USER'S MANUAL

SpotLight™ 2000

Installation Manual

CDMA System and Analog Pass-Thru option
for SC 9600 Cellular Site

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6/3/99

SpotLight 2000 Documentation Kit 11.0 for Motorola SC 9600 Mixed Mode with Analog Pass-Thru

This manual is part of Documentation Kit 11.0 (P/N 280-0047-01) which consists of the following Technical Publications:

Technical Publication	Part Number
SpotLight 2000 for SC 9600 with APT Installation Manual	500-0030-01
SpotLight 2000 for SC 9600 with APT Service Manual	515-0030-01
SpotLight 2000 for SC 9600 with APT Theory of Operation	525-0023-01
SpotLight 2000 for SC 9600 with Optimization Manual	505-0030-01
SpotLight Configuration Tools User's Guide	530-0001-01
BmCtrl Modeling Tool User's Guide	530-0002-01
SpotLight 2000 Documentation Kit CDROM	350-0030-01

If you have questions or comments about the content of this document, please contact:

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Preface

Audience

This document is written for Metawave and customer service personnel who are installing, configuring, and testing the Metawave SpotLight™ 2000 CDMA 1.1 with optional Analog Pass-Thru system in a Motorola SC 9600 Mixed Mode cellular site.

Scope

The installation instructions in this manual are intended as guidelines that supplement and support customer engineering practices and policies, site engineering standards, Metawave site survey documentation, and relevant safety standards.

The information herein is not meant to supersede the site engineering documents. If these instructions present such a conflict, contact the Metawave Customer Service Department for further instructions.

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Text Conventions

This manual uses special paragraphs and symbols to call attention to information that is of particular importance to the reader.

Note: Presents nonessential, but potentially helpful information.

Important: Presents information that helps to understand a topic or avoid an undesirable result.

Caution: Notifies the reader of a situation where there is a potential to damage equipment.

Attention! Notifies the reader of a situation where proper electrostatic safety equipment is required. In illustrations, the symbol on the left indicates the presence of electrostatic-sensitive components.

Warning! ***Notifies the reader of a potentially hazardous situation that could result in personal injury.***

Regulatory Notices

FCC Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 and Part 22 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense.

Do Not Substitute Parts or Perform Unauthorized Modification

The SpotLight system has been authorized by the FCC using only the parts and configurations described in this manual. Do not replace parts with unauthorized parts, and never perform unauthorized modification to the system. Install the system as described in this manual. Use only the cables and other parts specified in this manual. Unauthorized changes or modifications can void the user's authority to operate this equipment.

CSA Information

This equipment is to be installed only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70.

This equipment requires the use of circuit breakers as main power disconnect devices, as specified in Section 1.2.1.

This equipment has not undergone testing for static charge accumulation or immunity to lightning discharge.

Reader Survey Form

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Chapter 1 - Installation Overview	5	4	3	2	1	0
Chapter 2 - Installing the Antennas	5	4	3	2	1	0
Chapter 3 - Installing & Cabling Rack Components	5	4	3	2	1	0
Chapter 4 - Site Configuration Files	5	4	3	2	1	0
Chapter 5 - Configuration & Integration Testing	5	4	3	2	1	0
Chapter 6 - Commissioning Test Procedure	5	4	3	2	1	0

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Chapter 1 Installation Overview

Contents

1.2.1 Power Requirements

The Integrated Duplexer/LNA Subassembly (IDLS), Synthesis cage, DMPA, and the DMPA fan module all connect to the +27 VDC power distribution module at the top of the 19" equipment rack.

The IDLS modules, including the IDLS Alarm Module (IAM), share a single 10-ampere circuit breaker. The IDLS power cabling may also be connected to the power distribution panel.

The power requirement for the Linear Power Amplifier (LPA) cage depends on whether the cage uses 30 watt or 50 watt LPA modules.

- Each 30-watt LPA cage requires standard cell site power, nominally +27 VDC at up to 80 amperes, and should be directly wired to one 100-ampere or two 50-ampere circuit breakers. If the 50-ampere circuit breakers are used they must be physically connected to operate in unison (two-pole configuration). These circuit breakers serve as the main power disconnect device for these cages.
- Each 50-watt LPA cage requires standard cell site power, nominally +27 VDC at up to 120 amperes, and should be directly wired to two 70-ampere circuit breakers in a two-pole configuration. These circuit breakers serve as the main power disconnect device for these cages.

The router for remote access requires one 5-ampere circuit breaker in the -48V panel, or can be plugged into a DC-DC converter which requires standard +27 VDC with a 10 ampere circuit breaker.

1.2.2 Equipment Rack and Cable Layout Planning

Refer to the site engineering documents and site survey information for the location of the SpotLight equipment racks. Once the location of the racks has been determined, plan for the layout of all cables and ascertain that all required cables (including appropriate cable lengths) were ordered to complete the installation.

Caution: This equipment is to be installed only in Restricted Access Areas (Dedicated Equipment Rooms, Equipment Closets, or the like) in accordance with Articles 110-16, 110-17, and 110-18 of the National Electric Code, ANSI/NFPA 70.

1.6 Installation Sequence

Although the configuration of cell site equipment and customer engineering requirements ultimately determine installation sequence, Metawave recommends that the installation tasks be performed in this sequence:

1. Install and test the antenna array and cables.
2. Install and ground SpotLight assemblies.
3. Connect power cables to SpotLight assemblies.
4. Connect RF cables to SpotLight assemblies.
5. Connect intrasystem communications bus, reference frequency, and alarm cables to SpotLight assemblies.
6. Perform power-on test to assure all SpotLight assemblies and modules power up properly.
7. Connect RF voice and signal cables between the SpotLight system and base station radios.
8. Install inline attenuators.
9. Install the software and configure the system to site-specific parameters.
10. Perform any tests or adjustments required to assure that the system is operating according to Metawave specified parameters.
11. Perform the commissioning test procedure with the customer.

1.6.1 Installing Antenna Array and Cables

In most cases the antenna arrays and cables will be installed by a professional rigging crew in advance of the receipt of the SpotLight system electronic assemblies. If you need to install the antennas and cables, refer to Chapter 2, "Installing and Testing the Antennas" for instructions.

1.6.2 Installing and Cabling SpotLight Assemblies

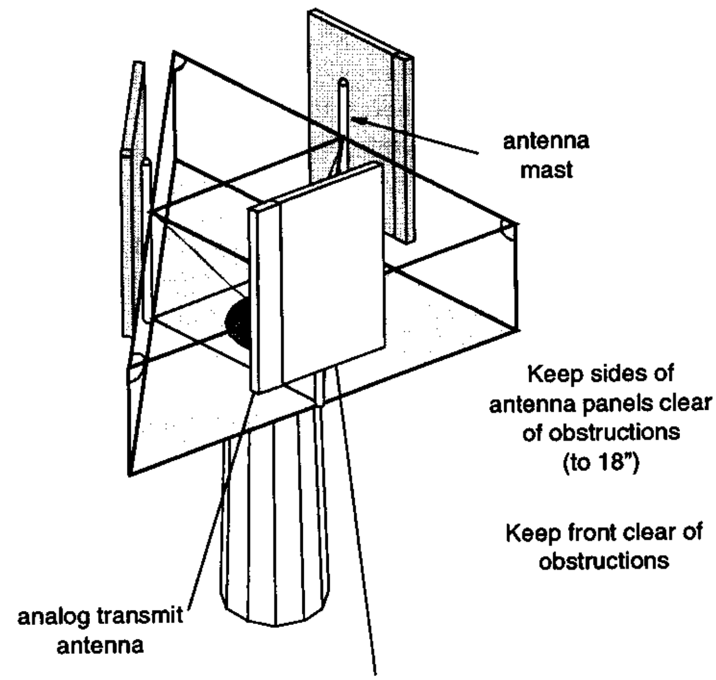
SpotLight equipment racks are shipped assembled and pre-cabled. Typically, you need only to slide in LPA modules and install the IDLS modules. Refer to Chapter 3, "Installing and Cabling Rack Components" for instructions on installing SpotLight assemblies. This chapter also covers installing inline attenuation in the forward and reverse path to customize the system to meet cell site requirements.

Chapter 2 Installing and Testing the Antennas

Contents

Important: Before beginning the installation of the antenna, unpack the equipment and perform a visual inspection. Inspect the shipping containers and antenna hardware for any signs of physical damage. Report any damage immediately to the carrier, and to Metawave Customer Service.

Figure 2.1 Typical Plan of Antenna Tower with Panel Antennas



After you have installed the antenna masts on the tower, affix the antenna panels to the masts.

1. Using the brackets in the mounting kit included with the antenna, attach a bracket to each of the two mounting clamps built into the back of the antenna panels. All hardware should initially be hand-tight only.
2. Mount the antenna panel to the mast, making sure the antenna panel's up arrow is properly oriented.
3. Adjust the azimuthal alignment and tilt of antenna panels in accordance with requirements provided by your cell site engineers.
4. Tighten all hardware.

plate, and provide a fire-proof, weather-tight seal. Figure 2.2 is a schematic diagram of antenna RF cabling interconnections.

Figure 2.2 Schematic Representation of Typical Antenna Cabling

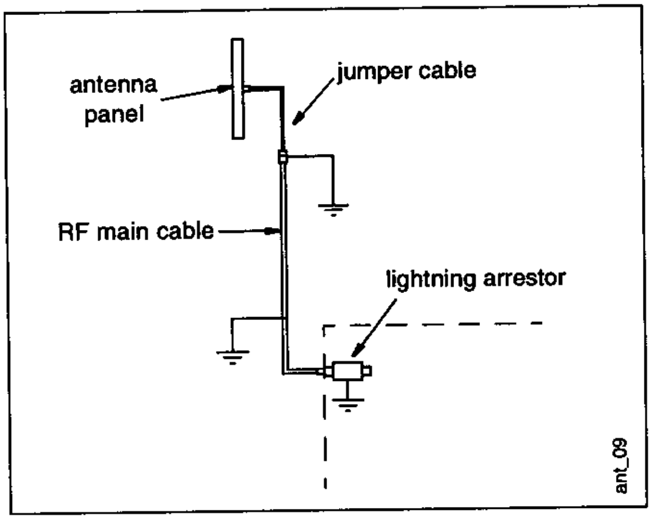


Table 2.2 describes the connector types and quantities of RF cables required for the SpotLight antenna installation. The lengths of the RF main cables are site-dependent. Refer to your site RF engineering documents for exact length specifications.

Table 2.2 Antenna to Lightning Arrestor Cabling[1]

Cable Assembly	Signal	Cable Material	Qty	Connector Types
Upper RF cable jumpers (connect antenna panel to RF main cable). Assemble on-site.	Duplexed voice channel	1/2″ LDF4 (or equivalent)	12	DIN Male DIN Male
RF main cables from upper jumper to lightning arrestor. Assemble on-site.	Duplexed voice channel	7/8″to 1-5/8″ LDF5 - LDF7 (or equivalent)	12	DIN Female site specified
RF main cables from antenna panel calibration port to lightning arrestor. Assemble on-site.	Calibration Out	1/4" LDF1 or 1/2″ LDF4 (or equivalent)	3	N Male site specified
Analog Tx antenna	analog Tx	?	3	?

1. These are the preferred and recommended cabling and connector configurations. They are required for all new cable runs. In the event that the SpotLight installation uses RF main cables already existing at the cell site, then jumpers are required to mate with the connectors already present on the existing cables.

2.3.5 Antenna Testing Overview

Test the antenna for proper connection and continuity using the VSWR and IMD tests. Figure 2.4 is a flow chart of the VSWR and IMD testing sequence. The IMD test should be performed only after determining that the VSWR is within specification.

Record and maintain the results of the VSWR and IMD tests, along with the antenna's serial number and tower position, for traceability and problem solving purposes. This test data should be kept in a secure place, along with the test data supplied by the antenna manufacturer.

During the testing process, VSWR test data and time-domain reflectometry (TDR) sweep data should be recorded and stored as data files. If a test produces an undesirable result, this test data is important for determining the appropriate course of action.

