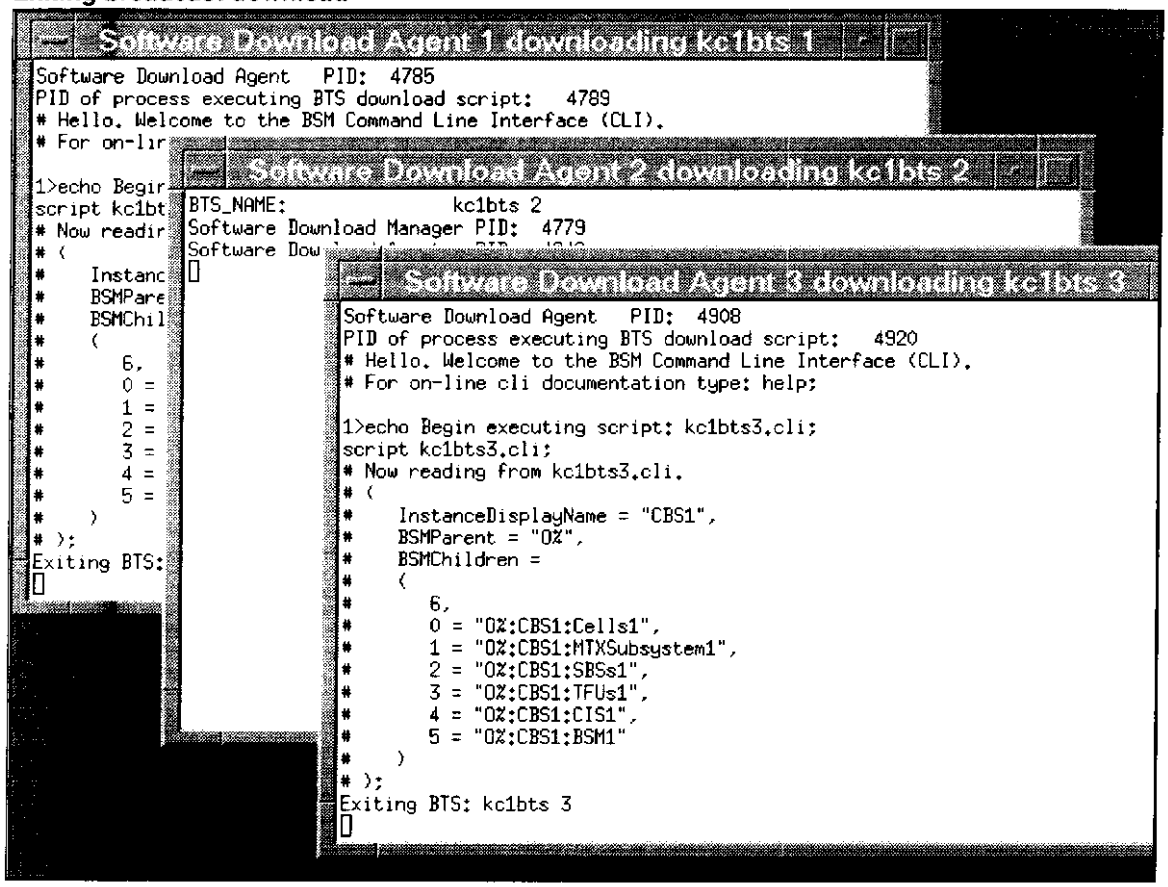


Table 3-4 provides a list of commonly asked questions and answers about using the BTS broadcast tool.

Table 3-4
BTS broadcast tips

Question	Response
Does the tool check for any syntax errors in CLI scripts?	No.
Does the tool check whether the BSM is up and running?	No.
Can the craftperson run CLIAPP on a separate xterm while the tool is executing?	Yes, but the total number of CLIAPP running at any given instant must not exceed the engineering limit. As a safety measure, it should not be.
Does the tool check for any syntax errors in the configuration file?	No. The user must provide syntactically accurate file.
Can the log-files or temporary files be moved or deleted while the tool is executing?	No.
Are the previous log-files deleted at the start of a new run of the tool?	Yes.

RF calibration procedures

RF calibration must be performed following the replacement of any RF component. The procedures provided in this section detail the steps necessary to calibrate and test the RF radios and shelves in the 1900 MHz Mini BTS RF system.

You will need a fully loaded Mini-BTS and Base Station Monitor Unit (BMU) computer with calibration software files to perform these procedures.

Required materials

You need the following materials to perform the RF calibration procedures.

- Toshiba 6600 (or equivalent) BMU PC
- XDM PC with XDM software (optional)
- RF Calibration software
- HP 8921A (or equivalent analyzer)
- HP 83203B CDMA Adapter
- HP 83236A PCS Adapter
- 3 30dB 50W attenuators
- HP 437B Power Meter
- HP 8482A Power Sensor
- BMU to DISCO cable (part number 45-17071)
- XDM test cable (part number 45-14322)
- 2 N-Type to N-Type RF cables
- 2 BNC to BNC RF cables
- 1 TNC to N-Type RF cable
- 1 N-Type to N-Type barrel

Precautions

Observe general safety precautions against personal injury and equipment damage at all times.

Caution
Personal injury
Ensure that the sector transmit antennas are terminated at the RFFE J4 port with a 30dB attenuator when transmitting.

Note: When rebooting the BMU, do not turn off the power or use CNTL+ALT+DEL. This can cause problems with OS2. Instead, double click on the PC background with the right mouse button. Select 'SHUT DOWN' from the window and confirm as requested or select shutdown from the lower BMU tools bar.

Preparations

Prior to starting the operations presented in this method, arrange all materials, tools, and test equipment at the work location so as to minimize fatigue and inconvenience.

Note: Note: The even second clock and the 10MHz reference connections are only required for the Rho and the code domain measurements. If these connections are unavailable due to the placement of the RFFE with respect to the enclosure, the spectrum check, cable loss measurement, TX power measurement, and the receive measurement tests will show 'REF Unlock' alarm but will still function.

It is important to note that J4 on the RFFE is both the transmit and the receive 0 port.

Record all results on a form similar to that in Figure 3-16.

Figure 3-16
1900 MHz Calibration checklist

Date _____ BMU Load Version _____

Site Name _____ Site Number _____

Site CDMA Channel Number _____

Site CDMA Frequency _____

Alpha Sector Results		Beta Sector Results		Gamma Sector Results	
No. of Batt. Strings		No. of Batt. Strings		No. of Batt. Strings	
Enc. to RFFE TX		Enc. to RFFE TX		Enc. to RFFE TX	
Enc. to RFFE RX 0		Enc. to RFFE RX 0		Enc. to RFFE RX 0	
Enc. to RFFE RX 1		Enc. to RFFE RX 1		Enc. to RFFE RX 1	
Spec. Check TX		Spec. Check TX		Spec. Check TX	
Spec. Check RX		Spec. Check RX		Spec. Check RX	
Pwr. Meter @ 4W		Pwr. Meter @ 4W		Pwr. Meter @ 4W	
BMU Power @ 4W		BMU Power @ 4W		BMU Power @ 4W	
Ambient Air Temp.		Ambient Air Temp.		Ambient Air Temp.	
BMU Pwr Reading Tolerance check		BMU Pwr Reading Tolerance check		BMU Pwr Reading Tolerance check	
BMU Atten. @ 4W		BMU Atten. @ 4W		BMU Atten. @ 4W	
BMU Atten. Norm (BMU Atten x 16)		BMU Atten. Norm (BMU Atten x 16)		BMU Atten. Norm (BMU Atten x 16)	
XDM TX Pwr. (if avail)		XDM TX Pwr. (if avail)		XDM TX Pwr. (if avail)	
Rho Reading		Rho Reading		Rho Reading	
Rho Time Offset		Rho Time Offset		Rho Time Offset	
Rho Carr Feed		Rho Carr Feed		Rho Carr Feed	
Code dom. Lock		Code dom. Lock		Code dom. Lock	
Receive Wilt		Receive Wilt		Receive Wilt	

Sector Imbalance Check (±1.1 Watt) Pass ☐ Fail ☐

Techs _____ Signature _____

Comments _____

Cable loss calibrations

Cable loss measurements are to be done on the TX BTS enclosure to RFFE and both RX0 and RX1 enclosure to RFFE cables before the download files are created.

> ***Note 1:*** For remote RFFEs currently installed on towers, the cable losses for the TX, RX0, and RX1 enclosure to RFFE cables will still require measurement and a tower climbing crew will be needed to assist the cable loss calibration. NT personnel are not to climb towers.
>
> ***Note 2:*** Always ensure any connections or adapters are finger tight to ensure accurate readings.

Any other cables to be used for measurements will also need to be measured for loss. The test cables should be measured on a weekly basis at a minimum.

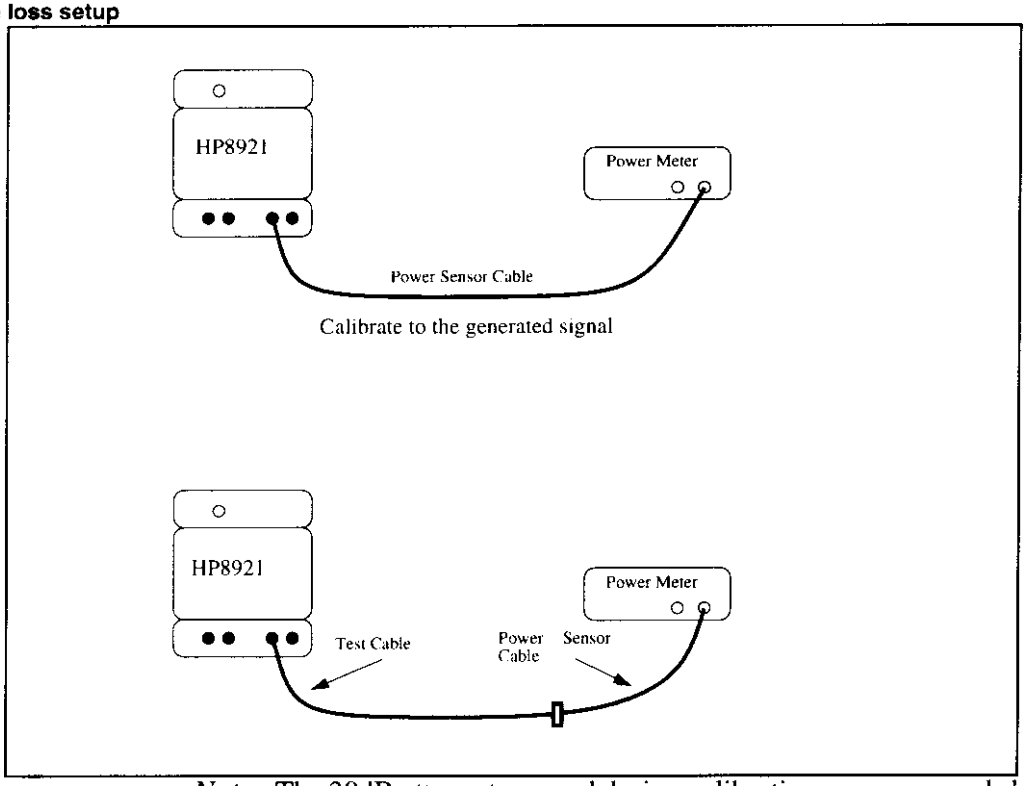
Verify with Appendix B that all the HP8921A, HP83203B, and HP83236A connections are in place.

Ensure that the BTS is not transmitting and disconnect both ends of the sector cables between the RFFE and the BTS enclosure.

> ***Note:*** Be sure to turn the coupling nut of the test equipment (such as the power sensor) when making connections. Turning the coupling nut instead of the adapters will reduce wear on the coupling nut.

Refer to Figure 3-17 for cable loss measurement connectivity information.

Figure 3-17
Cable loss setup



Note: The 30dB attenuators used during calibration may vary, and should be marked as to the actual loss they provide. Attenuators should be recalibrated every six months.

Follow Procedure 3-11 to determine loss of the cables.