2.4 Intermodulation (IMD) Testing Procedure

TBD

Chapter 3 Installing and Cabling Rack Components

Contents

Attention! Equipment racks must be electrically isolated from cell site flooring to prevent multiple grounding paths.

SpotLight assemblies are organized in the racks as shown in Figure 3.1.

Figure 3.1 SpotLight 19" and 25" Equipment Racks (front view)

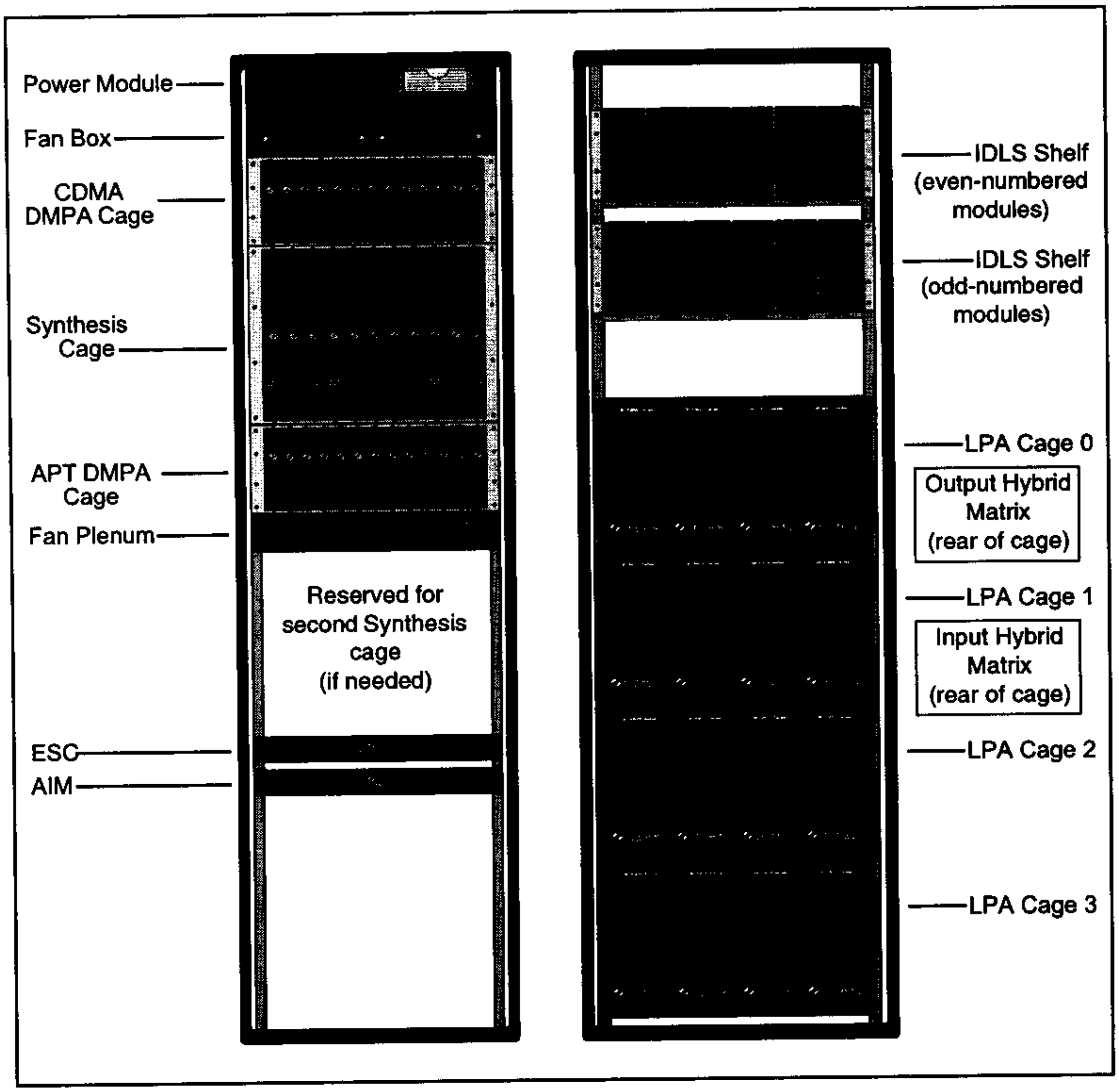


Table 3.1 Cabling the IDLS Modules to the Synthesis Cage

From:	Cable Number	To Synthesis Cage port:
–40 dB ports on IDLS modules 1-6 (cable # matches the IDLS module #)	(2) 135-0257-10	J2002 (IDLS Coupler Ports 1-6)
–40 dB ports on IDLS modules 7-12 (cable #1 connects to IDLS module 7, cable #2 connects to IDLS module 8, etc.)		J2003 (IDLS Coupler Ports 7-12)
Rx1 ports on IDLS modules 1-6 (cable # matches the IDLS module #	(2) 135-0257-10	J2004 (CDMA Rx FRU 1 Ports 1-6)
Rx1 ports on IDLS modules 7-12 (cable #1 connects to IDLS module 7, cable #2 connects to IDLS module 8, etc.)		J2005 (CDMA Rx FRU 1 Ports 7-12)
Rx2 ports on IDLS modules 1-6 (cable # matches the IDLS module #	(2) 135-0257-10	J2006 (CDMA Rx FRU 2 Ports 1-6)
Rx2 ports on IDLS modules 7-12 (cable #1 connects to IDLS module 7, cable #2 connects to IDLS module 8, etc.)		J2007 (CDMA Rx FRU 2 Ports 7-12)

3.3.2 Synthesis Cage to CDMA DMPA

The synthesis cage and the CDMA DMPA cage are connected using a single, bundled cable (135-0265-00) with two 8W8 connectors on either end.

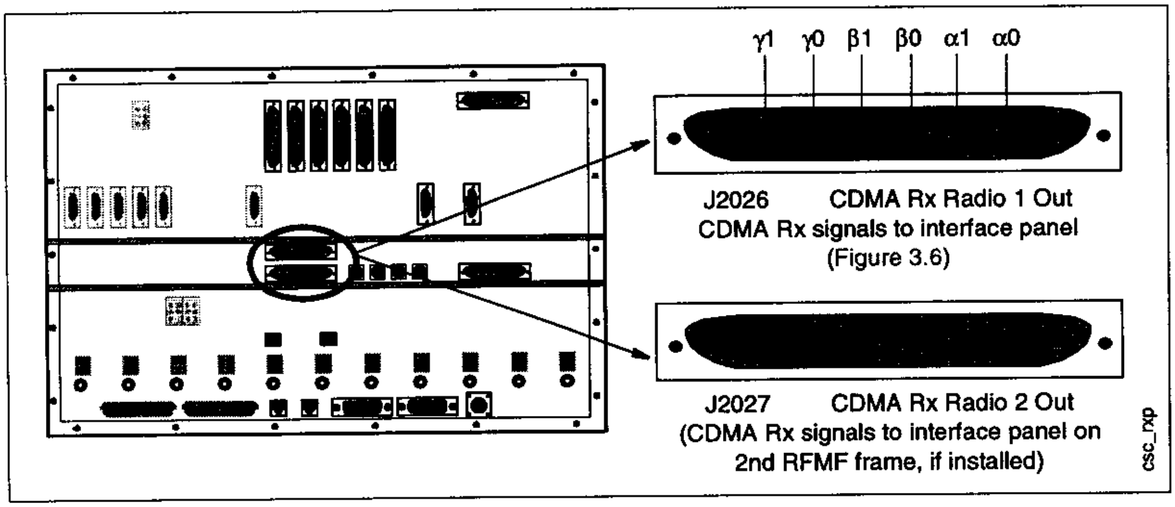
1. For ease of installation, connect cable 135-0265-00 to the DMPA first. The labeling on the cables match the labelling on the ports.
   1.1 Connect the cable to DMPA BEAMS 1-6 (J46) and DMPA BEAMS 7-12 (J48) in accordance with the cable labeling (Figure 3.3).
   1.2 Install terminations (P/N 250-0191-01) on J47 and J49.

Caution: Do not allow the connectors on this cable to swing upward and rest against the terminations on the DMPA analog inputs. The connectors on these inputs can be easily broken if mishandled.

2. Connect the other end of the cable to the Synthesis cage. The labeling on the cables match the labelling on the ports.
   2.1 Attach the connector marked BEAMS 11, 12, 1, 2, 3, 4 to J2001.
   2.2 Attach the connector marked BEAMS 5, 6, 7, 8, 9, 10 to J2024.
3. If a second Synthesis cage is installed, repeat steps 1 and 2 to connect the second bundled cable to the CDMA DMPA cage, but use J47 for DMPA BEAMS 1-6 and J49 for DMPA BEAMS 7-12 (Figure 3.3).

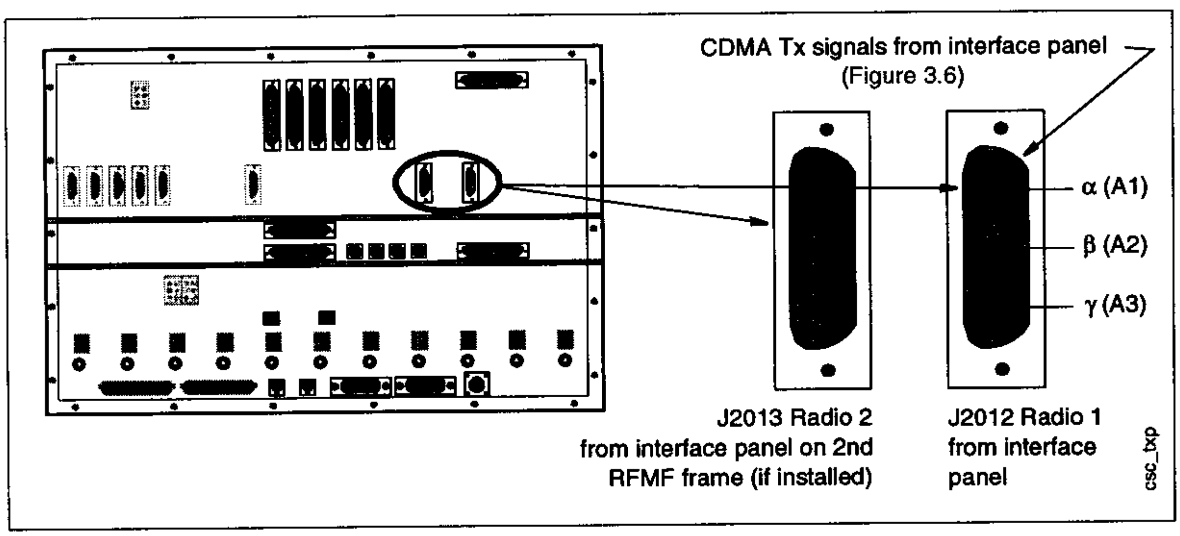
Panel,"), connect port J2026 on the Synthesis cage (Figure 3.4) to the six Rx SMA-P ports on the interface panel (Figure 3.6).

Figure 3.4 Synthesis Cage Rx Ports



2. Connect port J2012 on the Synthesis cage (Figure 3.5) to the three Tx SMA-P ports on the interface panel (Figure 3.6).

Figure 3.5 Synthesis Cage Tx Ports



3. If only one RFMF frame is installed, terminate J2027 and J2013 on the Synthesis cage. If a second RFMF frame is present:
   3.1 Repeat steps 1 and 2 but connect a second Rx cable to J2027 and a second Tx cable to J2013 on the Synthesis cage.