Procedure 3-11
Cable loss calibrations

Step	Action	Outcome
1	Insert the program memory card into the HP8921A	
2	Press the green HP8921A PRESET button to reset the equipment to a known set of values.	RX TEST window appears
3	Press the HP8921A 'Tests' key.	'Tests (Main Menu)' window appears.
4	Select 'Select Procedure Location'.	Choices are displayed.
5	Select 'Card'.	Card location is selected.
6	Scroll to and select 'Select Procedure Filename'.	Choices are displayed.
7	Scroll to and select 'Manual'.	'HP83236A MANUAL CONTROL' appears at the top and options are displayed in the top right corner.

-sheet 1 of 3-

Procedure 3-11
Cable loss calibrations (continued)

Step	Action	Outcome
8	Scroll to and select 'Run Test'.	'HP83236A Manual Control Main Menu' window appears and an HB-IB bus configure confirmation may appear if first test is installed.
9	If prompted, scroll to and select 'Yes' to continue the operation.	'HP83236A Manual Control Main Menu' appears and the cursor is available.
10	Scroll to and select 'Change System Settings'.	'System Type and Connection Menu' appears.
11	Check the fields and modify as necessary	Verify the following: Equipment Type — Base Station Frequency Band — 1850-1900MHz Channel Type — CDMA HP83236A RF OUT Port — RF OUT ONLY Transmitter Test Cable Loss — 0.0dB Receiver Test Cable Loss — 0.0dB
12	Scroll to and select 'Back to Previous menu'.	Returns to the 'HP83236A Manual Control Main Menu' window.
13	Check the fields and modify if necessary.	Verify the following: Channel number — *(CDMA Ch #)* RF Generator level — -10dB
14	Scroll to and select 'Analyzer Attenuation'.	'Analyzer Path Attenuator Setting' options appear.
15	Scroll to and select 'User Fixed Atten. Settings'.	Attenuation setting input option is highlighted.
16	Enter '0' for the attenuation value.	
17	Scroll to and select 'Back to Previous Menu'.	Returns to the 'HP83236A Manual Control Main Menu' window.
18	Zero the power meter and connect the HP8482A power sensor to it.	
19	Calibrate the power meter according to the meter's manual.	
20	Connect the HP8482A sensor head to the HP83236A RF OUT ONLY port.	
21	Verify that the meter reads approximately -10dB.	Meter reading is -10dB ±0.2dB.
22	From the HP437 power meter, press the 'REL' key ***unless this is a remote RFFE application*** (see below). ***Note:*** For remote RFFE applications, note the output power directly from the HP83236A RF OUT ONLY port. This will be approximately -10dBm. Do not press the 'REL' button for remote applications.	The meter reference power is set to 0.0dB.

-sheet 2 of 3-

Procedure 3-11
Cable loss calibrations (continued)

Step	Action	Outcome
23	Disconnect the HP8482A power sensor from the HP83236A RF OUT ONLY port. ***Note:*** For remote RFFE applications, take the HP437 power meter to the RFFE end of the cable. If the power meter must be disconnected to move it to the RFFE end of the cable, the HP437 power meter will have to be re-calibrated before being used.	
24	Connect one end of the cable to be tested to the HP83236A RF OUT ONLY port.	
25	Connect the other end of the cable to be tested to the HP8482A power sensor.	
26	Record the loss from the power meter display on a form similar to that found in Figure 3-16 as the sector 'Enc to RFFE' TX, RX0, or RX1. Label the loss on the cable. ***Note:*** For remote RFFE applications, the cable loss will be the difference between the HP8921A direct output value measured in Step 20 (approximately 10dB) and the value measured at the end of the cable under test. Record this value in the table, and label the cable with it.	
27	Repeat the procedure until all provisioned 'Enclosure to RFFE' cables are measured and labeled, and these values recorded in the form.	Each test cable is measured for loss.

-sheet 3 of 3-

Calibration software download

Perform the following setup steps; then proceed to Procedure 3-12.

1. Download files should have been created to reflect the cable losses from the BTS enclosure to the RFFE for the transmit path as well as both receive diversity 0 and diversity 1.
2. Download the BTS using the 'XXXrcp.bgi' file if RF Calibration is to be performed. If this has been done, the BMU will be at the 'RF TX Calibration' window and the calibration software has already been downloaded. At that point, proceed to *Transmit power tests* on page 3-45 and begin the transmit power tests. If the calibration software was not loaded, proceed to Step 3 below.
3. Ensure the 45-1701 cable is connected from the BMU MICC port to the 25-pin J4 BTS Maintenance Unit port at the top front of the BTS.
4. Ensure that the 'Ant 0' port J4 on the RFFE is terminated with a 30dB 50W attenuator. Make sure that all sectors provisioned and powered-up are terminated this way.

Caution
RF exposure / equipment damage
Failure to terminate the RFFE J4 port while the HPA is enabled can result in personal injury or equipment damage.

5. Go to Procedure 3-12 to download calibration software.

   Note: Specific load file names may differ due to ongoing software development. If you are unsure of the file name, or if you encounter problems, contact your TAS representative.

Procedure 3-12
Calibration software download

Step	Action	Outcome
1	Ensure that each RFFE transmit J4 port is terminated to the transmit antenna through a 30dB 50W attenuator.	
2	Connect the 45-14322 cable from the XDM PC MICC connection to the front of the UCC card in slot A12 of the MDS. The port is labeled 'XDM'.	

-sheet 1 of 4-

Procedure 3-12
Calibration software download (continued)

Step	Action	Outcome
3	Click the SDM icon (or type 'xdm' from the SDM working directory) and select 'Connection' from the SCM top menu bar.	'Connect' window is displayed.
4	Select 'Lite'.	XDMSlite options are displayed.
5	Select 'Target Sync'.	XDMSlite Server window opens and is ready for monitoring.
6	Cycle power to the TST shelf using circuit breaker 5.	Verify power is turned OFF and then turned back ON to the TST shelf.
7	Cycle power to the MDS with circuit breaker 1.	Verify power is turned OFF and then turned back ON to the MDS. Wait approximately eight minutes until the alarm LED on the UCC card goes out. Also from the XDMSlite window, 'AIS Child Ready For Download' is displayed within 15 minutes. If the message does not appear, verify the XDM connections and cycle CB1 again.
8	From the BMU, double click on the 'BMUGUI' icon (or type 'bmu' from the d:\2413\bin directory).	BMU GUI window opens.
9	From the BMU select 'BTS Configuration' from the top Tools bar.	Configuration window appears.
10	Click on 'Select BGI File'.	File choices are displayed.
11	select 'XXXrcp.bgi'.	Confirmation window appears.
12	Click on 'OK' to confirm.	The XDMSlite window scrolls as the MDS starts to load. This file loads the entire BTS and takes approximately 45 minutes to complete.
13	When the 'exec address' is displayed on the XDM PC, select 'Connection' from the top Tools menu bar.	
14	Select 'Disconnect'.	
15	Move the XDM cable from the front of the MDS UCC card in slot A12 to the CSM card in slot A5.	
16	Select 'Connection' from the XDM top menu bar.	
17	Select 'Lite'.	
18	Select 'Target Sync'.	XDMSlite Server window opens and is ready for monitoring.
19	When the 'exec address' is displayed on the XDM PC, select 'Connection' from the top Tools menu bar.	
20	Select 'Disconnect'.	XDMSlite window is disconnected.
21	Move the cable along the provisioned CSM cards depending on how many are provisioned. Begin with slot A5, then A6, then begin counting at slot A1 if provisioned.	Verify the scrolling of the XDMSlite screen as each CSM card is downloaded.
22	Select 'Connection' from the SDM top menu bar.	

-sheet 2 of 4-

Procedure 3-12
Calibration software download (continued)

Step	Action	Outcome
23	Select 'Lite'.	
24	Select 'Target Sync'.	
25	When the last provisioned CSM card 'exec address' is displayed on the XDM PC, select 'Connection' from the top Tools menu bar.	
26	Select 'Disconnect'.	
27	Move the cable from the CSM cards to the TCC card in slot A2 of the TST shelf.	
28	Select 'Connection' from the XDM top menu bar.	Connect window is displayed.
29	Select 'Lite'.	
30	Select 'Target Sync'.	
31	When the 'exec address' is displayed on the XDM PC, select 'Connection' from the top Tools menu bar.	Connect options are displayed.
32	Select 'Disconnect'.	
33	Select 'Connection' from the XDM PC top menu bar.	
34	Select 'Connect'.	XDM window is displayed.
35	Select 'Target Sync'.	Opens XDM windows.
36	Completion of the BTS download is indicated by the 'RF TX Calibration' window on the BMU.	The current 'Attenuation' and 'Power Output' is indicated in the window. The 'Power Output' will be 0 Watts.
37	Check the MDS (BIU) front panel LEDs.	Verify the following LEDs are ON: Slot A12 Power, Enabled, Active Slot A13 Power Slot A14 Power, Enabled, Active Slot A15 Power Slot A16 Power, Enabled, Active Slot A17 Power, Enabled, Active Slot A18 Power, Enabled
38	Check the TFU front panel LEDs.	Verify the following LEDs are ON: Slot A9 Power, Enabled, Active Slot A10 Power Slot A11 Blank

-sheet 3 of 4-

Procedure 3-12
Calibration software download (continued)

Step	Action	Outcome
39	Check the CSM front panel LEDs.	Verify the following LEDs are ON: (Slot A1) Power, Enabled, Active (Slot A2) Power, Enabled, Active (Slot A3) Power, Enabled, Active (Slot A4) Power, Enabled, Active Slot A5 Power, Enabled, Active (Slot A6) Power, Enabled, Active Slot A7 Power, Enabled, Active * ( ) denote provisional and may be on or off
40	Check the TCC front panel LEDs.	Verify the following LEDs are ON: Slot A1 Power, Enabled, Active Slot A2 Power, Enabled, Active Slot A3 Power Slot A4 Power, Enabled, Active Slot A5 Power, Enabled Slot A6 Power, Enabled, Active (Slot A7) Power, Enabled (Slot A8) Power, Enabled, Active (Slot A9) Power, Enabled * ( ) denote provisional and may be on or off
41	If an XDM is available, check the XDM window.	Verify the following from the 'Alpha TCCRCA Calibration' window: Sector Id - indicates sector Administration State - Unlocked Operational State - Enabled Usage State - Idle HPA State - Enabled CDMA Center Freq - (Site frequency) TFU Source - TFU 1 Transmit Power - 0dB/16

-sheet 4 of 4-

Transmit power tests

The purpose of the Transmit Power Test is to calibrate the `TxAttenNormal` parameter in a known configuration. This helps ensure the BTS will operate nominally.

This procedure also verifies that the accuracy of the RFFE power sensor to within the following limits:

- for a BTS being calibrated where the ambient temperature is between 50°F (10°C) and 86°F (30°C), the output power must fall between:

  3.35W≤`SectorTxPower`≤4.73W

  - or -

  35.25dBm≤`SectorTxPower`≤36.75dBm

- for a BTS being calibrated where the ambient temperature is outside the range of 50°F (10°C) and 86°F (30°C), the output power must fall between:

  2.99W≤`SectorTxPower`≤5.31W

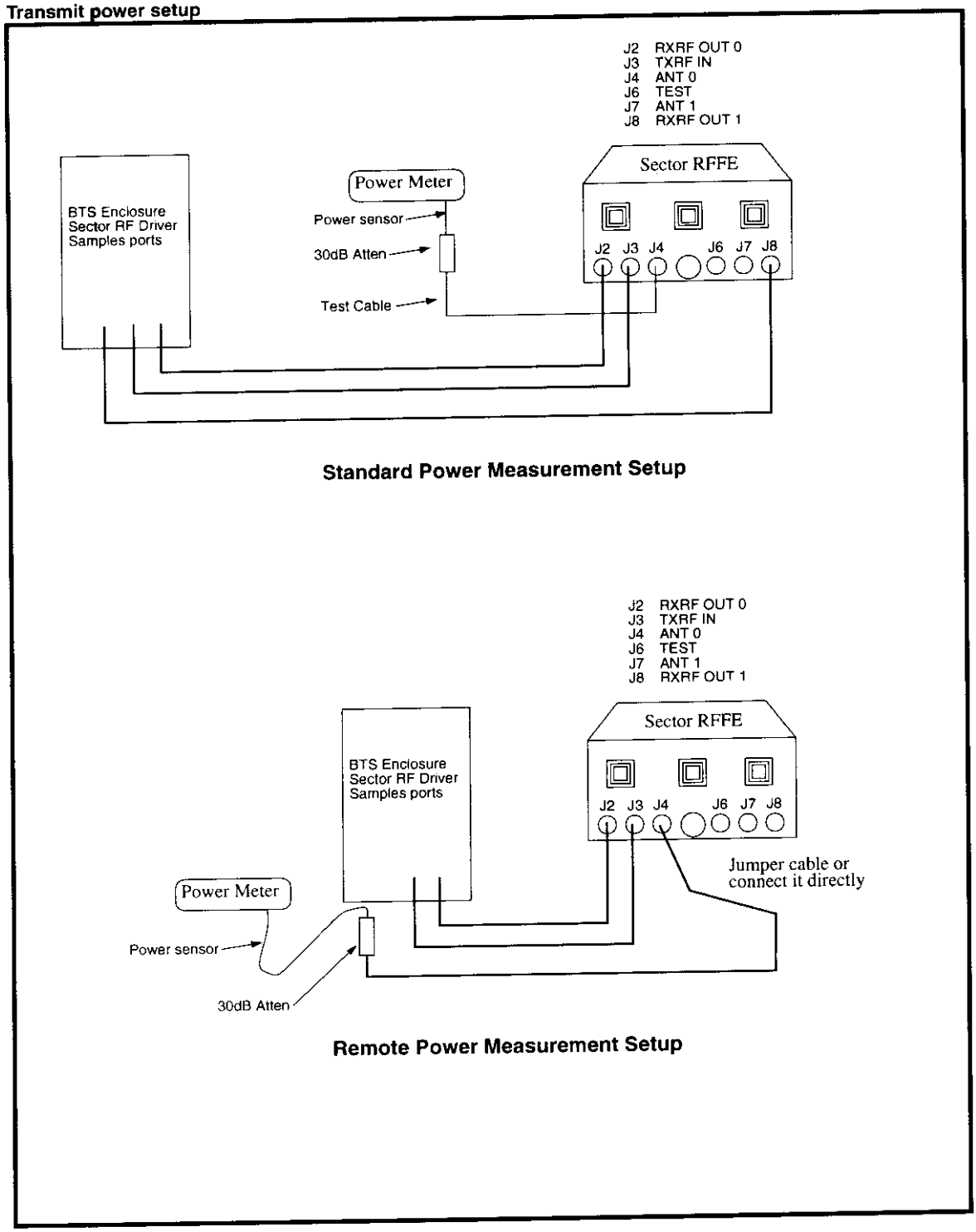
  - or -

  34.75dBm≤`SectorTxPower`≤37.25dBm

At this point, the BTS should be powered-up with the calibration software downloaded. All provisional sectors should be ENABLED and ACTIVE, but NOT transmitting RF power. Note the following points:

1. The BTS will be calibrated for 4W (36dB or 576/16dB), full digital gain (`PilotDigitalGain` 0xFE or 254), single Walsh code signal (PILOT), using software resident in the BMU.
2. The RFFE J4 (ANT0) port on all provisioned sectors must be terminated with either a transmit antenna, or a 30dB 50W attenuator during this test.
3. Ensure the BMU is connected to the BTS craft panel 'BTS Maintenance Unit' J4 port (BCN port 3 of the DISCO backplane) located above the TST shelf communicating to the BTS.
4. It is recommended that sections *Transmit power tests* on page 3-45, *Code domain power measurements* on page 3-49, and *Receiver path verification* on page 3-54 be performed on the Alpha sector first. Then, if provisioned, repeat them for the Beta and Gamma sectors.
5. Refer to Figure 3-18 for connectivity information for both a standard installation, as well as a remote RFFE configuration.

Figure 3-18
Transmit power setup



Note 1: Each provisioned RFFE will need to be transmitting RF power for 30 minutes before stable readings can be achieved. Warm up time required may vary, but 30 minutes is recommended.

Note 2: The HP437B power meter requires warming up for approximately 30 minutes before stable readings are possible. The operating range of the power meter and the HP8284 power sensor is 32°F (0°C) to 131°F (55°C).

Note 3: The HP437B power meter and the HP8284 power sensor are affected by temperature. If they are ever moved from a sheltered to an unsheltered environment, recalibrate the power meter and allow it to reach thermal equilibrium. This takes approximately 30 minutes.

Note 4: BTS calibration is influenced by the ambient temperature of the BTS, RFFEs, the PCS drivers, and the upconverters. The ambient temperature must be recorded as part of the procedure.

Note 5: As part of this procedure, accuracy of the RFFE power sensor determined. As such, it is critical that the loss of all test cables and attenuator is known at the PCS frequencies.

Caution
RF exposure / equipment damage
Failure to terminate the RFFE J4 port while the HPA is enabled can result in personal injury or equipment damage.

Caution
Equipment damage
Failure to connect a 30dB attenuator between the RFFE J4 (ANT 0) port and the HP8482 Power Sensor head attached to the HP437B Power Meter will result in damage to the sensor head, and possibly the meter.

Follow Procedure 3-13 to calibrate the system, to obtain a value for `TxAttenNormal`, and to verify that the RFFE calibrations tables have been properly loaded.

Procedure 3-13
Transmit power calibration

Step	Action	Outcome
1	Calibrate the power meter using the manufacturer's recommended procedure.	Power meter is calibrated with the sensor head looped back to the power meter.
2	Take into account the attenuator loss and any other RF cable attenuation from the RFFE J4 port to the RFFE and input as the 'Offset' on the power meter. ***Note 1:*** The attenuator loss is approximately 30dB but needs to be more exact. The actual loss of the attenuator should be marked on it. Use this number. ***Note 2:*** For remote RFFEs, the 'Offset' loss includes the RFFE J4 jumper to the RX1 cable, the RX1 to enclosure cable loss measured earlier, the RX1 cable jumper to the 30dB attenuator, and the attenuator to the power meter.	The 'Offset' is set to '-30' plus any other cable loss on the power meter. The cable loss between the RFFE and power sensor must be included in the 'Offset'.
3	Connect the power sensor attached to the power meter to the RFFE J4 port of the sector to be calibrated.	Transmit port is terminated. Refer to Figure 3-18 for connectivity details.
4	For stability, each RFFE to be calibrated must be transmitting for 30 minutes prior to readings being taken. Ensure each provisioned sector is terminated with a 30dB attenuator on the RFFE J4 port. The sector being calibrated will be terminated through the 30dB attenuator to the power sensor.	
5	The 'Attenuation' value from the 'RF TX Calibration' window shows '56' with a power of approximately '0'.	Verify from the 'RF TX Calibration' window that the power is approximately zero.
6	Select the sector to be calibrated (Alpha, Beta or Gamma) from the BMU. ***Note:*** Ensure the sector is terminated.	
7	Click on the 'Autocal' button to start the sector transmitting.	The sector adjusts the output power to approximately 4W.
8	Repeat Steps 6 and 7 for each provisioned sector.	Each provisioned sector is transmitting through the 30dB attenuators.
9	Wait 30 minutes for the RFFEs to stabilize.	
10	Ensure that the sector to be calibrated is selected on the 'RF TX Calibration' window.	Proper sector is selected.
11	Ensure the HP437B and HP8482A are terminated to the 30dB attenuator off of the sector RFFE J4 port.	

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Procedure 3-13
Transmit power calibration (continued)

Step	Action	Outcome
12	From the BMU, click on the 'Auto Cal' button to auto calibrate to a 4W signal output.	Information is updated and the power in Watts is displayed in the BMU window. This figure is close to the actual power out measured by the HP power meter.
13	Adjust the up and down arrows of the 'RF TX Calibration' BMU window in 0.5 increments and update the information to obtain a 4W ±.1W output power reading on the HP.	HP power reading is 4W ±.1W.
14	Record the power meter reading in Watts. Also record the reading in 'Watts' from the BMU window. Use the form in Figure 3-16. ***Note:*** If the readings are not within the correct tolerances, replace the RFFE.	Verify the tolerances according to the outside ambient temperature. Between 50°F (10°C) and 86°F (30°C), the difference should be ±0.75dB. Outside that range, the tolerance is ±1.25dB.
15	Record the 'Attenuation' value off the BMU window.	
16	Adjust the up and down arrows of the 'RF TX Calibration' BMU window to obtain an attenuation of '56' with approximately 0 power.	BMU power display shows approximately zero.
17	Disconnect the power meter and power sensor from the RFFE J4 port 30dB attenuator.	

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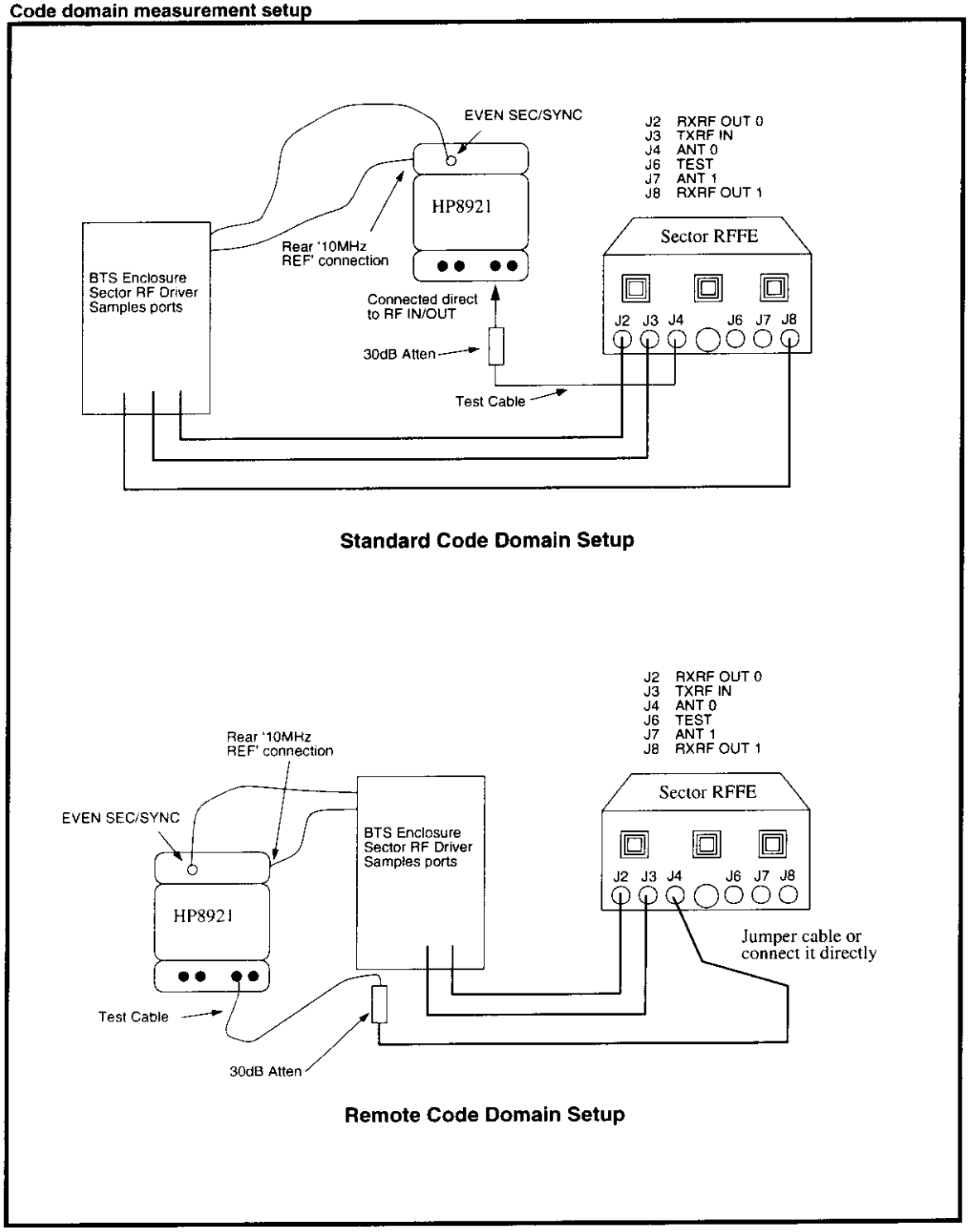
Code domain power measurements

Perform the following setup steps; then proceed to Procedure 3-14.