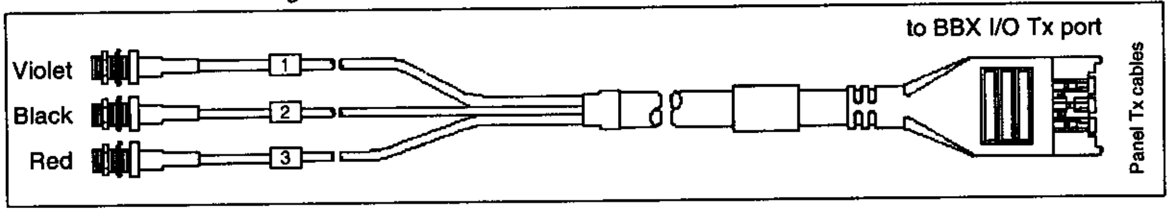
Table 3.2 Interface Panel Cable Connections

Interface Panel Ports (Figure 3.6)	Rx						Tx		
	α0	α1	β0	β1	γ0	γ1	α	β	γ
Tx Cable	---	---	---	---	---	---			
Rx Cable							---	---	---

Note: Any unused outputs on the nine splitter/combiners on the interface panel must have 50Ω terminations installed.

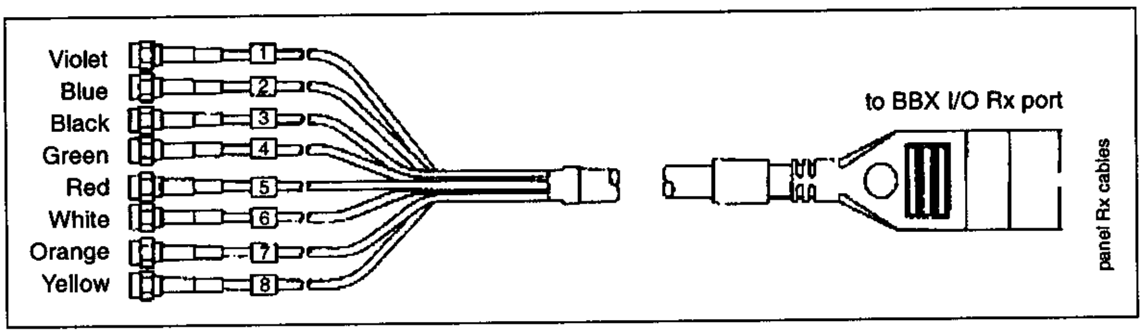
- The Tx cable (135-0409-00) consists of a Harting connector on one end and three color-coded wires ending in SMA-F connectors on the other (Figure 3.7).

Figure 3.7 Interface Panel Tx Cable



- The Rx cable (135-0277-00) consists of a Harting connector on one end and eight color-coded wires ending in SMA-P connectors on the other (Figure 3.8).

Figure 3.8 Interface Panel Rx Cable



1. Install SMA adapters (165-0111-01) on all nine ports on the top of the interface panel, and connect nine 30' SMA cables 135-0195-30 from the Synthesis cage (refer back to Figure 3.6) to these adapters.
2. Connect the SMA ends of the Rx cable 135-0277-00 to one port on each Rx splitter, and connect the SMA ends of one cables 135-0409-00 to one

4. Disconnect the existing cables from the BBX I/O Tx and Rx ports, and secure them out of the way. No termination is necessary for these cables.
5. Connect the Rx and Tx cables from the interface panel to their respective ports on the BBX I/O board(s).

Note: Not all cables will be used in all configurations.

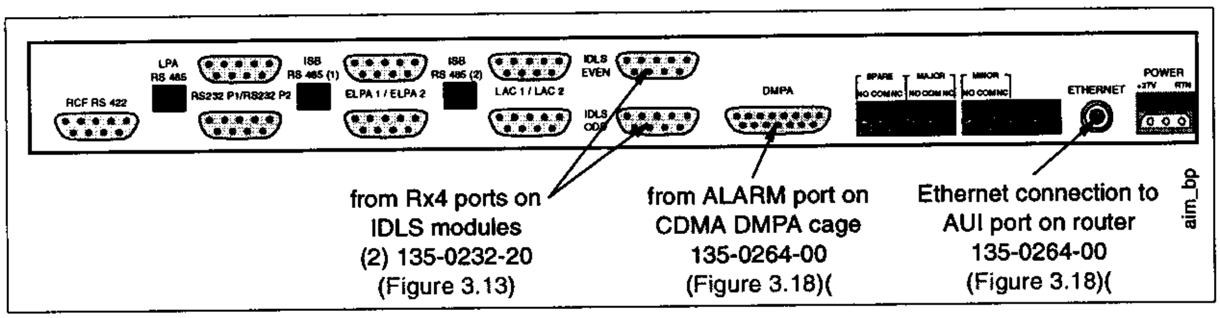
6. Dress all cables to the RFMF frame.

Caution: Ensure that the unused cable connectors are securely dressed to the chassis and cannot come in electrical contact with any components or interfere with removal/replacement of base station components.

3.5 Cabling the Alarm Interface Module

The AIM (Figure 3.10) monitors alarms from the IDLS, DMPA, and LPA assemblies and communicates any alarm conditions to the Synthesis cage by way of the RS-485 intrasystem communication bus (ISB).

Figure 3.10 Alarm Interface Module (rear view)



RS-232 ports and a 10Base2 Ethernet port provide connection to a laptop computer or other external equipment, enabling the user to view alarm conditions using LampLighter or the CDMA Configuration Tool.

The AIM front panel has four status LEDs:

- POWER — A green LED indicates power to the AIM.
- AIM FAIL — A red LED indicates failure of the AIM.
- WARNING — An amber LED indicates a minor alarm from one of the connected components.
- ALARM — A red LED indicates a major alarm from one of the connected components.

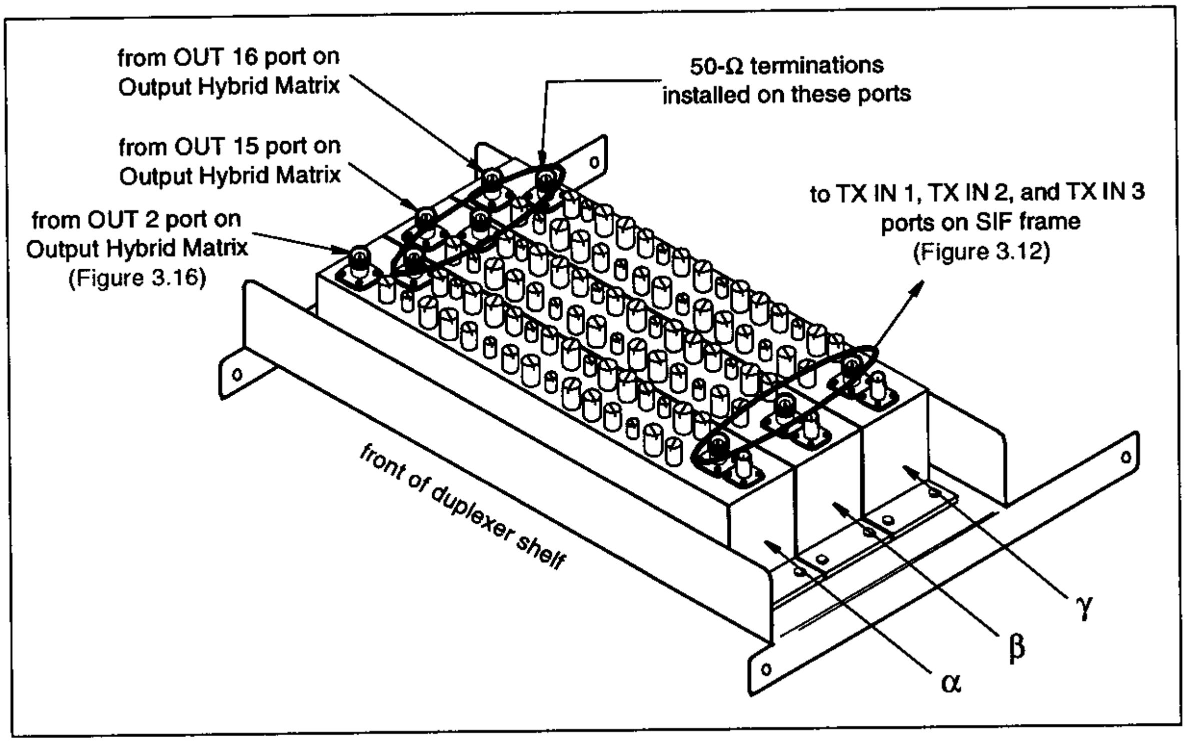
3.6 Cabling the Duplexer Shelf

The duplexer shelf (Figure 3.11) mounts on top of the 25" rack. It filters the α, β, and γ Tx signals coming from the Output Hybrid Matrix and sends them to the SIF frame.

Table 3.4 Output Hybrid Matrix to Duplexer Cable Specifications

Cable Description and Part Number	Qty	Source Connection	Destination Connection
1/2" Heliac coax	3	OUT 2, OUT 15, or OUT 16 ports on Output Hybrid Matrix	RX port on each duplexer
TBD	3	TX port on each duplexer	TX IN 1, TX IN 2, and TX IN 3 ports on top of the SIF frame

Figure 3.11 Duplexer Shelf

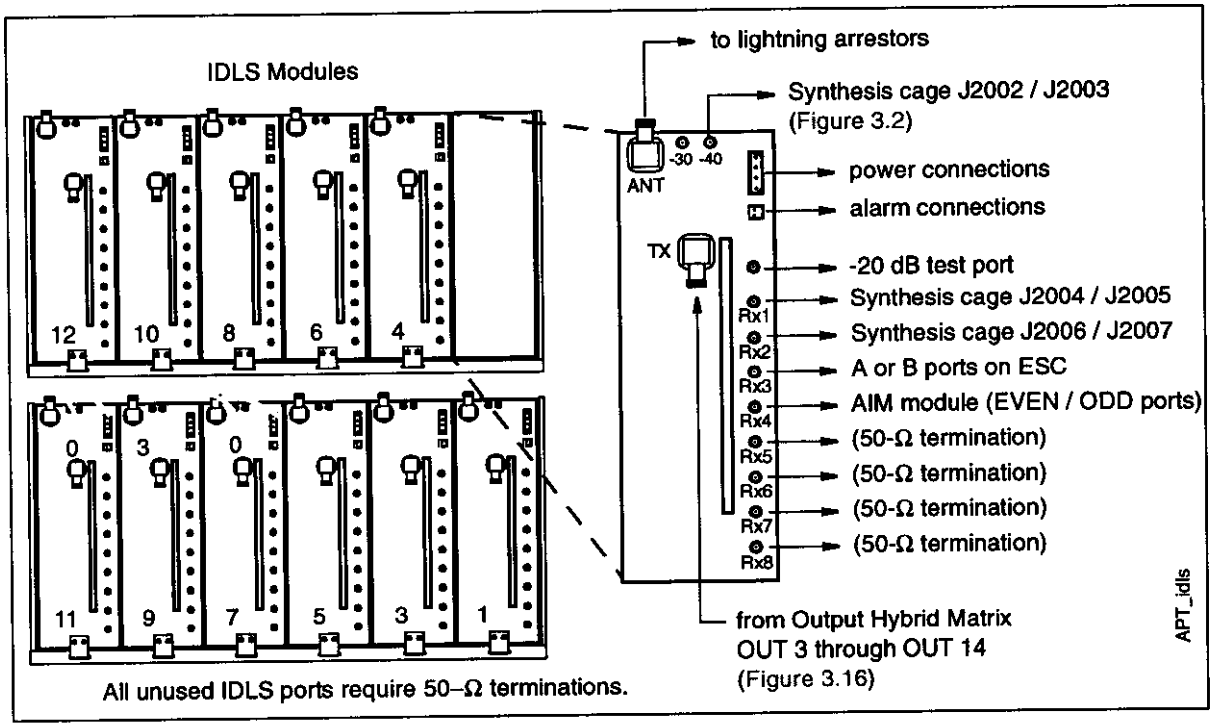


After being filtered, the analog Tx signals from the duplexer shelf are connected to TX IN 1, TX IN 2, and TX IN 3 ports on the SIF frame as shown in Figure 3.12 and Table 3.5. The Tx signals then exit the SIF at the TX OUT 1, TX OUT 2, and TX OUT 3 ports and are cabled through the lightning arrestors to the SpotLight analog transmit antennas.