1. Ensure that when the calibration software is downloaded, all channels are active except the pilot channel
2. The following cable connections are required:
   - HP83236A RF IN / OUT port to the sector RFFE J4 port
   - HP8921A Even Sec / Sync port to RFFE J5 port above the TST shelf
   - HP8921A rear 10MHz OUT port to the HP83236A rear 10MHz IN
   - HP8921A rear SYNTH REF IN port to J5 10MHz port above the TST shelf
3. Refer to Figure 3-19 for code domain power measurement connectivity information.

Figure 3-19
Code domain measurement setup



Procedure 3-14
Code domain power measurements

Step	Action	Outcome
1	Ensure the RF IN/OUT port of the HP83236A is terminated with the 30dB attenuator off the RFFE J4 port. Refer to Figure 3-19 for standard and remote RFFE connectivity information.	Transmit port is terminated.
2	The 'Attenuation' value from the 'RF TX Calibration' window will show '56' with a power of approximately 0.	Verify from the 'RF Calibration' window that the power is approximately 0.
3	Insert the program memory card into the 8921A.	
4	Press the green PRESET button.	RX TEST window appears.
5	Scroll to and select 'Amplitude'.	Cursor is positioned on the Amplitude field and the number is highlighted.
6	Press the ON/OFF button, then press the ENTER button.	Amplitude display shows 'OFF'.
7	Scroll to 'TO SCREEN', and select' MORE'.	More choices are displayed.
8	Select 'CDMA GEN'.	CDMA GENERATOR screen is displayed. Ignore the CHAN PWR and ADC FS indications.
9	Verify Amplitude is OFF and go to Step 11. If it is not, repeat Steps 5 and 6; then proceed to Step 11.	
10	Press the 'Tests' key on the HP8921A.	'Tests (Main Menu)' window appears.
11	Select 'Select Procedure Location'.	
12	Select 'Card'.	
13	Select 'Select Procedure Filename'.	
14	Select 'Manual'.	'HP83236A Manual Control Main Menu' appears, and options are displayed.
15	Select 'Run Test'.	'HP83236A Manual Control Main Menu' window appears and an HB-IB bus configure confirmation window may appear if the first test is installed.
16	If prompted, select 'Yes' to continue the operation.	
17	Select 'Change System Settings'.	'System Type and Connection Menu' appears.
18	Check the fields and modify if necessary. ***Note:*** The attenuator loss is approximately 30dB but needs to be more exact. The actual loss of the attenuator should be marked on it. Use this number.	Verify the following fields: Equipment Type — Base Station Frequency Band — 1850-1990MHz Channel Type — CDMA HP83236A RF OUT Port — RF OUT ONLY Transmitter Test Cable Loss — 30.0dB + cable Receiver Test Cable Loss — 0.0dB
19	Select 'Back to Previous Menu'.	
20	Check the fields and modify if necessary	Verify the following: Channel number — *(CDMA chnl #)*

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Procedure 3-14
Code domain power measurements (continued)

Step	Action	Outcome
21	Select 'Analyzer Attenuation'.	'Analyzer Path Attenuator Setting' options appear.
22	Select 'User Fixed Atten. Settings'.	
23	Enter '0' for the attenuation value.	
24	Select 'Back to Previous Menu'.	Returns to the 'HP83236A Manual Control Main Menu' window.
25	Select 'HP83236A TX Power Measurement'.	
26	Select 'Change Power Measurement Settings'.	Verify the following fields: Trigger Type IMM Samples to Collect 4800
27	Select 'Previous Menu'.	'HP83236A Power measurement Main' window appears.
28	Select 'Pause for Manual HP892NX Measurements'.	Explanation appears.
29	Scroll to 'TO SCREEN'; select 'MORE'.	
30	Select 'CDMA ANL'	CDMA analyzer screen is displayed.
31	Select 'Chan Pwr' field.	Avg Pwr field is highlighted and cursor is moved to 'Choices' window.
32	Select the 'Rho' field.	
33	Check the HP DCMA ANALYZER fields and modify if necessary.	Verify the following fields: Tune Freq (800MHz range) (Site center freq) Input Atten 0 Input Port RF IN / Ant Synth Ref 10 CDMA TB Internal PN Offset (Site PN offset) Meas Intvl 1.0 Gain Auto / hold Anl Dir Fwd / Rev Analyzer Single / Cont Qual Event None Trigger Event 27ms ***Note:*** The PN offset can be checked in the system.dfg file if you aren't sure what it is.
34	At the BMU, adjust the up and down arrows of the 'RF TX Calibration' BMU window to the attenuation level determined earlier (see Procedure 3-13) to obtain an output of 4W.	The attenuation value is set and the output is approximately 4W. (The power meter watt reading reflects the accurate output.)
35	Check the Rho reading in the meter's top left corner.	Reading is > 0.912 with pilot only. Enter this value in the checklist (use a form similar to Figure 3-16).
36	Check the 'Time Offset' reading (CDMA base station transmitter accuracy synchronized to its own CDMA clocks).	Reading is <10µsec offset. Enter this value in the checklist.

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Procedure 3-14
Code domain power measurements (continued)

Step	Action	Outcome
37	Check the 'Carrier Feedthru' reading (indicates the level of RF carrier suppression in the base station I/Q modulator).	Signal is <-25dB. Enter this value in the checklist.
38	Scroll to 'TO SCREEN' and select 'MORE'.	
39	Select 'CODE DOM'.	Code Domain Analysis screen is displayed.
40	Check the 'HP CODE DOMAIN ANALYZER' fields. Modify if necessary.	Verify the following fields: Controls — Main RF IN / Ant Tune Freq — (Site center freq) Measurement — Power Single / Cont
41	Select the 'Main' field.	
42	Select 'AUX'.	
43	Check the HP Auxiliary fields and modify if necessary.	Verify the following field: PN Offset — (Site PN offset) ***Note:*** The PN offset can be checked in the system.dfg file if you aren't sure what it is.
44	Scroll to 'Controls' and select 'AUX'.	
45	Select the 'Refs' field.	
46	Check the HP Refs fields and modify if necessary.	Verify the following fields: Synth Ref — 10 CDMA TB — Internal
47	Select the 'Refs' field.	
48	Select the 'Gain' field.	Gain choices are displayed. ADC FS reading is between -1 and -10.
49	Check that the base HP is able to lock onto the 64 Walsh channels, and that only the Pilot channel is transmitting. The 'Ref Unlock' light should not be lit.	HP Code Domain Analyzer is correlated to the signal and the 64 Walsh channels are displayed. Record 'Yes' in the checklist in 'Code Domain Lock'.
50	Adjust the up and down arrows of the 'RF TX Calibration' BMU window to obtain an attenuation of '56' with approximately 0 power.	The BMU power display shows approximately 0.
51	Return to the 'HP83236A Manual Control main Menu' by pressing the 'Tests' button and selecting 'Continue'.	'Return to IBASIC Program Continue' is displayed at the top of the screen.
52	Select 'Quit' to exit the PCS program.	Returns to the 'Tests' screen.

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4. Once all provisioned sectors have been transmit calibrated and the Calibration checklist updated to reflect the measured values, a check of the sector imbalance is necessary. Note the 'BMU Power @ 4W' values for each sector in the Calibration Checklist, and compare the values. They should be within ±1.1W of each other. If not, a hardware or calibration

fault exists and must be corrected. Check the appropriate box in the checklist.

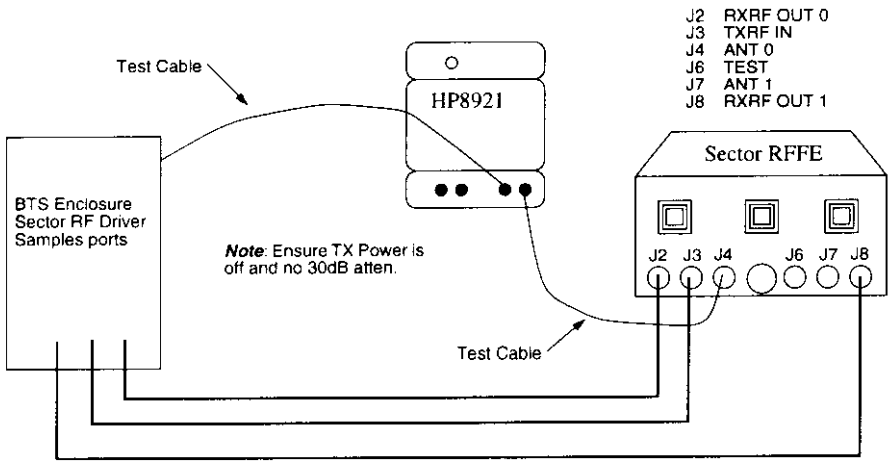
Receiver path verification

The procedure in this section verifies receiver functionality. It must be repeated for each receive path (main and diversity if used). It is best to begin with diversity 0 and complete all receiver tests, the repeat for diversity 1.

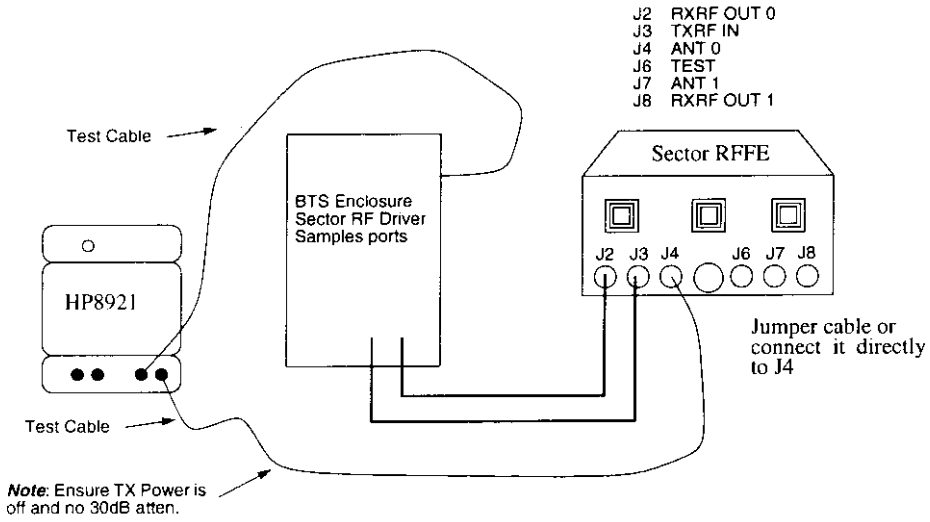
Perform the following setup steps; then proceed to Procedure 3-15.

1. This test requires an input cable into the RFFE and a measurement at the BTS. The cable loss between the RFFE and the BTS must be known for accurate results. If the RFFE is remote from the BTS, take the input signal up to the RFFE on the TX cable, and jumper the input signal to the appropriate receive diversity input and read the RFFE RX0 or RX1 outputs at the RF driver sample port (keeping cable losses in mind).Refer to Figure 3-20 for connectivity information.

Figure 3-20
Receive path verification setup



Standard Receive Gain Setup



Remote Receive Gain Setup

2. At this point, the Alpha sector should be powered up with the TCC calibration software downloaded.

Caution
RF exposure / equipment damage
Failure to terminate the TX port while the HPA is enabled can result in personal injury or equipment damage.

Note: The receive frequency is 80 MHz less than the site center frequency when setting the transmit and receive tune frequencies.

3. Perform Procedure 3-15 to verify the receive functionality of receive diversity 0.

Procedure 3-15
Receive path verification

Step	Action	Outcome
1	Verify the 'Attenuation' value from the 'RF RX Calibration' window shows '56' with power of approximately 0.	
2	Connect the calibrated RF cable between the HP89326A RF OUT ONLY port and the RFFE J4 port without the 30dB attenuator connected.	Refer to Figure 3-20 for connectivity.
3	Connect an RF cable between the HP89326A RF IN/OUT port and the DIV 0 receive port at the Alpha RF driver module.	
4	Insert the program memory card into the 8921A.	
5	Press the green PRESET button on the HP to reset the equipment to default values.	RX TEST window appears.
6	Scroll to and select 'Amplitude'.	
7	Press the ON/OFF button, then press the ENTER button.	'Amplitude' display shows 'OFF'.
8	Scroll to 'TO SCREEN' and select 'MORE'.	
9	Select 'CDMA GEN'.	'CDMA GENERATOR' screen is displayed. Ignore the 'CHAN PWR' and 'ADC FS' indications.
10	Verify the amplitude is OFF and go step 12. If it is not OFF, repeat steps 6 and 7; then proceed to step 12.	
11	Press the 'Tests' key on the HP8921A.	'Tests (Main Menu)' window appears.
12	Select 'Select Procedure Location'.	