3.7 Cabling the Integrated Duplexer and LNA Splitter (IDLS)

The IDLS consists of two separate chassis at the top of the 25" rack. Each IDLS chassis contains up to six IDLS modules, as shown in Figure 3.13.

Figure 3.13 IDLS Port Destinations

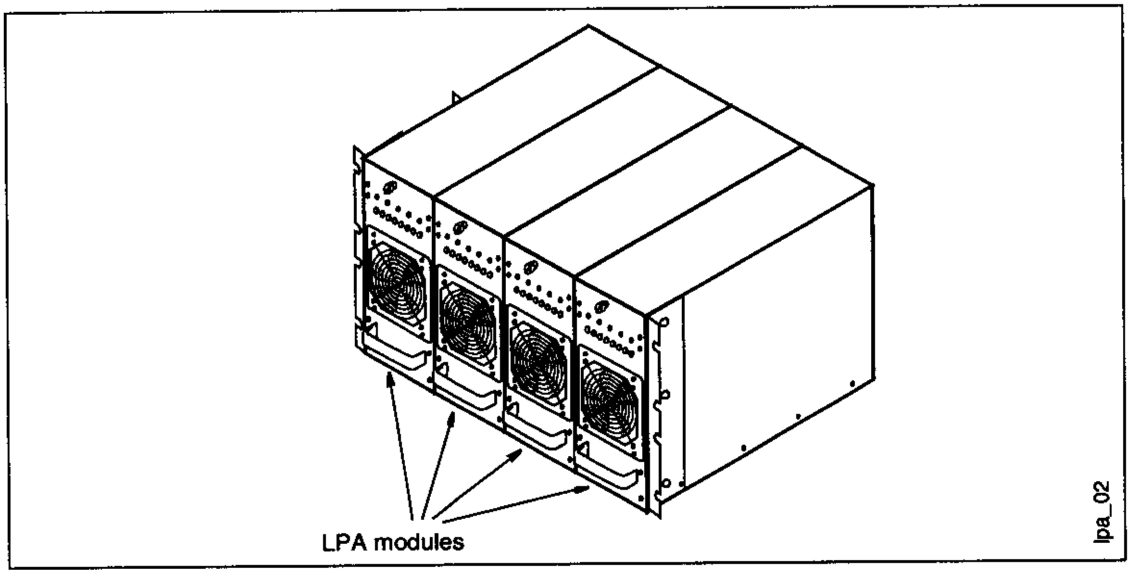


The two IDLS chassis are installed in the racks prior to shipment. The individual IDLS modules are shipped separately. To install them, first invert the mounting brackets on the front and rear of each IDLS module. Install the modules, and secure the brackets to hold them to the chassis.

3.9 Linear Power Amplifier (LPA) Cages

The standard LPA assembly mounts in the 25" rack and consists of an Input Hybrid matrix, an Output Hybrid matrix, and four LPA cages. Each cage holds four LPA modules (Figure 3.15).

Figure 3.15 Standard LPA Cage, with Four LPA Modules



Ensure that address switch S1 on the backplane of each LPA cage is set from 0 (highest cage) to 3 (lowest cage).

3.10 Cabling the Output Hybrid Matrix

The Output Hybrid Matrix is attached to the back of LPA cage 0, as shown in Figure 3.16. The output ports on the Output Hybrid Matrix are cabled in accordance with Table 3.7:

- OUT 3 through OUT 14 are cabled to the TX ports on the IDLS modules.
- OUT 2, OUT 15, and OUT 16 are cabled to the duplexer shelf.

Note: The input ports are pre-cabled at the factory.

When cabling is complete, dress the cables.

Table 3.7 Cabling the Output Hybrid Matrix to Duplexer Shelf and IDLS

Output Hybrid Matrix	To Duplexer Shelf (Figure 3.11)	To Tx Port on IDLS Module# (Figure 3.13)
OUT 16	α duplexer (front unit)	---
OUT 15	β duplexer (middle unit)	---
OUT 14	---	1
OUT 13	---	2
OUT 12	---	3
OUT 11	---	4
OUT 10	---	5
OUT 9	---	6
OUT 8	---	7
OUT 7	---	8
OUT 6	---	9
OUT 5	---	10
OUT 4	---	11
OUT 3	---	12
OUT 2	γ duplexer (rear unit)	---
OUT 1 (50-Ω termination)	---	---

3.11 Cabling the Input Hybrid Matrix

The Input Hybrid Matrix is attached to the back of LPA cage 10, as shown in Figure 3.17.

Note: The input ports are pre-cabled at the factory.

Table 3.7 shows how to cable the output ports to the duplexer shelf and to the Tx ports on the IDLS modules. When cabling is complete, dress the cables.

3.12 Cabling the DMPA Assemblies

Figure 3.18 Cabling the CDMA DMPA Module

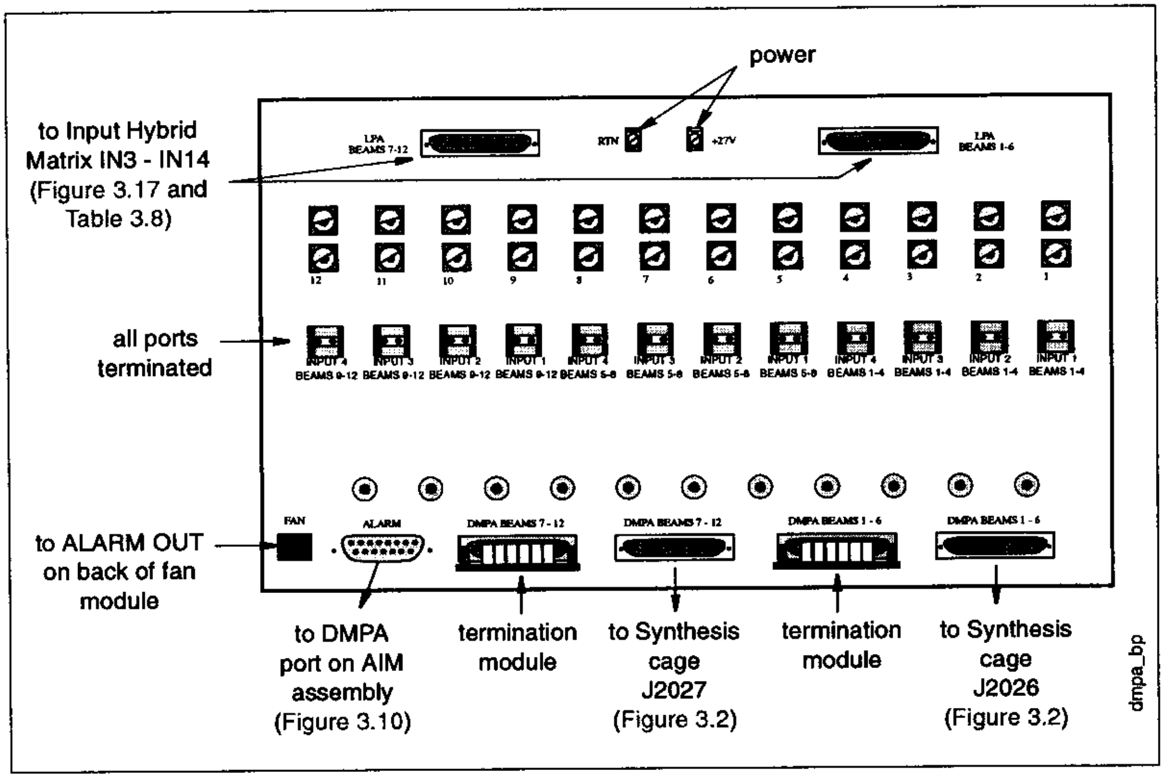


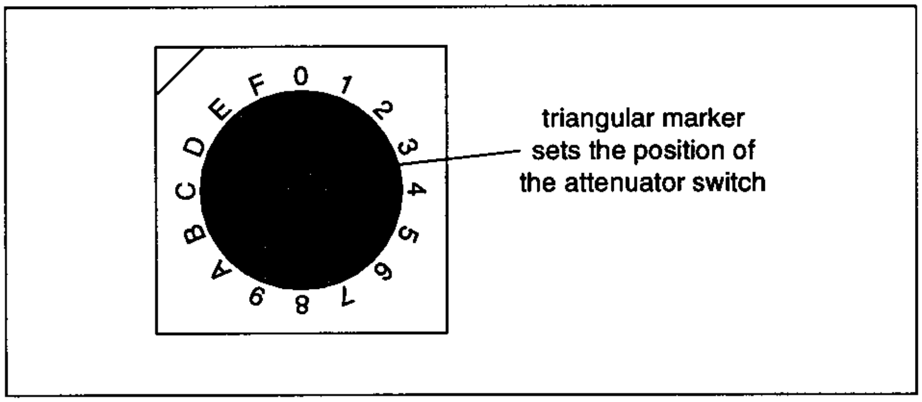
Table 3.8 CDMA DMPA to Input Hybrid Matrix Cabling

LPA BEAMS Port	SMA Cable	Input Hybrid Matrix
1-6	0	IN 3
	1	IN 4
	2	IN 5
	3	IN 6
	4	IN 7
	5	IN 8
7-12	0	IN 9
	1	IN 10
	2	IN 11
	3	IN 12
	4	IN 13
	5	IN 14

3.12.1 Setting DMPA Attenuators

The DMPA backplane contains two sets of rotary switch attenuators, as shown in Figure 3.21, that are used to set the gain of the DMPA FRUs. Each set includes one switch for each beam.

Figure 3.21 DMPA Attenuator Switch



Note: The switch position is indicated by the triangular marker on the switch.

Caution: Improper switch settings can cause an LPA overpower condition, possibly damaging SpotLight equipment. To minimize the possibility of over-powering the LPA assembly, the rotary switches come from the factory set for high attenuation. The analog path (top) attenuator is set for 28 dB (position 7), and the common path attenuator is set for 6 dB (position 6).

The bottom row of switches set the gain in the analog path, as shown in Table 3.9. The analog path switches are configurable in 4 dB increments from 0 to 28 dB.

Caution: Do not use analog path switch settings 8 through F. Doing so may result in improper attenuation selection, and possibly cause an overpower condition.

3.13 Cabling the ESC Assembly

Analog Rx signals from the ESC module are connected at the top of the RFMF frame. Connect the six analog Rx cables from the ESC module to the RFMF frame as shown in Figure 3.22 and Table 3.11.