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Procedure 3-15
Receive path verification (continued)

Step	Action	Outcome
13	Select 'Card'.	
14	Select 'Select Procedure Filename'.	
15	Select 'Manual'.	'HP83236A MANUAL CONTROL' appears.
16	Select 'Run Test'.	'HP83236A Manual Control Main Menu' window appears and an HB-IB bus configure confirmation may appear if first test is installed.
17	If prompted, select 'Yes' to continue the operation.	
18	Select 'Change System Settings'.	'System Type and Connection Menu' appears.
19	Check the fields and modify if necessary.	Verify the following fields: Equipment Type — Base Station Frequency Band — 1850-1990MHz Channel Type — CDMA HP83236A RF OUT Port — RF OUT ONLY Transmitter Test Cable Loss — cable(s) loss Receiver Test Cable Loss — (cable loss in dB)
20	Select 'Back to Previous Menu'.	Returns to the 'HP83236A Manual Control Main Menu' window.
21	Check the fields and modify if necessary.	Verify the following fields: Channel number — CDMA cH # RF Generator level — -40dB
22	Select 'Analyzer Attenuation'.	'Analyzer Path Attenuator Setting' options appear.
23	Select 'Use Fixed Atten. Settings.'	
24	Enter 0 for the attenuation value.	
25	Select 'Back to Previous Menu'.	Returns to 'HP83236A Manual Control Main Menu' window.
26	Select 'HP83236A TX Power Measurement.	
27	Select 'Change Power Measurement Settings'.	Verify the following fields: Trigger Type — IMM Samples to collect — 4800
28	Select 'Back to Previous Menu'.	'HP83236A Power Measurement Main' window appears.
29	Select 'Back to Previous Menu'.	'HP83236A Manual Control Main Menu' window appears.
30	Select 'Pause for Manual HP892NX Measurements'.	Explanation appears informing that return to this screen, press 'Tests' and 'Continue'.
31	Scroll to 'TO SCREEN' and select 'MORE'.	
32	Select 'CDMA GEN'.	'CDMA GENERATOR' screen is displayed. Ignore the 'CHAN PWR' and 'ADC FS' indications.

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Procedure 3-15
Receive path verification (continued)

Step	Action	Outcome
33	Check the 'CDMA GENERATOR' fields. Modify fields as necessary.	Verify the following fields: RF GEN Freq (center freq -80MHz) Amplitude 40dBm Output Port RF OUT / Dupl Synth Ref 10 CDMA TB Internal PN Offset (Site PN offset) Even Sec In Enable / Not Gen Dir Fwd / Rev Gen Mode Data Data Source Zeroes CW Path Bypass / IQ
34	Select 'SPEC ANL'.	The 'Spectrum Analyzer' screen is displayed.
35	Verify that 'RF IN' in the 'RF IN / ANT' field is underlined. If not, select it.	RF IN' is underlined. Ignore the Ref Level at this time.
36	Select 'SPAN'.	
37	From the Data pad, enter a span of '5' and then press the ENTER button.	Span is set to 5MHz.
38	Select 'Main'.	
39	Select 'Auxiliary'.	
40	Scroll to the position directly under the 'Auxiliary' prompt (AVG options).	
41	Select 'AVG 5'.	
42	Select 'Attenuation'.'	
43	Enter an attenuation of '0'.	
44	Select 'Center Freq'.	
45	From the Data pad, enter the receive center frequency from step 33 and press the ENTER button.	
46	Verify the signal is present on the HP8921A.	
47	Select 'CDMA GEN'.	'CDMA GENERATOR' screen is displayed. Ignore the 'CHAN PWR' and 'ADC FS' indications.
48	Select the 'Amplitude' field.	
49	Press the 'On/Off' button, and then the 'Enter' button to turn the generator off.	The 'Amplitude' field displays 'Off'.
50	Verify the signal is removed from the HP8921A.	
51	Enter 'Yes' in the checklist (see Figure 3-16) for 'Receive Wilt' if the signal is removed from the receive path.	

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4. Remove the cable end terminated on the Alpha RF driver Div 0 port. Terminate the end on the Alpha diversity 1 port.

5. Repeat the entire procedure for Receive diversity 1.
6. Repeat the procedure for each sector provisioned.
7. When complete, properly reconnect all cables.

BTSC monitoring and reporting

The Processor Utilization Statistics feature monitors and reports utilization statistics on critical processors such as the BTS Controller (BTSC) via the BSM (Base Station Monitor) or NOC (Network Operations Center). The statistics can be queried and/or an alarm can be generated when a definable threshold is met.

Processor utilization for critical processors is useful to help determine subsystem utilization and performance during high traffic loads.

This feature provides a mechanism for collecting and reporting the processor utilization information of the critical processors of the BSC (Base Station Controller) and BTS (indoor or outdoor) in the MTX-CDMA system.

Functional overview

This feature provides support for the following functions:

- The ability for the critical processors; the SBSC (at the BSC), the BTSC and the BSM, to compute and store the processor utilization information.
- The ability to query and display the processor utilization information of the critical processors through the BSM user interface including the Graphical User Interface (GUI) and the Command Line Interface (CLI).
- The ability to set a threshold value for processor usage of a critical processor through the BSM user interface including the GUI and the CLI. The value of a threshold indicates the beginning point of high processor usage.
- The ability for the critical processors to send event reports to the BSM so that alarms can be generated and displayed to the users when the processor usage has reached the set threshold.
- The ability to allow querying and displaying the processor utilization information, setting threshold values, receiving event reports and displaying alarms on a remote NOC.
- The ability to engage and disengage upon requests the functionality provided by this feature.

Compute and store the processor utilization information

This feature provides a mechanism to compute and store the processor utilization information of the critical processors. On the BTSC and SBSC, this feature makes use of the operating systems to compute the processor usage at a regular interval, and provides a new Performance and Utilization Managed Object (MO) for a subsystem to store these computed usage. The processor usage for the BTSC and SBSC is averaged over a 4-second time interval.

Query and Display the Processor Utilization Information

This feature provides an interface to query and display the processor utilization information of the critical processors.The processor usage and threshold can be queried from the individual Performance and Utilization MOs in the MO tree of the BSM navigator and the CLI.A new BSM GUI is provided to select a set of processors, query and display the processor usage and thresholds as a group.

Set Threshold Values

This feature provides the craftsperson with a mechanism to set the threshold values of the processor usage individually for the critical processors through the BSM GUI and CLI.

A threshold value is a percentage value ranging from 0 to 99. The threshold can also be disabled by using the BSM GUI and CLI. The craftsperson can choose to not be notified of high processor usage conditions for a critical processor by disabling the threshold.

As shown in Table 3-5, there is a default threshold value provided for the processor usage of each critical processor type.

Table 3-5
Default threshold values

Processor Type	Default Threshold Value (%)
BSM	80
SBSC	80
BTSC	80

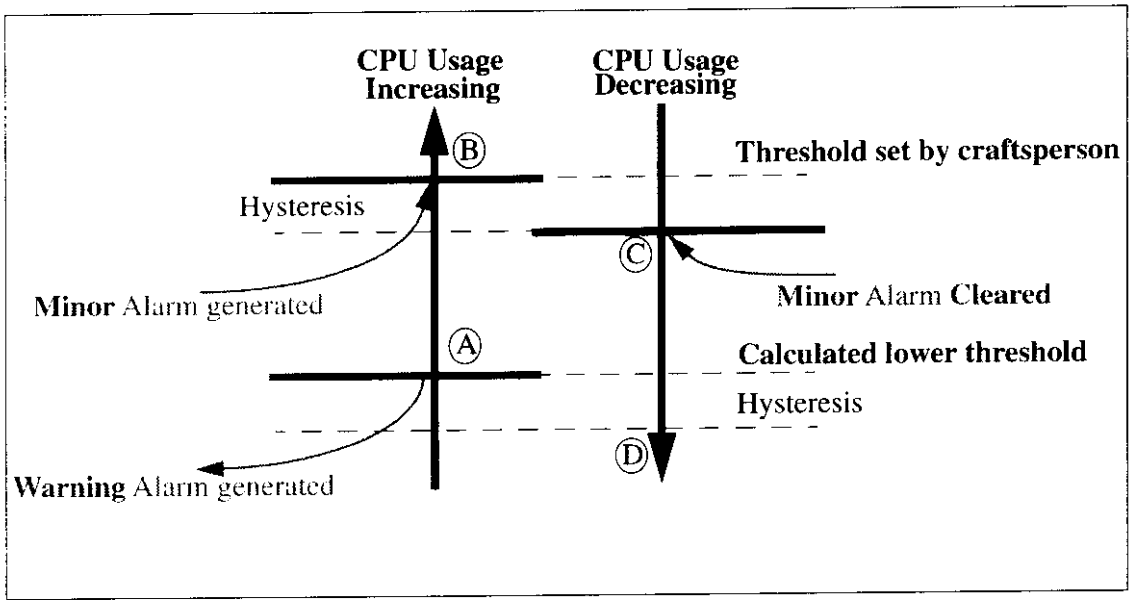
Generate and display alarms

This feature provides a mechanism to notify the craftsperson when the processor usage has crossed the thresholds and the CPU threshold is enabled.

Whenever the processor usage of the critical processors have surpassed the set thresholds, event reports are generated and sent to the BSM from the Performance and Utilization MOs in the critical processors. These event reports are converted into alarms and displayed.

Multi-level alarms notify the BSM of high processor utilization; refer to Figure 3-21. In this mechanism, the craftsperson sets only one threshold but a second **lower** threshold is calculated.

Figure 3-21
Multi-Level Alarms



In the case where the processor utilization is increasing, a lower severity 'Warning' alarm is generated at point A. As the utilization increases to point B, an alarm with a severity of "Minor" is generated and displayed as 'Active.' The 'Minor' alarm is displayed as 'Clear' after the processor usage drops below point C. A 'Clear' 'Minor' alarm is no longer displayed after it has been acknowledged by the craftsperson. A 'Warning' alarm is displayed as 'Clear' by default, and gets removed from the display after the craftsperson acknowledges it. For a 'Warning' alarm to be sent again, the utilization has to go below point D and then reach point A.

The percentage value of the lower threshold is 20 less than the percentage value of the threshold set by the craftsperson. A hysteresis is used to prevent a spate of alarms being generated when the processor usage hovers around the thresholds. The percentage value of the hysteresis is 10 less than the percentage value of the set threshold or the lower threshold.

Alarms are displayed in the existing Alarm Window and presented as Alarm MOs in the MO tree on the BSM. They can also be queried from a CLI.

Engage and disengage processor utilization

You can selectively engage and disengage the functionality provided by this feature if you do not need it.

SWACT

If there are two processors for a subsystem (SBS or BTS), and if the Performance and Utilization MOs representing these two processors are selected for monitoring and reporting of the processor usage information, the Processor Utilization GUI displays the processor usage information for both processors without indicating which one is the active or inactive processor.

Restrictions/limitations

- This feature does not support the CLI to query processor usage and threshold values for a set of critical processors at once.
- This feature does not support the capability of setting threshold values for a set of critical processors at once.