Figure 3.22 Cabling the ESC module to the RFMF frame

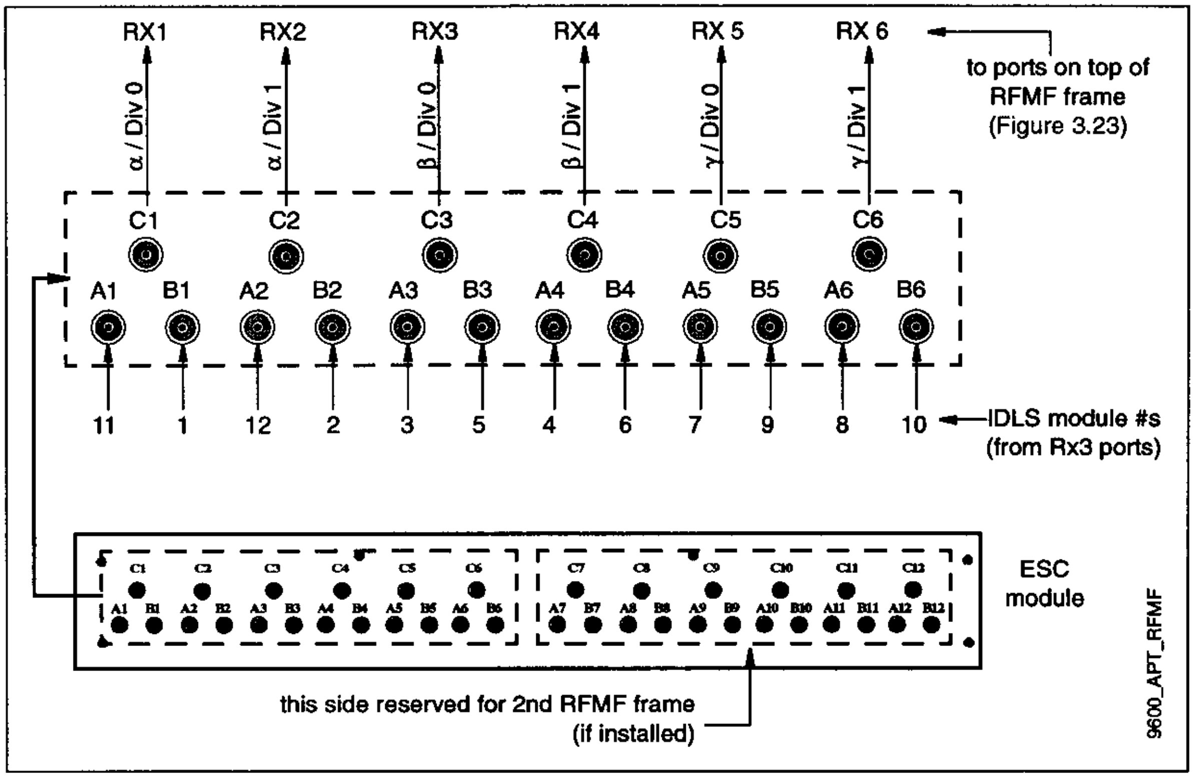


Table 3.11 ESC to RFMF Cable Mapping

Cable	ESC Port and Cable Label	RFMF Frame (Figure 3.23)
135-0257-20	C1 / α 0	RX 1
	C2 / α 1	RX 2
	C3 / β 0	RX 3
	C4 / β 1	RX 4
	C5 / γ 0	RX 5
	C6 / γ 1	RX 6

This LCI Emulator assembly (270-0223-01) contains two separate LCI Field Replaceable Units (250-0223-03) which operate as a pair, with one active and one in standby during normal operation.

- One LCI Field Replaceable Unit (FRU) emulates the odd-numbered LCI cards.
- The other FRU emulates the even-numbered LCI cards.

Note: If one FRU fails, it can be removed and replaced while the other unit remains active and functional.

The LCI Emulator is shipped with an LCI Field Installation Kit (280-0098-xx) that contains the screws, cable assemblies, terminations, and other hardware required for installation and cabling.

3.14.1 Installing the LCI Emulator

Perform the following steps.

1. Unpack the two LCI FRUs, and inspect them for any shipping damage.
2. Open the flip-down front panel on the LCI chassis by unscrewing the two knurled screws, and slide the two emulator boards into their slots in the chassis.

Note: When properly installed, the LAN A, LAN B, RS-232, ISB and power connectors on each board will fit through the cutouts in the rear of the chassis.

3. Secure the circuit boards to the chassis by installing the jack screws on the RS-232 connector and the nuts on the LAN connectors.
4. Set the DIP switch on one LCI emulator card to ODD (up). Set the DIP switch on the other card to EVEN (down).

Caution: The LCI emulator will not function properly if these DIP switches are both set to the same position.

5. Install the LCI Emulator in the 19" rack.

3.14.2 Cabling The LCI Emulator to the Base Station

The LCI emulator allows the removal of up to two Motorola LPA frames. In general, the emulator should be cabled to the same devices as the ELPA/LPA that it replaces. Typically, this places the LCI emulator between the SIF and the RFMF, but alternative cabling schemes may be encountered (Figure 3.25).

3.14.3 Loading LCI Emulator Software

The LampLighter program is used to load the LCI Emulator software. To enter the LCI Version Number:

1. Select "Options >> Commands", then type "HELP". A list of supported commands is displayed.
2. Enter the following command:

   `LCI SET VERSION version dd.dd.dd.dd.dd` (dd=decimal format)
3. To verify the version number you entered, type "LCI GET VERSION". The user enters the version number as provided by the operator.

Note: You must enter the correct LCI software load as indicated in the next displayed load table before proceeding to bring the site up.

3.14.4 Upgrading the LCI Emulator Software

Note: The LCI Emulator does not support LCI software upgrades. If an LCI software upgrade is necessary, the operator must provide the new LCI software version number to be entered to the emulator. If a site is upgraded with a LCI software version, you should upload logged data to determine if the new software load introduces new messages.

1. Insert the upgrade floppy disk in the laptop drive.
2. Select "Configuration >> Software Upgrade", then select the file "LCIEM.BIN" from the floppy.
3. To determine if you've successfully upgraded the software:

   3.1 Wait until the operation gets to "100% verified", then reset the emulator.

   3.2 Select "Options → Commands", and type in "VERSION". You should get the same version number that was given to you.

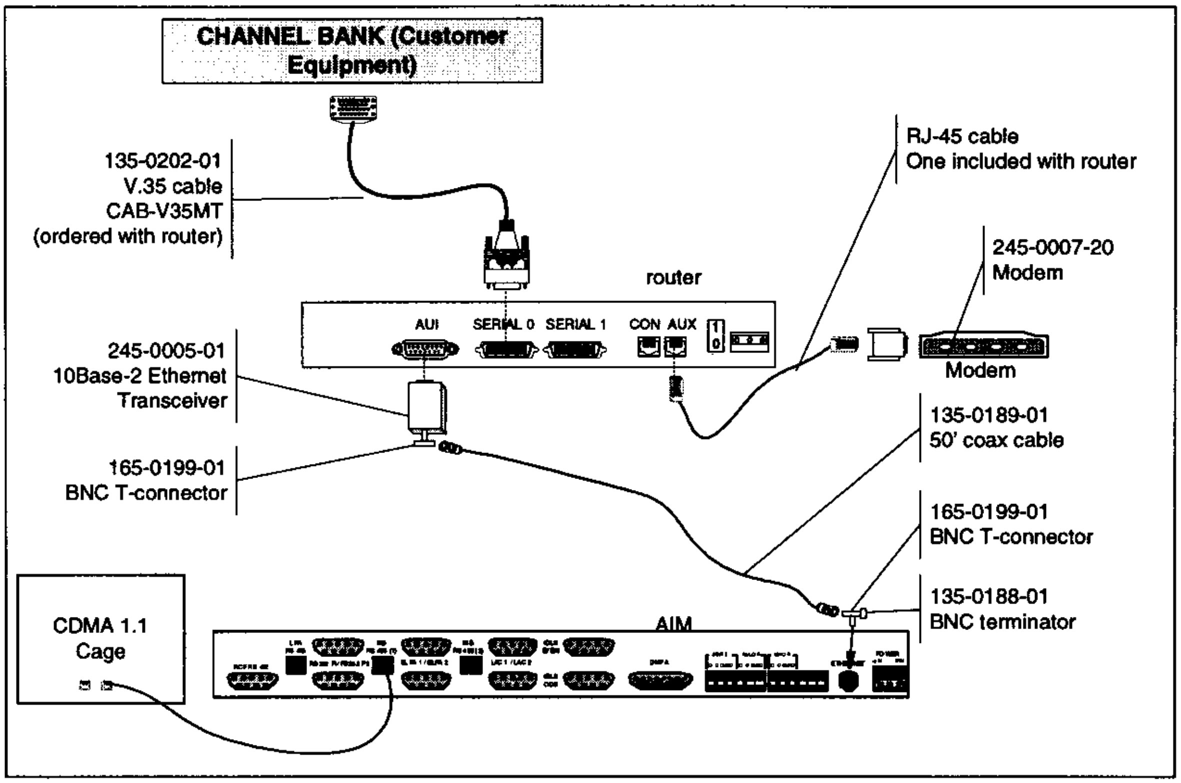
2. Connect +27V and RTN cables from the power distribution module to the DMPA backplane.
   2.1 Measure and cut a #14 black cable the appropriate length.
   2.2 Crimp a blue fork lug (Panduit PN14-6LF-C or equivalent) on one end.
   2.3 Attach the lug to the RTN tap on the DMPA backplane.
   2.4 Repeat the above three steps using a #14 red cable for the +27V tap on the DMPA backplane.
   2.5 Dress the cables to the power distribution module and attach them to the RTN and +27V taps for position 2, as shown previously in Figure 3.26.
3. Connect +27V and RTN cables from the power distribution module to the AIM.
   3.1 Measure and cut a #14 black cable the appropriate length.
   3.2 Strip and insert one end into the right (RTN) input on the AIM power terminal.
   3.3 Measure and cut a #14 red cable the appropriate length.
   3.4 Strip and insert one end into the left (+27V) input on the AIM power terminal.
   3.5 Dress the cables to the power distribution module and attach them to the RTN and +27V taps for position 6, as shown previously in Figure 3.26.

3.16 Installing Network Access Components

To use dial-up networking to access a cell site remotely, you must first install and configure the routers and modems necessary to access the LAN.

Installation can vary, depending on whether or not you have a modem and POTS (Plain Old Telephone Service) line available at the cell site. If you do, follow the subsections below. If you do not, follow the relevant subsections and see Section 3.17.

Figure 3.27 SiteNet Cabling Diagram



3.16.2.1 Modem Cabling

Follow these steps to connect the modem:

1. Connect a D25 to RJ-45 adapter (labelled "Modem") to the serial port on the modem.
2. Connect the supplied Cisco RJ-45 cable from the adapter to the auxiliary port on the router.

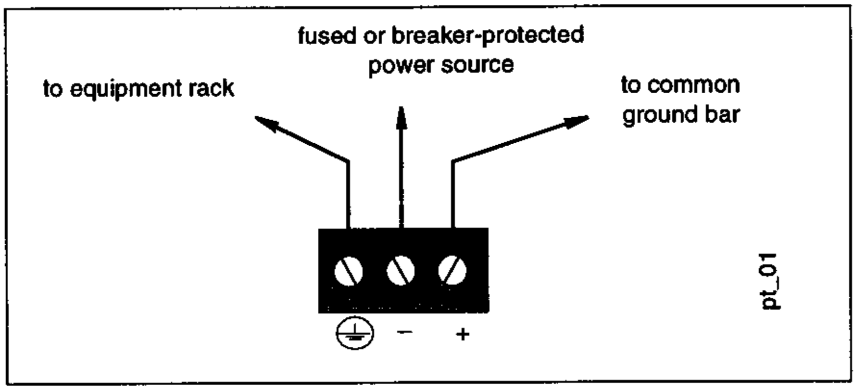
3.16.3 Cabling to Power

When installing power cables, follow the convention that reserves red wires for power and black wires for ground.

- For +24V wiring, use red for + wire and black for - wire.
- For -48V wiring, use red for - wire and black for + wire.

Before you start cabling, confirm that a 5-ampere (max.) fuse or circuit breaker is available and properly installed at the cell site power-supply bay. Make sure the circuit breaker is in the OFF position.

Figure 3.28 Cabling from Router Power Terminal



3.16.3.3 Modem (Optional)

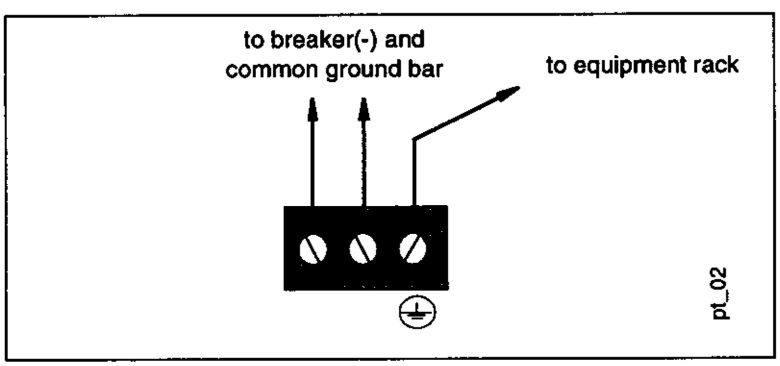
The modem (depending on the model) can use a -48V or +24V DC power source or 120V AC power source.

Caution: If you are connecting to a DC power source, make sure that you are connecting the appropriate power supply voltage to the modem. Modems using 24V and 48V can be damaged by incorrect supply voltage.

To connect power to the modem (Figure 3.29):

1. If you are connecting to an AC power source, plug the power cord into the modem.
2. If you are connecting to a DC power source, measure and cut the ground (black) cable to common ground bar. Measure and cut the power (red) cable to no more than 5A breaker on customer provided breaker panel.

Figure 3.29 Cabling from Modem Power Terminal (DC Power Supply)



Chapter 4 Site Configuration Files

Contents

4. Open the configuration file for the type of Cisco router installed at the cell site:
   - Rtrbs1en.2_0 (for Cisco 2501)
   - Rtrbs2en.2_0 (for Cisco 2514)
5. You will see 192.168.S.1 throughout the template file. Replace each instance of "S" with the third octet (part) of the network address "nnn". You can edit the host name as desired.

   For example: If the cell site's network address is 192.168.121, then replace 192.168.S.1 with 192.168.121.1
6. Save the file with a different name and in another directory.

4.2.1.2 Connecting to the Router

1. Connect a DB9 to RJ-45 adapter to the serial port (for example, Com1) on your computer.
2. Connect an RJ-45 cable from the adapter to the console port on the router.
3. Select Programs from the Start menu.
4. Select Hyperterminal from the Accessories menu.
5. Double click Hypertrm.exe to start the program. The Connection Description dialog box appears.
6. Enter a name for the connection, choose an icon, and click OK. The Phone Number dialog box appears.
7. In the Connect using: field, select Direct to Com 1 (or other port) and click OK. The Com1 Properties dialog box appears.
8. Select the options listed in Table 4.2 and click OK.

Table 4.2 Selections for Com1 Properties Dialog Box

Field	Selection
Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow Control	Hardware

9. Turn on all power (breakers and power switches).
10. Version 11.2(4) or later should flash across the Hyperterminal screen.
11. You will be prompted with the message:

```
Would you like to enter the initial dialog?[yes] no
```

2. Select Send Text File from the Transfer menu. The Send Text File dialog box appears.

Note: Do not attempt to use a binary file transfer method.

3. Select the router configuration file and click Open. Wait until the configuration file has completely downloaded.
4. Save the configuration file.

```
Router# copy running-config startup-config
```

5. Restart the router:

```
Router# reload
Proceed with reload?
```

Press Enter to confirm.

The following statements should appear (text might vary slightly with different software versions):

```
%SYS-5-RELOAD: Reload requested
System Bootstrap, Version 5.2(8a), RELEASE SOFTWARE
Copyright (c) 1986-1995 by cisco Systems
2500 processor with 4096 kbytes of main memory
```

4.2.1.7 Verifying Connectivity

You need to dial-in to verify the configuration and installation. If the dial-in is successful, then follow these steps:

1. Type `sho ip route` in the hyperterminal screen to confirm network connections.
2. Use Windows Explorer to make a back-up copy of the router configuration.

4.2.2 Introducing IP Terminology

Network addresses are 32-bit binary numbers expressed in Dotted-Decimal Notation such as:

120.42.41.1

In a Metawave network, addresses take the form of:

192.168.S.H

where S is the site ID and H is the host ID. The first three numbers identify the network and the last number identifies a specific device on that network.

3.2 For the IP address, change the network parameters (the first three numbers) to match the router's address. The fourth number should be unique to each computer (any number between 8-20).

3.3 Set the Subnet Mask address to 255.255.255.0.

3.4 Click the Gateway tab for the addresses of the installed gateways. Change to match the router's complete IP address.

Note: If you change your computer's IP address, you may no longer be able to connect to the network you were originally configured for (for example, the LAN at your workplace). To prevent this from happening, change your IP address back to the original address before shutting down.

4.3 Setting the AIM Module's IP Address

To remotely access the cell site through dialup networking, you need to set the IP address, subnet mask, and default gateway for the AIM module in the CDMA Configuration Tool 1.1 program.

Table 4.4 Network Configuration Term Definitions

Term	Definition
Global/Local IP Address	Address of hosts, devices on network
Subnet Mask	Configuration parameter; devices use value to determine if destination IP address is on the same network
Default Gateway	A router to which data destined for addresses not found in the IP address table are sent

The Network Configuration dialog box allows you to view and set the AIM module's address. Only the AIM module's global internet protocol (IP) address, subnet mask, and the default gateway can be set. The IP Address field must contain a valid dotted address.

1. Obtain the site ID.
2. Verify that the AIM is set as the embedded device:

   `get_embedded_device`

   If the response shows something other than AIM, enter the command:

   `get_embedded_device AIM`

Chapter 5 Configuration and Integration

Contents

- Har-Pak pigtail assembly, female mini-coax to SMA-P (135-0304-01)
- 150-watt, 50-Ω dummy load (needed only if the IDLS modules are not cabled to the lightning arrestors)
- IBM PC laptop compatible with the appropriate versions of the LampLighter program, SysCal program, and the CDMA Configuration Tool program
- LMF Computer (Verify that the customer provides the correct version of LMF software.)
- Phase calibration stubs

5.1.2 Required Documentation

The following documentation should be available at the cell site:

- Motorola LMF Operator's Guide (provided by customer)
- Motorola EMD Operator's Guide (provided by customer)

5.1.3 Preparation

Complete the following items before starting the procedures in this chapter.

- The SC9600 system should already be calibrated and have completed its acceptance test plan (or equivalent).
- A LampLighter configuration file must be created and stored on the LampLighter computer for later recall. It should contain the following:
  - The RCUs have been assigned to the correct channel number and SAT.
  - Tx Adjust must be set to 8 (or the appropriate value).
  - All antennas should be enabled for all RCUs; click on the Set All button for each RCU in each RxSMU.
- The CalCable script must be run to calibrate the test cables. A different script is used for the analog LMF than for the CDMA LMF.

5. Turn off power to a second LPA module. After about one minute confirm that a major alarm is activated at the cell site's central switch.
6. Turn power back on to both module and confirm that the alarms are cleared at the cell site's central switch.

5.2.3 IDLS Alarm Relay Test

Perform this test on one IDLS module.

Note: The IDLS displays only major alarms.

1. Remove the alarm cable jack from one of the IDLS modules and confirm that the Major Alarm relay is activated at the cell site's central switch.
2. Replace the alarm cable jack into the alarm port of the IDLS module.
3. Confirm that the alarm is cleared at the cell site's central switch.

5.3 SpotLight Installation Verification

This section verifies that the SpotLight components and cabling have been installed correctly. The tests can be run during normal operating hours as they do not require the cell site to be out of service.

5.3.1 Calculating Cable Losses

The cable used to connect the HP 8921A or the Bird Watt meter to the IDLS must have its loss measured in order to accurately calibrate the system. To measure this loss, perform the following steps.

1. Using a 50-Ω cable and adapters, connect the short cable from the DUPLEX OUT to the RF In/Out port on the HP 8921A.
2. With the HP 8921A in Configure mode, set RF Offset to Off.
3. Press the Duplex button on the HP 8921A to put it in Duplex Test mode (Figure 5.1).
4. Set up the following values:
   - 4.1 Set Tune Freq to 880 MHz.
   - 4.2 Set Input Port to RF In.
   - 4.3 Set Amplitude to 10 dBm.
   - 4.4 Set Output Port to Dupl.

4. Set the HP8921A to Spectrum Analyzer mode with the ANT In port as the input. Connect the HP 8921A Ant In port to the RFMF end of the cable from the ESC α Div 0 output.
5. Connect the HP 8921A RF In/Out port to the ANT port on IDLS module #1.
6. In the CDMA Configuration application, enter "DISCONNECT ALL" followed by "SET RXC 1 A DIV0".
7. Using the HP8921A, verify that the ESC α Div 0 output is –30 ± 10 dBm.
8. Repeat steps 5 through 7 for each remaining IDLS module. For each IDLS ANT In port, enter "DISCONNECT ALL" followed by "SET RXC x A DIV0", where x = 1–12 for beams 1–12.
9. Connect the HP8921A RF In/Out port to the ANT port on IDLS module #1.
10. Connect the HP8921A Ant In port to the RFMF end of the cable from the ESC α DIV 1 output.
11. In the CDMA Configuration Application, enter "DISCONNECT ALL" followed by "SET RXC 1 A DIV1"
12. Using the HP8921A, verify that the ESC α DIV 1 output is –30 ± 10 dBm.
13. Repeat steps 10 through 12 for the cables listed in Table 5.1. In step 11, enter "DISCONNECT ALL" followed by the "SET RXC..." command listed in Table 5.1 corresponding to the cable under test.

Table 5.1 CDMA Rx Path Tests

Cable	Command
ESC β DIV 0	SET RXC 1 B DIV0
ESC β DIV 1	SET RXC 1 B DIV 1
ESC γ DIV 0	SET RXC 1 G DIV0
ESC γ DIV 1	SET RXC 1 G DIV1

5.3.3 Port-to-Port Isolation

(How much of this section still applies?)

This measurement establishes the isolation levels of RF signals between antenna ports. It involves connecting the test equipment to an antenna port, then measuring and recording the output power of a radio signal at that port as it is connected to each of the twelve SpotLight antennas.

1. Set up the SpotLight system for the procedure:

9. In the Options menu, select Commands to open the Command Interface dialog box.
10. Disable beam switching by typing the command ENG KEY RCU# 8, where RCU# is the channel under test.
11. In the LampLighter Status Window, select the Tx SMU corresponding to the channel under test.
12. In the Command Interface dialog box, connect the channel under test to a single antenna with the command TXCONNECT ANT# RCU# 0 0, where ANT# is the antenna number and RCU# is the channel under test.

Note: In LampLighter, antennas are numbered 0 through 11, rather than 1 through 12. Therefore ANT0 in LampLighter corresponds to IDLS module #1.

13. Record the power reading from the HP 8921A test set in a data sheet similar to Table 5.2. The RF signal on the measured port should be around 0 dBm ± 10 dB with at least an 18 dB difference in the measurement when the signal is injected on the other ports.

Table 5.2 Example Port-to-Port Isolation Measurements for Antenna 0

Beams Keyed	IDLS Module											
	1	2	3	4	5	6	7	8	9	10	11	12
1	-5											
2	-27											
3	-28											
4	-28											
5	-34											
6	-29											
7	-33											
8	-31											
9	-29											
10	-31											
11	-32											
12	-31											

14. Disconnect the channel under test from the antenna using the LampLighter command DISCONNECT.
15. Repeat Step 12 through Step 14 for each remaining antenna until the channel under test has been connected to each antenna and the results recorded on the data sheet.

5.4 CDMA Tx Amplitude Calibration

In running this test, use the standard calibration configuration.

1. Start the CDMA Configuration Tool program, and load the calibration script.
2. Terminate all IDLS Ant ports with 50-Ω, 25-watt terminators.
3. Set the HP 8921A to the RF Generator mode with the output on the RF In/Out port at –50 dBm on one of the following frequencies:
   - For A-band IDLS, 876 MHz (Channel 200)
   - For B-band IDLS, 885 MHz (Channel 500)
4. Set up the Spectrum Analyzer mode for input on the ANT In port, centered at the frequency selected in step 3.
5. Connect the two test cables to be used in the tests in series between the RF In/Out port and the ANT In port. Adjust the RF Generator level until the Spectrum Analzer measures –50.0 dBm.
6. Connect the HP 8921A RF In/Out port to the RFMF end of the appropriate TIB cable for the sector under test, and connect the HP 8921A ANT In port to the –40 dB port of the IDLS for each beam to be tested.
7. Measure and record the output level for each path, and calculate the correction factor between the desired and the measured values in a format similar to Table 5.4 (desired – measured = Correction Factor). Table 5.5 shows typical measurements and Correction Factors.
8. Enter the correction factors into the standard calibration script file. Repeat the gain measurements. The results should be –38 ± 1.0 dBm. Save the script file under a different name for later use.
9. If results are outside of this range, adjust the appropriate correction factors in the script file and repeat steps 6 through 8 until the desired output values are achieved.