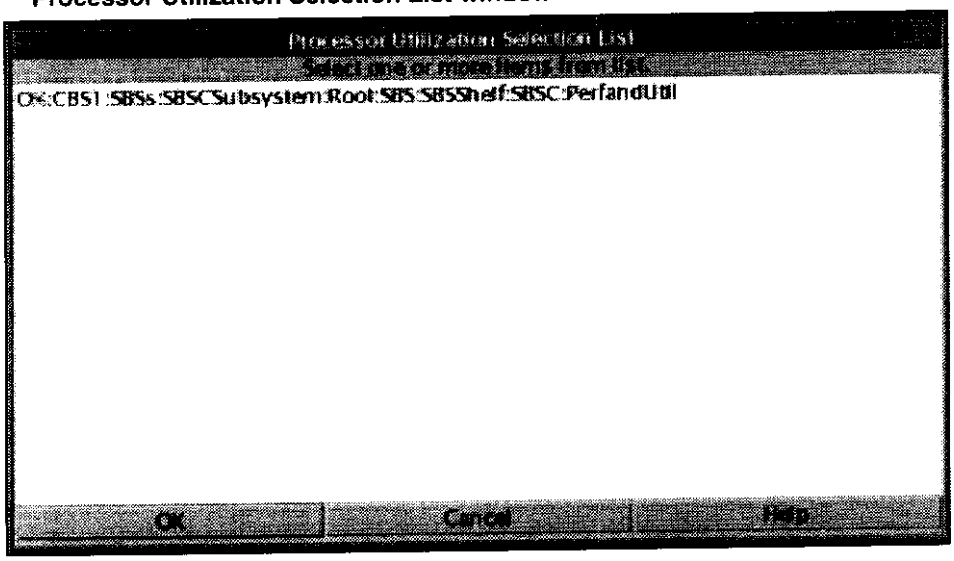
Processor utilization display

A new BSM GUI is provided by this feature to query and display the processor utilization for the BSM, a set of SBSCs, and a set of BTSCs. It allows the craftsperson to select critical processors whose processor utilization information is to be displayed as a group.

Processor Utilization Selection List Window

A selection list containing entries for all the critical processors allows the craftsperson to select/deselect entries from this list. Figure 3-22 shows an example of this window.

Figure 3-22
Processor Utilization Selection List window



The Processor Utilization Selection List window contains a scrollable list of the PerfandUtil MOs for all the SBSCs and BTSCs (Indoor and Outdoor) in the current CDMA system, and a BSMPerfandUtil MO for the BSM.

Multiple items can be selected and deselected from the Selection List Window before clicking the **OK** or **Cancel** button. Both contiguous and discontinuous ranges of items can be selected.

Clicking the **OK** button removes the Processor Utilization Selection List window from the display. The Processor Utilization Display window is popped up and displayed with a list of CPU usage and threshold values of the selected processors.

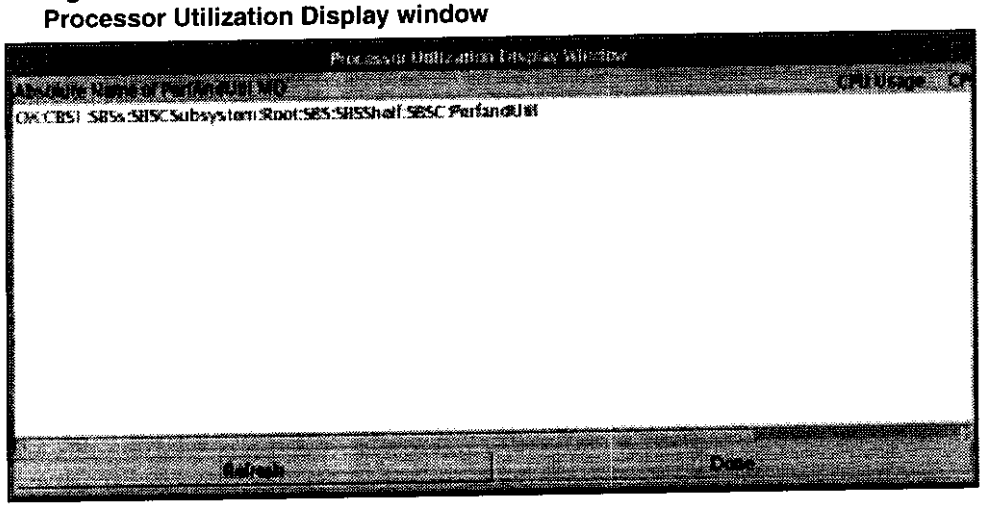
Clicking the **Cancel** button removes the Processor Utilization Selection List window from the display. If no items are selected in the Selection List window, and **OK** button is clicked, the effect is same as clicking the **Cancel** button.

Updating the Selection List Window is not dynamic. For example, if Selection List Window is brought up, then a Performance and Utilization MO gets deleted from the MO hierarchy on the BSM, or if communication to the BSM is lost, the MO continues to stay in the selection list. The deleted MO is not removed from the selection list until the Selection List Window gets closed and brought up again.

Display window

Once the selection has been made, the processor utilization information of selected processors is then displayed in the display window. Figure 3-23 shows an example of this window:

Figure 3-23
Processor Utilization Display window



The Processor Utilization Display window contains a scrollable list displaying the current CPU usage and threshold values of those processors that are selected in the Selection List window. The values of the CPU usage and threshold are for display only. The window contains a horizontal, and a vertical scrollbar on an as-needed basis.

Clicking the **Refresh** button updates the display with the most current values of the CPU usage and threshold for all the processors displayed in the window. The states of the Performance and Utilization MO is properly indicated if the MO is disengaged or deleted from the subsystem at the moment of Refreshing.

Clicking the **Done** button removes the Processor Utilization Display window from the display.

If a Performance and Utilization MO is deleted from the MO hierarchy on the BSM or loses communication to the BSM, and the **Refresh** button is clicked to query the processor utilization information, the entry does not change. The craftsperson must quit out of the Processor Utilization Display Window and re-enter in order to get the updated list of the Performance and Utilization MOs. If the CPU usage and threshold values of a processor are blank, it means that the processor is under a error condition. Check the Alarm window to find out the fault.

Attributes, actions and states

Performance and utilization MO attributes, actions, and states are detailed below.

Edit Attributes Window

The CPU usage and threshold of a given critical processor can be displayed individually in the 'Edit Attributes' dialog window which is brought up from the Performance and Utilization MO for this processor in the BSM Navigator window. An 'Edit Attributes' dialog window exists for every MO created in the BSM Navigator window to allow the craftsperson to edit the attributes of the MO.

The value of the threshold shown in the 'Edit Attributes' window is the most current threshold value used by the critical processor; however, the processor usage value shown in this window may not be up-to-date for the critical processor. The craftsperson needs to press the 'Update Values' button in the window to ensure the current processor usage value is being displayed in the window.

The threshold for a critical processor can also be set by the craftsperson via this 'Edit Attributes' dialog window. The threshold is illustrated in a CPUThresholdEnabled field which indicates if the threshold is enabled, and a CPUThresholdValue field which contains the threshold value. At the time a

Performance and Utilization MO is created, CPUThresholdEnabled is set to true, and the threshold value is set to a default value (80% for the BSM, 80% for the SBSC, and 80% for the BTSC). The craftsperson can set it to values ranging from 0 to 99, or set the CPUThresholdEnabled to 'false' to stop notification of the high processor usage conditions.

Figure 3-24 shows a sample of the Edit Attributes window for the Performance and Utilization MO on the SBSC or the BTSC.

Figure 3-24
Edit Attributes window of the PerfandUtil MO for SBSC

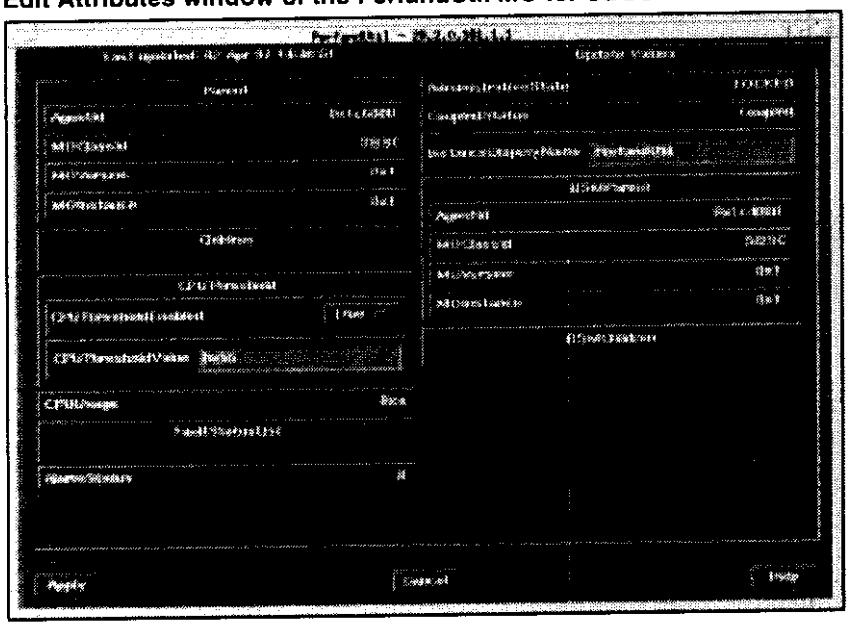
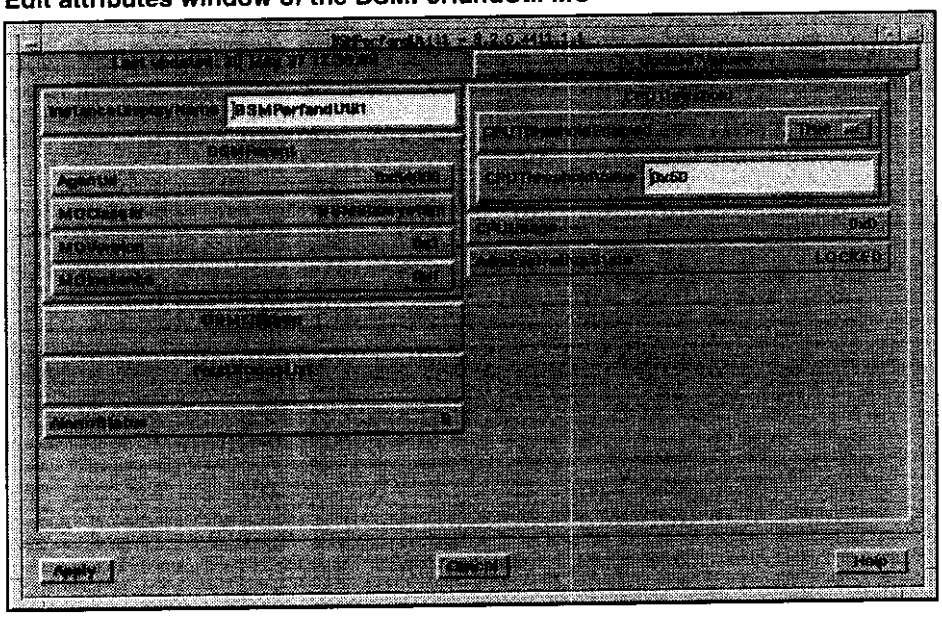


Figure 3-25 shows the Edit Attributes window for the Performance and Utilization MO on the BSM.

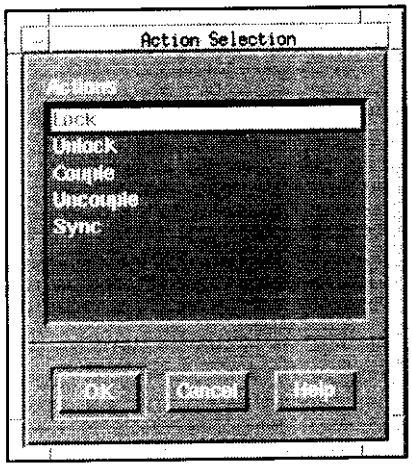
Figure 3-25
Edit attributes window of the BSMPerfandUtil MO



Action Selection Window

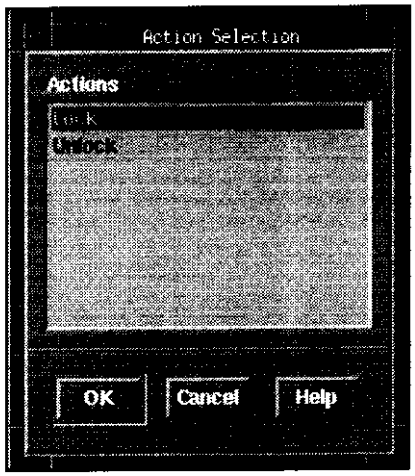
The Performance and Utilization MO on the SBSC or BTSC allows the types of actions shown in Figure 3-26.

Figure 3-26
Action Selection window of the PerfandUtil MO



The Performance and Utilization MO on the BSM allows the types of actions shown in Figure 3-27.