Table 5.5 Example CDMA Tx Gain Correction Factors

Beam Under Test		α Sector			β Sector			γ Sector		
		Desired Output	Measured Output	Correction Factor	Desired Output	Measured Output	Correction Factor	Desired Output	Measured Output	Correction Factor
1	1st Test	–36.0 dBm	-37.7	1.7						
	Verification		-36.6	0.6						
2	1st Test		-36.9	0.9						
	Verification		-35.7	0.3						
3	1st Test				–36.0 dBm	-39.1	3.1			
	Verification					-35.9	-0.1			
4	1st Test					-38.8	2.8			
	Verification					-36.4	0.4			
5	1st Test					-39.3	3.3			
	Verification					-35.8	-0.2			
6	1st Test					-38.9	2.9			
	Verification					-36.0	---			
7	1st Test							–36.0 dBm	-35.3	-0.7
	Verification								-36.2	0.2
8	1st Test								-38.9	2.9
	Verification								-35.7	-0.3
9	1st Test								-39.6	2.1
	Verification								-38.2	---
10	1st Test								-35.4	-2.3
	Verification								-36.9	0.9
11	1st Test	–36.0 dBm	-38.6	2.6						
	Verification		-34.9	-1.1						
12	1st Test		-37.3	1.3						
	Verification		-36.3	0.3						
(Desired) - (Measured) = Correction Factor										

5.5.1.2 Setting Time and Date

Set the time and date to the local standard.

1. At the % prompt type
   `set_system_time "yyyy mmm dd, hh:mm:ss"`
   where:

   yyyy = year
   mmm = month
   dd = day
   hh = hour
   mm = minute
   ss = second

Note: The quotation marks must also be typed as part of the command.

5.5.1.3 Clearing Logs

Clear the engineering and message logs so you have a clear starting point for any messages that may appear during the calibration process.

1. Clear the engineering log by typing **`send_system "elog clear"`**.
2. Clear the message log by typing **`send_system "log message clear"`**.

Note: The quotation marks must also be typed as part of the command.

5.5.2 Frequency Tables

The following tables show the different frequencies that should be used for the Tx and Rx tests, depending on which band you are working in and the number of carriers in your system.

Table 5.6 Transmit Test Frequencies

Carrier	Tx A-band Channel	Tx A-band Frequency	Tx B-band Channel	Tx B-band Frequency
1	255	877.65	412	882.36
2	214	876.42	453	883.59
3	173	875.19	494	884.82
4	132	873.96	535	886.05

- Set AMPLITUDE to 10 dBm.
- Set ATTEN HOLD to OFF.
- Set OUTPUT PORT to DUPL.
- Set AFGEN1 to OFF.
- On Tx Power screen, set units to dBm.

5. Press SHIFT, then CONFIG on the 8921A test set.
6. In the Configure mode, set the RF LEVEL OFFSET to OFF.
7. Return to the DUPLEX screen.
8. Measure the RF power present at the RF IN/OUT port by reading the Tx power on the duplex screen.

Note: Do not use the Spectrum Analyzer screen for this measurement. The value, displayed in dBm, is your reference.

9. Subtract this value from 10 dBm to determine the loss of the cable. Round to the nearest tenth of a dBm.
10. Turn the amplitude OFF on the RF Generator.
11. Press SHIFT, then CONFIG on the 8921A test set. In the Configuration mode, set the RF LEVEL OFFSET to ON.
12. Scroll down to the RF IN/OUT selection and enter the value you determined in Step 9 as a negative number.
13. Return to the DUPLEX screen.
14. Turn the amplitude ON in the Duplex screen. If the calibration was performed correctly a value of 10 dBm should be displayed in the Tx Power field.

5.5.5 Test Setup

Once the cable loss has been calibrated, set up the Tx Path Calibration test in the following order.

1. Set up the DUPLEX screen of the HP 8921A test set as follows:
   - TUNE FREQ to the Tx frequency for the carrier under test, as shown earlier in Table 5.6.
   - INPUT PORT to RF IN
   - RF GEN FREQ to the same as TUNE FREQ
   - AMPLITUDE to -30 dBm
   - OUTPUT PORT to DUPL

7. Connect the test cable from the DUPLEX OUT port of the HP 8921A to the end of the 135-0263-20 Tx CDMA cable connected to the alpha input of the CDMA 1.1 synthesis cage.
8. Connect the test cable from the RF IN/OUT port of the HP 8921A to the ANT port of IDLS module 1.
9. Follow the instructions provided by the CDMA Configuration Tool 1.1 to adjust the FRU attenuation to the target level. This involves entering the value that is displayed in the Tx power field of the Duplex screen on the HP 8921A test set. The program then performs a calculation and adjusts the Tx FRU attenuation to match the desired target value.
10. When the output level displayed on the HP 8921A matches the target value displayed by the CDMA Configuration Tool 1.1 to within ±1 dB, record the value displayed on the HP 8921A in the appropriate cell of Table 5.9.

Table 5.9 Data Sheet for Tx Path Calibration Test

			α Panel				β Panel				γ Panel			
			11	12	1	2	3	4	5	6	7	8	9	10
alpha FRU	primary	non-delayed												
		delayed												
	spare	non-delayed												
		delayed												
beta FRU	primary	non-delayed												
		delayed												
	spare	non-delayed												
		delayed												
gamma FRU	primary	non-delayed												
		delayed												
	spare	non-delayed												
		delayed												

11. Press ENTER to move to the next task.
12. Follow the instructions on the CDMA Configuration Tool 1.1 screen to complete the remainder of the test. The program will move through each FRU (primary/spare), path (delayed/non-delayed), sector, and beam. It

8. Measure the RF power present at the ANT IN port by reading the Rx power on the Spectrum Analyzer screen. The value, displayed in dBm, is your reference.
9. Subtract this value from 10 dBm to determine the loss of the cable. Round to the nearest tenth of a dBm.
10. Press SHIFT, then CONFIG on the 8921A test set. In the Configuration mode, set the RF LEVEL OFFSET to ON.
11. Scroll down to the ANT IN selection and enter the value you determined in Step 9 as a negative number.
12. Return to the Spectrum Analyzer screen. If the calibration was performed correctly a value of 10 dBm should be displayed.

5.5.9 Test Setup

Once the cable loss has been calibrated, set up the Rx Path Calibration test in the following order.

1. Set up the RF Generator screen of the HP 8921A test set as follows:
   - RF GEN FREQ to the Rx frequency for the carrier under test, as shown earlier in Table 5.6.
   - AMPLITUDE to -40 dBm
   - OUTPUT PORT to DUPL

Caution: Make sure you change the amplitude of the test signal from 10 dBm to -40 dBm before connecting any cables between the SpotLight system and the HP 8921A test set. Failure to do so may damage your test equipment.

2. Go to the Spectrum Analyzer screen and set it up as follows:
   - Set the Spectrum Analyzer Controls to MAIN.
   - Set the Input Port to ANT.
   - Set the Reference Level to -30 dB.
   - Set the Span to 200 kHz.
3. Connect the SpotLight components to the test set as shown in Figure 1.

8921A test set. The program then performs a calculation and adjusts the Tx FRU attenuation to match the desired target value.

10. When the output level displayed on the HP 8921A matches the target value displayed by the CDMA Configuration Tool 1.1 to within ±1 dB, record the value displayed on the HP 8921A in the appropriate cell of Table 5.10.

Table 5.10 Data Sheet for Tx Path Calibration Test

		α Panel				β Panel				γ Panel			
		11	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
alpha	primary												
	secondary												
beta	primary												
	secondary												
gamma	primary												
	secondary												

11. Press ENTER to move to the next task.
12. Follow the instructions on the CDMA Configuration Tool 1.1 screen to complete the remainder of the test. The program will move through each FRU (primary/spare), sector, and beam. It will also prompt you when it is appropriate to move the test cables to another beam or sector.
13. When you have completed the test, type **`send_system`** "**`rxbase finish`**".

Note: The quotation marks must also be typed as part of the command.

14. Type **`EXECUTE`**. The information you have just generated will then be stored in flash memory.

Important: The Tx and Rx Path Calibration tests must be completed before the Bay Level Offset (BLO) calibration script can be prepared, the BLO test run, and the Transmit Power Verification test completed. These tests rely on calibration data already being stored in the FRUs.

4. Activate the pattern using the configuration tool by typing **`execute pattern 1`**.
5. With equipment connected as shown in Figure 5.2, measure the output signal level for beams 11, 3, and 7. Begin with beam 11. The target output level should be 33 dBm for the SC 9600 system.
6. If the signal level displayed on the HP 8921A test set does not match the target value, adjust the beam weighting as follows:
   - 6.1 Type **`set_target_pattern 1`**.
   - 6.2 Type **`relgain Tx`** *`port attenuation`*, where *port* is the beam number and *attenuation* is the attenuation value in 10ths of a dB.
   - 6.3 Check that the pattern was adjusted properly by typing **`pattern get 1`**.
   - 6.4 Verify on the HP 8921A that the output level matches the target value. If not, repeat the above steps until it is within ±1 dB tolerance.
   - 6.5 Record the difference for that beam.
7. Move the test cable to the ANT port on the IDLS for beam 3 and repeat Step 6.
8. Move the test cable to the ANT port on the IDLS for beam 7 and repeat Step 6.
9. Modify the beam weightings in the original CDMA script to reflect the recorded difference in the actual versus the target signal level for each beam. Keep this calibration Script on a disk in the site documentation binder for use during the Bay Level Offset test.

5.5.12 Bay Level Offset Test Procedure

This test measures the Bay Level Offsets and applies correction factors to the SC 9600 CDMA system. When a SpotLight system is installed, the Bay Level Offsets need to be measured for operation with the SpotLight system.

This test accomplishes three goals:

- It generates new Bay Level Offests for the SC 9600 CDMA system.
- It allows the operator to run the Motorola ATP tests.
- It demonstrates that the SpotLight system has been properly connected to the SC 9600 CDMA system.

1. Load the calibration script modified in the previous section.

The following is an example of what this script should look like.

```
* Clear previous Tx and Rx connections
SET DISCONNECT ALL
*
* -------- Begin Set Tx Port Connections ------
*
** Alpha Sector Tx **
SET TXC 11 A NONDELAY LOW
SET TXC 12 A NONDELAY LOW
SET TXC 1 A NONDELAY LOW
SET TXC 2 A NONDELAY LOW
** Alpha Sector Beam Weighting Gains **
SET RELGAIN TX 11 0
SET RELGAIN TX 12 0
SET RELGAIN TX 1 0
SET RELGAIN TX 2 0
** Beta Sector Tx **
SET TXC 3 B NONDELAY LOW
SET TXC 4 B NONDELAY LOW
SET TXC 5 B NONDELAY LOW
SET TXC 6 B NONDELAY LOW
** Beta Sector Beam Weighting Gains **
SET RELGAIN TX 3 0
SET RELGAIN TX 4 0
SET RELGAIN TX 5 0
SET RELGAIN TX 6 0
** Gamma Sector Tx **
SET TXC 7 G NONDELAY LOW
SET TXC 8 G NONDELAY LOW
SET TXC 9 G NONDELAY LOW
SET TXC 10 G NONDELAY LOW
** Gamma Sector Beam Weighting Gains **
SET RELGAIN TX 7 0
SET RELGAIN TX 8 0
SET RELGAIN TX 9 0
SET RELGAIN TX 10 0
*
```

5.5.14 Test Setup

Before running the test you must first calibrate the test cable losses and enter them into the HP 8921A test set.

1. Connect the 30 dB attenuator to the RF IN/OUT port.
2. Connect one end of the test cable to the attenuator and the other end to the DUPLEX OUT port of the HP 8921A test set.

5.5.15 Test Procedure

1. Store the Tx Power script in pattern location 1 in the CDMA Configuration Tool 1.1. To load the pattern, type: **`source_cdma10 filename 1`**.

   The filename should include the path if the script file is not in the same directory as the configuration tool. The integer entered after the filename specifies which pattern location you want the script stored in (1 - 10).