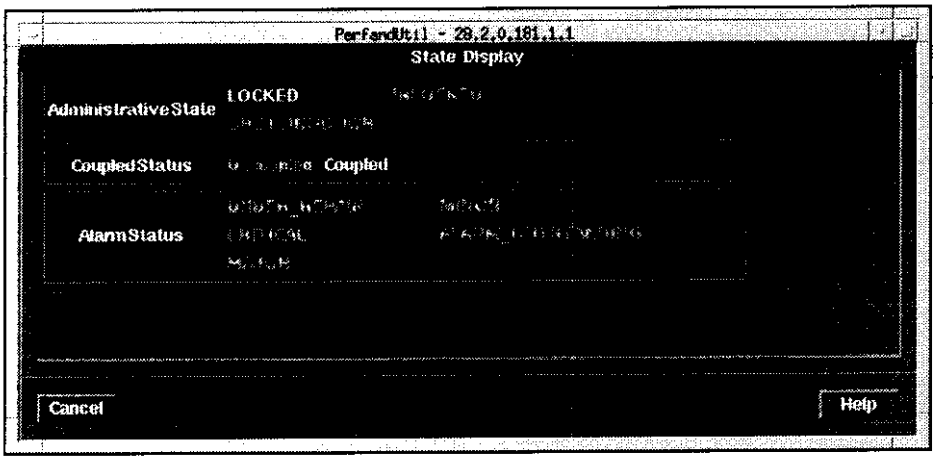
Figure 3-27
Action Selection window of the BSMPerfandUtil MO



State Display Window

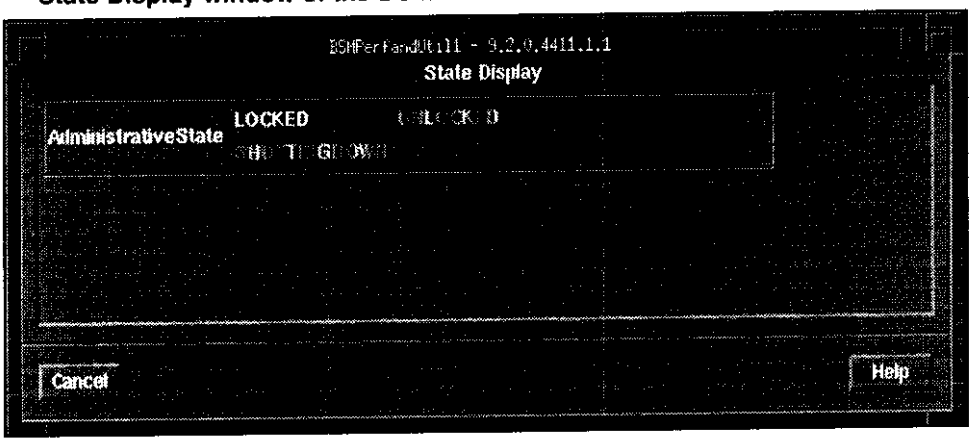
The possible states for the Performance and Utilization MO on the SBSC or BTSC are shown in Figure 3-28.

Figure 3-28
State Display window of the PerfandUtil MO



The possible states for the Performance and Utilization MO on the BSM are shown in Figure 3-29.

Figure 3-29
State Display window of the BSMPerfandUtil MO



Alarm Display

Alarms generated when the processor usage has crossed the thresholds are displayed via the following mechanism:

- Alarms are displayed in the existing Alarm Window as they are received. The Alarm Window can be invoked from the Windows Menu on the BSM Navigator Menu bar. Please refer to Figure 3-30 for a sample of the window (the information shown in the sample is not created by this feature). A minor alarm stays in the display until the craftsperson has acknowledged it and the processor usage has dropped below the set threshold. A warning alarm comes up in the display as "Clear" by default, and is removed from the display after the craftsperson acknowledges it.
- Alarms are displayed as Alarm MOs in the Alarm Manager MO tree in the BSM Navigator window whenever they are received. Please refer to Figure 3-31 for an example.
- Alarms are displayed upon request (by issuing an **alarm** command) in a Command Line Interface Application (CLIApp) window. Please refer to Figure 3-32 for an example.
- Alarms are displayed on a remote Network Operations Center (NOC) as they are received. Alarms are displayed like the results of the alarm command shown in Figure 3-32 without the need to issue the alarm command.

Figure 3-30
Alarm Window

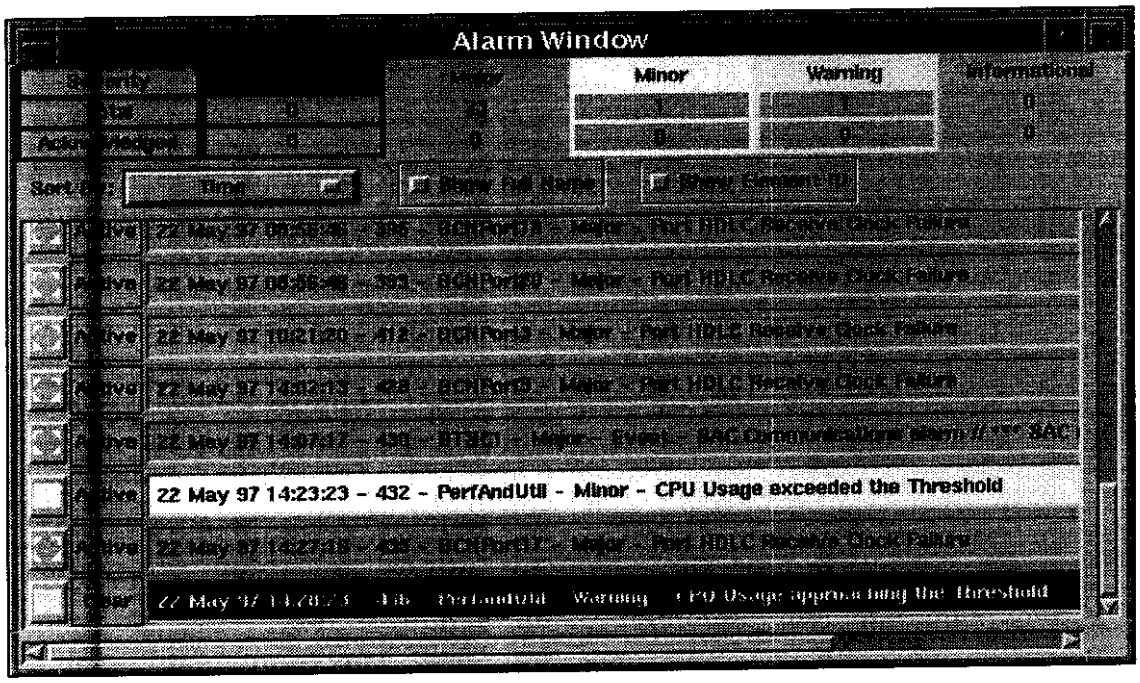
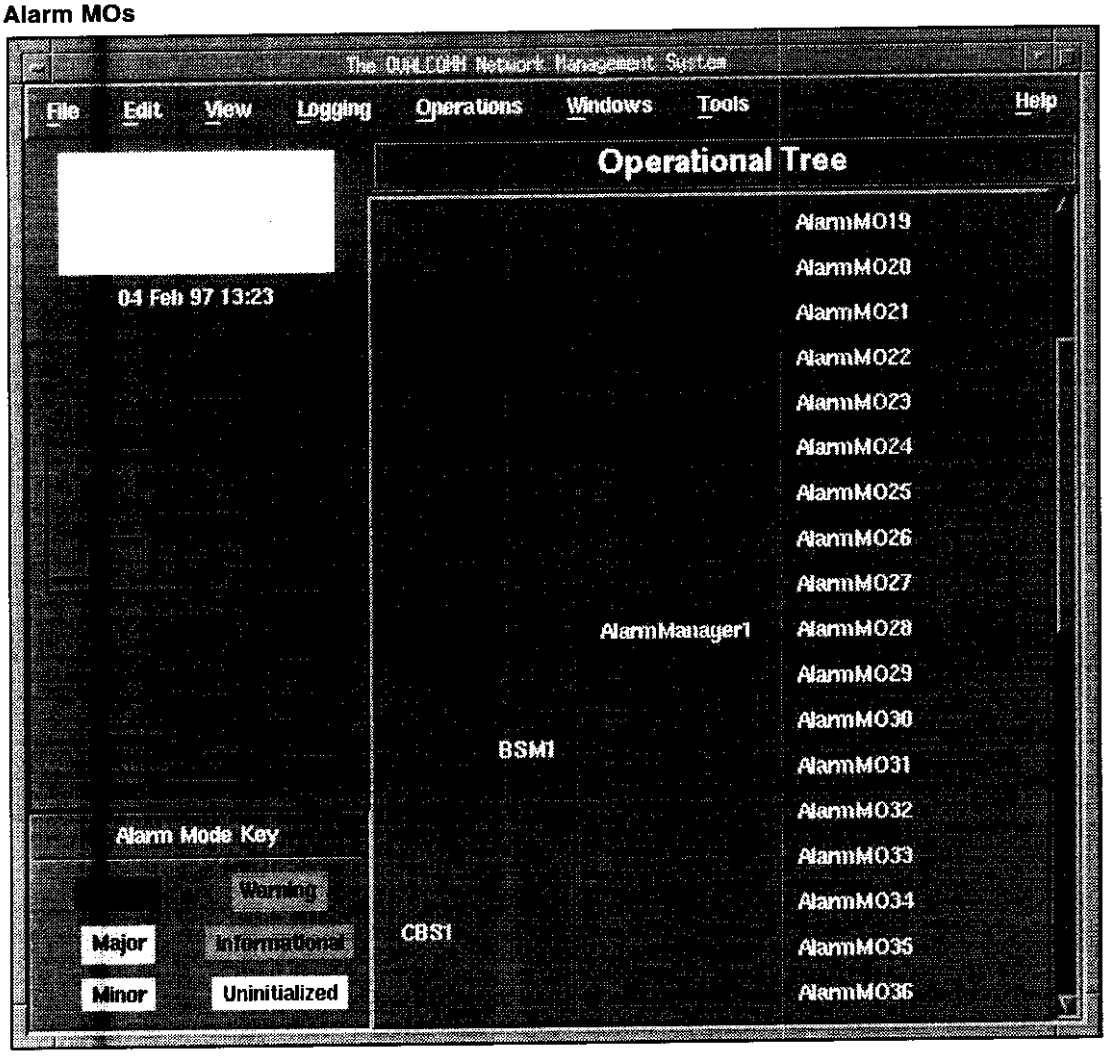


Figure 3-31
Alarm MOs



Command Line Interface Application (CLIApp) Window

A CLIApp window is a text-based command line interface which allows the craftsperson to query the processor usage and alarms, query and set threshold values, and perform actions on the Performance and Utilization MOs with appropriate security levels. Figure 3-32 shows examples of these operations.

Figure 3-32
CLIApp window

```
1>alarm -df;
# Id Status Activity Date/Time Source Severity FaultName
# 1818 Ack Active "23 Nov 97 12:12:09"
"O&:CBS1:SBSs1:SBSCSubsystem1:Root1:SBS1:SBSShelf1:SBSC1:PerfandUtil1"
MINOR "CPU Usage exceeded the Threshold"
# 1829 Nak Clear "23 Nov 97 12:38:00"
"O&:CBS1:SBSs1:SBSCSubsystem1:Root1:SBS1:SBSShelf1:SBSC1:PerfandUtil1"
WARNING "CPU Usage exceeded the Threshold"
# 1850 Nak Clear "27 Nov 97 05:56:14"
"O&:CBS1:Cells1:BTS0054:Root1:BTSC1" WARNING "TimeOut while
waiting for response"
# 1855 Nak Clear "27 Nov 97 07:40:05"
"O&:CBS1:SBSs1:SBSCSubsystem1:Root1:SBS1:SBSShelf1:SBSC1:PerfandUtil1"
WARNING "CPU Usage approaching the Threshold"
. . . . . .
2>list -af O&:CBS1:SBSs1:SBSCSubsystem1:Root1:SBS1:SBSShelf1:SBSC1:
PerfandUtil1 (CPUUsage);
# (
#    CPUUsage = 85
# );

3>cd O&:CBS1:Cells1:MiniBTS06:Root1:MDS1:UCC:PerfandUtil1;

4>edit (CPUThreshold=(CPUThresholdValue=80));

5>cd O&:CBS1:BSM1:BSMPerfandUtil1;

6>action Lock;
```

Accessing processor utilization information from NOC

A Network Operations Center (NOC) is a remote terminal that provides limited access into the BSM via a CLIApp window. This feature allows the craftsperson to access processor utilization information on a NOC in the following ways:

- Remote login to a CLIApp window with appropriate security level to query and display the processor utilization information, set threshold values and disable thresholds for the critical processors.
- Alarms generated when the processor usage crosses the thresholds are displayed on a NOC as they are received.

Storage impact

This feature requires storage for the following:

- A Performance and Utilization MO in each of the SBSCs and BTSCs.

- Performance and Utilization MOs in the BSM corresponding to their counterparts in the SBSCs and BTSCs.
- A Performance and Utilization MO for the BSM.
- Objects storing information of MOs for the Processor Utilization Statistics GUI.

The storage estimates in each SBSC and BTSC is approximately 100 bytes. The storage estimates in the BSM is approximately the (number of SBSCs + number of BTSCs) x 200 bytes + 200 bytes. The size of the V2 software executable in the SBSC or BTSC increases about 1.002 megabytes - 987K bytes = ~15K bytes.

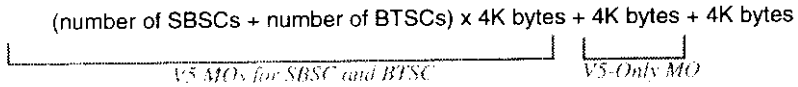
Data storage formula

The following shows the memory storage in bytes for each MO:

- V2 MO on the SBSC: ~ 800
- V2 MO on the BTSC: ~ 800
- V5 MO corresponding to the V2 MO on the SBSC: ~ 4K
- V5 MO corresponding to the V2 MO on the BTSC: ~ 4K
- V5-Only MO for the BSM: ~ 4K

Therefore, the total storage measurement in each SBSC or BTSC is approximately 800 bytes.

In the BSM, the Processor Utilization Statistics GUI requires additional storage for the MO related information of up to 30 MOs. It takes at least 100 bytes per MO. The store measurement is 30 x 100 bytes = ~ 4K. Therefore, the total storage measurement in the BSM is:



FRU replacement procedures

This section provides replacement procedures for all 1900MHz Outdoor BTS Field Replaceable Units (FRUs). Table 6-1 provides a list of BTS FRUs and their Product Engineering Codes (PECs). System cables and their PECs are listed in Table 6-2.

Note: When returning equipment for repair, follow the guidelines outlined in the section *Technical assistance and equipment return procedures*. Be sure to include a completed return repair tag.

Table 6-1
FRUs and PECs

Description	PEC
Frame	
1900Mhz Outdoor BTS Assembly	NTGK08AA
1900Mhz Outdoor BTS Assembly	NTGK01BA
1900MHz Outdoor BTS Assembly 2 Drawer	NTGK08BA
Digital Shelf	
Chassis Assy, Digital, Mini BTS	NTGK40BA
Digital Chassis Assy	NTGK60AA
Analog Common Card	NTGB49AA
CSM Channel Card	NTGB62AA
Backplane Assy	NTGK31AA
Blank Panel CCA Narrow	NTPX0201
Digital Shelf Blank Panel Assembly	NTGK6010
Jumbo Universal Controller Card	NTGB37AA

-sheet 1 of 4-

Table 6-1
FRUs and PECs (continued)

Description	PEC
Freq Ref Card	NTGB15AA
BCN Interface Card 6-Port	NTGB69AA
ATM Ultra Lite Card	NTGK20AA
ATM Ultra Lite Card	NTGK20BA
Power Supply, digital shelf	NTGK2122
CDSU	
C/DSU Dual Card Shelf Assy, T1	NTGB5127
CIM 2102 - T1	NTGB52BA
E1 CIM Card BNC Unbalanced	NTGB52KB
CDSU E1/T1 Advance Comm Engine, CCA	NTGB5149
ACE 2000 E1/T1 Card w/ Extra Flash	NTGB51TA
Power Supply	NTGK3502
Power Supply	NTGK0125
Power Supply, +24VDC, C/DSU Dual Card Shelf	NTGK0128
Panel, Blank, C/DSU Front	NTGB1812
Panel, Blank, C/DSU Rear	NTGB1813
Assembly, Chassis, Modem	NTGK36BA
Phone Modem	NTGB5142
GPS Receiver, -54 VDC	NTGB1102
GPS Receiver (Z3801A Option #4)	NTPX26AA
RFFEs	
RF Front End, Phase 3 A/D Band	NTGK05GA
RF Front End, Phase 3 B/E Band	NTGK05HA
RF Front End, Phase 3 C/F Band	NTGK05LA
RFFE Fan Tray Assembly	NTGK37BA

-sheet 2 of 4-

Table 6-1
FRUs and PECs (continued)

Description	PEC
RFFE Solar Shield	NTGK0555
TST Shelf	
TST Chassis Assy, EMI/Knockdown	NTGK61AA
TST Backplane, EMI	NTGK29AA
Subscriber Test Unit	NTGK21AA
Subscriber Test Unit	NTGK21BA
Subscriber Test Unit	NTGK21CA
Subscriber Test Unit	NTGK21DA
Transceiver Controller Card (TCC)	NTGK22AA
Upconverter	NTGK23AA
Receiver	NTGK24AA
Transceiver Shelf Blank Panel-Assy	NTGK6110
Transceiver Shelf EMI Shield	NTGK6126

-sheet 3 of 4-

Table 6-1
FRUs and PECs (continued)

Description	PEC
Misc.	
Driver Module	NTGK15AA
Driver Module	NTGK15BA
Driver Module CCA	NTGK28AA
Test Access Panel	NTGK06AA
Power Shelf	
MPR25 Enh. Ext. Basis Rectifier	NT5C06CC
Temperature Control Module (TCM)	NT6C18HB
Battery Management Unit (BattMU)	NT7C24AA
Cabinet / Enclosure	
Heat Exchanger	A0671796
Right front door panel and lock	A0671886
Left front door panel and lock	A0673033
Battery Tray (slide out assembly)	A0671889
Battery Access Panel (front or rear)	A0671887
Thermal Control Unit (TCU)	A0671801
Tamper Resistant Wrench	A0671277
DC Fan—Internal Air Flow (cabinet)	A0674443
DC Fan—External Air Flow (ambient)	A0674444
Heat Exchanger Chain and Dog Latch Hook	A0671874
Tamper Resistant Bolt	A0671873

-sheet 4 of 4-

Table 6-2
Cable Descriptions and PECs

Signal Description	Cable Description	PEC	QTY
Digital-to-RF Frame Cables	Standard Cable Kit	NTGB86AA	1
BCNINTF_TRANSALPHA	BCN Status Data: Molex/25 Pin D-Sub	NTGB5861	1
BCNINTF_TRANSGAMMA: BCNINTF_BTU	BCN Status Data: Molex/25 Pin D-Sub	NTGB5862	2
BCNINTF_TRANSALPHA	BCN Status Data: Molex/25 Pin D-Sub	NTGB5860	1
DISTBETA0_DIG: DISTBETA1_DIG	TNC Plug/SMA Plug, RG142	NTGB5019	2
DISTGAMMA0_DIG: DISTGAMMA1_DIG: DIG_TRANSALPHA	TNC Plug/SMA Plug, RG142	NTGB5020	3
DIG_TRABSBETA	TNC Plug/SMA Plug, RG142	NTGB5021	1
DIG_TRANSGAMMA	TNC Plug/SMA Plug, RG142	NTGB5022	1
DISTALPHA0_DIG DIST_ALOHA1_DIG	TNC Plug/SMA Plug, RG142	NTGB5023	2
RFCB_DIGCB	Fan/Breaker Fault: Rack/Rack	NTGB5025	1
TFU_TRANSALPHA	TFU 10MHz Distribution, Molex/9 Pos D-Sub	NTGB5032	1
TFU_TRANSALPHA TFU_TRANSGAMMA	TFU 10MHz Distribution, Molex/9 Pos D-Sub	NTGB5034	2

RFFE removal and replacement procedure

Use this procedure when replacement of a faulty RF Front End (RFFE) is necessary.

Note: If RFFE cooling fans are faulty replace the fan tray assembly, not the entire RFFE (see *RFFE fan tray removal and replacement procedure* on page 6-8).

Follow Procedure 6-1 to remove and replace the RFFE.

DANGER
High Working Environment
If the RFFE is located high on a tower or building, exercise caution to avoid injury to personnel and damage to equipment when working on the RFFE.

DANGER
Heavy lifting
The RFFE weighs approximately 80 pounds. Ensure that you have good footing and a good grasp of the RFFE when attempting to remove or install to avoid injury.

Note: Once the RFFE is replaced, the site must be reloaded in order to bring that sector up again. Reloading the site requires the sector to be recalibrated to get the new values for the sector. This must be done when any subsystem in the RF path is replaced.

Procedure 6-1
RFFE removal and replacement

Step	Procedure
1	Wilt and lock out the suspect BTS sector. Disconnect all of the jumper cables on the RFFE except the test cable and the power cable.
2	Loosen the three bolts securing the bottom of the RFFE to the mounting unit.
3	Remove the solar shield cover from the suspect RFFE.
4	Remove the two bolts securing the top of the RFFE to the solar shield base plate, then the three bolts securing the bottom of the mounting plate to the solar shield base plate. ***Note:*** The unit will hang from the flange on the solar shield base plate.
5	Disconnect connector J9 from the driver of the suspect sector.
6	Place the circuit breaker to the suspect RFFE in the OFF position.

-sheet 1 of 2-

Procedure 6-1
RFFE removal and replacement (continued)

Step	Procedure
7	Disconnect the test cable, power cable, and ground cable at the RFFE.
8	After ensuring good footing and good grip of the RFFE, lift the RFFE from the solar shield base plate.
9	Install the replacement RFFE on the mounting unit.
10	Install the two bolts securing the top of the RFFE to the solar shield base plate.
11	Install and tighten the three bolts securing the bottom of the RFFE to the solar shield base plate.
12	Place the plastic protective connector caps from the new unit on the failed unit's connectors. Package the failed unit in the replacement unit's shipping container. Ensure the RFFE is secured to the pallet with a minimum of four bolts for safe shipping.
13	Reconnect the test cable, ground cable, and the power cable.
14	Reconnect connector J9 to the transmit end of the driver.
15	Place the circuit breaker mentioned in step 6 in the ON position.
16	Reconnect all jumper cables on the RFFE.
17	Replace the RFFE solar cover.
18	Unwilt the site sector.

-sheet 2 of 2-

RFFE fan tray removal and replacement procedure

Materials

Standard field maintenance tools are used to remove and replace the RFFE fan tray assembly. The following specific materials are required to remove the RFFE fan tray.

- Replacement RFFE fan assembly
- Phillips-head screwdriver

DANGER
High locations
When removing and replacing the RFFE fan assembly, exercise caution to avoid injury to personnel and damage to equipment.

Follow Procedure 6-2 to remove and replace the RFFE fan assembly.

Procedure 6-2
RFFE fans removal and replacement

Step	Procedure
1	Remove the RFFE solar shield and metal fan cover.
2	Unscrew two black captive Phillips- head screws on each end of the RFFE fan assembly.
3	Slide the RFFE fan assembly out of the unit.
4	Insert the replacement RFFE fan assembly into the fan bracket.
5	Tighten the two black captured Phillip-head screws on each end of the RFFE fan assembly. ***Note:*** The guide pins on the back of the RFFE fan assembly prevent improper installation.
6	Reinstall the RFFE solar shield and metal fan cover.

Fuse removal and replacement procedure

This section provides step-by-step instructions to remove and replace the following fuses

- Left-side battery heater fuse
- Right-side battery heater fuse
- TCU power input fuse
- Utility power indicator lamps fuses
- Rectifier/charger fuses
- TCM fuse.

Materials

The following specific materials are required for fuse removal

- keys to enclosure doors
- Phillips-head screwdriver
- Slotted-head screwdriver.

Left-side battery heater fuse removal and replacement

Use Procedure 6-3 to remove and replace the left-side battery heater fuse located within the BTS enclosure.

CAUTION
ESD hazard
Observe proper ESD precautions when working within the enclosure.

Procedure 6-3
Left-side battery heater fuse removal and replacement procedure

Step	Procedure
1	Open left battery drawer.
2	Unscrew and remove fuse located on the back edge of the drawer.
3	Screw replacement left-side battery heater fuse into the back edge of the drawer.
4	Close left battery drawer.