2. Type **`execute`**.
3. Activate the pattern using the configuration tool by typing **`execute pattern 1`**.
4. Connect the test cable from the 30 dB attenuator on the RF IN port to the end of the SpotLight bottom jumper that connects to the lightning arrestor for beam 11.
5. Have the cell tech turn on the SifPilotPwr to a setting that was used during Motorola calibration (typically 27 dBm, 30 dBm, or 33 dBm). Call processing should be inhibited on both analog and CDMA.

Caution: Do not use a SifPilotPwr setting greater than 33 dBm.

6. Record the level seen on the HP 8921A CDMA analyzer in Table 5.12.
7. Record the CDMA channel power output level in dBm for each beam in the sector in a format similar to Table 5.12.
8. Add the coupler loss (in dBm) to the measured values. Convert dBm to watts using the formula:

$$P_w = \frac{10^{\left(\frac{P_{dBm}}{10}\right)}}{1000}$$

9. Calculate the composite sector transmit power by summing the measured beam power for each beam in the sector (for example, beams 11, 12, 1, and 2 for alpha sector).
10. Convert the measured sector output power from watts to dBm using the formula:

$$P_{dBm} = 10 \times \log(P_{watts} \times 1000)$$

11. Calculate the difference in the measured power versus the desired power. The difference should be ±2 dB. The measured transmit beam power is for all signaling channels (pilot, page, sync) or 1.85x SifPilotPwr setting, as shown in Table 5.13.

5.6 Motorola SC 9600 Calibration and ATP Tests

Successful completion of this section accomplishes three goals:

- Demonstrates that the SpotLight system has been properly connected to the SC 9600 Mixed Mode system
- Generates new Bay Level Offsets for the SC 9600 Mixed Mode system
- Demonstrates that the SpotLight-for-SC 9600 system passes the Motorola ATP tests.

5.6.1 Overview

The SpotLight system changes how the SC 9600 Mixed Mode calibration procedure and acceptance test procedure, as given in the Motorola 'BTS Analog Optimization/ATP SC9600 Manual' and the Motorola 'BTS CDMA Optimization/ATP SC9600 Manual,' are performed.

Note: To minimize time spent configuring SpotLight with the LampLighter program, the calibration and ATP for a given path are performed sequentially in this chapter.

The default relationship between SpotLight and the SC 9600 Mixed Mode antennas is shown in Table 5.14. This can be changed for sites that have unusual sector configurations.

Table 5.14 SC 9600 Mixed Mode Antenna to SpotLight Beam Map

Sector	SC 9600 Antenna	SpotLight Beam
α	1	1
	2	12
β	3	5
	4	4
γ	5	9
	6	8

5.6.2 TCH and Sig Xcvr Tx Cal and ATP Procedure

Attention! Ensure that current Motorola calibration data for all RCUs is available on floppy disk at the cell site before starting this procedure.

1. Run Tx calibration on antennas 1-3.

```
autocal bts-bts# ant=1 dir=tx xcvr_slot=1..48
predict=yes load=no
```

7. Make two copies of the calibration file and ATP results on floppy disks. Keep one disk at the site, and give the other copy to the switch. Refer to the Motorola manuals for details on creating these two floppy disks.

Attention! If the cell site will be operated without SpotLight after these tests are run, ensure that the current Motorola calibration data file is reloaded to the transceivers prior to placing the site back in service.

5.6.4 CDMA

The following tests are run for the CDMA ATP:

- Tx Spectral Purity Mask
- Tx Rho
- Tx Code Domain Power
- Rx Frame Error Rate

Note: Rx Calibration is not run for CDMA on the SC 9600 Mixed Mode system.

Perform the following steps:

1. Refer to the Motorola SC 9600 Optimization manual for instructions on initiating the calibration and ATP procedures.
2. Load the CDMA script file generated in Section 5.4, "CDMA Tx Amplitude Calibration,' containing the CDMA gain correction factors.
3. If IDLS module 1 is not yet cabled to an antenna, connect a 150-watt, 50-Ω dummy load to the ANT port on IDLS Module 1. Otherwise, skip to step 4.
4. Connect the RF In/Out port on the HP 8921A to the –40 coupled port on IDLS module 1.
5. Run the calibration command for Antenna 1, BBX 1. The following is an example of this calibration command:

   ```
   cal bts-bts# ant=1 dir=tx cha=cha# bbx_slot=1
   ```

6. Load the calibration data to BBX 1:

   ```
   loa bbx-[bts#]-bbx1 ima=data
   ```

7. Run the Tx Spectral Purity Mask ATP. Refer to the Motorola CDMA manual for details.
8. Run the Tx Rho ATP. Refer to the Motorola CDMA manual for details.
9. Run the Tx Code Domain Power ATP. Refer to the Motorola CDMA manual for details

Chapter 6 Commissioning Test Procedure

Contents

6.2.2 CDMA Configuration Tool Test Description

1. Insert the CDMA Configuration Tool diskette into the PC.
2. Click the Start button on the Taskbar.
3. Select Run. Windows will open the Run Dialog Box.
4. In the Run Dialog Box Open field, type the drive letter for the diskette drive followed by :\CDMA.CFG
5. Click OK or press Enter. The dialog box will close and the PC will start loading the setup program.
6. Once the software has loaded, verify that you can activate the configuration tool by double-clicking on the icon.

The CDMA Configuration Tool Installation Test passes if you can access the command line interface. Refer to the SpotLight Configuration Tools Manual (530-0001-01) for more information on using this program.

6.3 Transmit Test

(How does this test change for a CDMA-only system?)

The purpose of this test is to demonstrate that customer-specified transmit power can be generated and controlled, as measured at the –40 dB port of the IDLS.

6.3.1 Equipment Required

The following equipment is required to perform this test.

- Laptop PC with LampLighter
- RS-232 cable to connect to the SpotLight system
- Power meter such as the Bird model 43 inline watt meter
- Channel map and link budget documents (verified correct prior to CTP)

6.3.2 Test Description

1. Connect the power meter to the IDLS –40 dB port for the beam under test.

Note: The power meter requires proper settings and/or power detector modules for the power range expected from the –40 dB port. The expected

13. Restore the beam power to the original value to match the link budget output power and verify that the power measured at the IDLS –40 dB port is restored to the value measured in step 8.

The Transmit Test passes if:

- You key the RCU under test and measure the expected power level at the IDLS –40 dB port when the beam under test is set to its specified power levels.
- The Tx power changes accordingly when the beam power is changed and the RCU is rekeyed.
- The desired Tx power at the IDLS –40 dB port is restored when the original beam power is restored.

6.4 Receive Test

(How does this test change for a CDMA-only system?)

The purpose of this test is to demonstrate the viability of the receive signal path to the RCUs.

6.4.1 Equipment Required

The following equipment is required to perform this test.

- Laptop PC with LampLighter, with RS-232 cable to connect to the SpotLight system
- HP 8921A cell site test set (or equivalent)

6.4.2 Test Description

1. Connect the HP 8921A to the IDLS –40 dB port for the beam under test. For simplicity, use the "primary parked beam" for the RCU under test. This provides a default RCU to antenna port connection.
2. Inject a –40 dBm at channel 500 signal.

   Measure the received power of the test signal on the RCU under test by issuing the MEAS command with the EXT parameter set. For example:

   ```
   MEAS: CELL cell number, RXPWR 0, CHANL 500, EXT
   ```

   The result of this command is to produce an RSSI value for Rx diversity 0 of the RCU under test. The RSSI value corresponds to the power

5. Turn off power to a second LPA module. After approximately one minute, confirm the red ALARM LED on the AIM front panel lights, and that a major alarm is detected at the cell site's central switch or NOC.
6. Turn power back on to both LPAs. Confirm that the AIM front panel alarm LEDs (amber and red) went out, and that the alarms cleared at the cell site's central switch or NOC.

6.5.3 IDLS Alarm Relay Test

Perform this test on one IDLS module.

Note: The IDLS only displays a major alarm.

1. Remove the alarm cable jack from one of the IDLS modules and confirm that the Major Alarm relay is activated at the cell site's central switch.
2. Replace the alarm cable jack into the alarm port of the IDLS module.
3. Confirm that the alarm is cleared at the cell site's central switch.

6.6 CDMA Call Processing Test

The purpose of this test is to demonstrate SpotLight's ability to process a CDMA call, and to verify sector pseudo-noise (PN) and handoffs.

6.6.1 Equipment Required

You need the following equipment to perform this test.

- CDMA cell phone capable of operating in "test mode" to display sector PN
- Automobile

6.6.2 Test Description

With the cell phone in test mode:

1. Place a call within the bcoverage boundary of each sector of the cell site under test and verify the correct PN is being transmitted for that sector.
2. Monitor the call and sector PN for softer handoffs as the mobile drives between the sectors of the cell site.
3. Monitor the call for soft handoffs as the mobile leaves and enters the coverage area of the cell site under test.

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OPERATIONAL DESCRIPTION

SpotLight™ 2000

for Analog and CDMA Cellular Sites

System Overview

6/15/99

Revision History

Date	Version	Description
6/15//99	N/A	Initial release.

Copyright Information

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Chapter 1 System Overview

Contents

1.1 Introduction

The SpotLight 2000 system consists of the following functional components:

- Three-panel antenna array
- Lightning arrestors[1]
- Bandpass/notch filters[1]
- Integrated Duplexer/LNA Aplitter (IDLS) assembly
- Dual-Mode Preamplifier Assembly (DMPA)
- Linear Power Amplifier (LPA) assembly
- Sig/Scan Interface modules (SSI 1 and SSI 2)
- Sig Transmit module (STM) assemblies)
- Analog spectrum management unit (SMU) cages
- CDMA Synthesis cage
- Alarm Interface Module (AIM)
- Interface components between SpotLight 2000 system and base station
- Remote configuration router[2]
- Modem[2]
- DC-DC power converter[2]

The SpotLight 2000 system also includes the following software programs:

- LampLighter™, a configuration tool for installing SpotLight system software, configuring the system hardware, monitoring system performance statistics, performing system tests, and troubleshooting.
- CDMA Configuration Tool 1.1, a command line interface program used to configure and monitor the SpotLight CDMA equipment.
- BmCtrl (Beam Control), a CDMA application used to model different antenna and transmit power configurations.
- SysCal, an application used for calibrating the SpotLight transmit path.

1. Customer supplied equipment.
2. SpotLight 2000 system option.

1.2 Operational Overview

The SpotLight RF signal path starts with three antenna panels that each contain four narrow-beam antennas. Each narrow-beam antenna uses a low-loss coaxial cable that runs through a lightning arrestor and then connects to the antenna input port on a separate IDLS module. These IDLS modules provide front-end filtering, low-noise amplification, and eight-way splitting of the received analog or CDMA signal. These eight identical signals are then sent to other components through eight output ports on each IDLS module. The actual signal flows are addressed separately in the Analog and CDMA sections of this chapter.

The LPA assembly contains 16 high-quality ultralinear power amplifiers and coupled by input and output hybrid matrices. An optional add-on LPA assembly can be installed to boost transmit power for a particular sector (CDMA mode) or to increase the entire coverage area for a cell site (analog mode). The transmit signals from the DMPA are processed by the input hybrid matrix, which splits each of the input RF signals 16 ways and distributes them to the 16 LPA modules. These LPA modules amplify the RF signals and sends them to the output hybrid matrix, which re-combines the RF signals.

These signals are then cabled from the output hybrid matrix to the transmit ports of the IDLS assembly, completing the connection of RF transmit energy to the narrow-beam antennas.

1.2.1 CDMA Operation

The CDMA portion of the SpotLight 2000 system provides the CDMA receive and transmit RF paths in either the A or B cellular band. On the receive path, even and odd beams are combined and fed to the diversity ports of the CDMA RCUs. On the transmit path, the CDMA signal is simulcast to multiple beams. Sector beamwidth and azimuth changes are controllable either locally or remotely through the CDMA Configuration Tool 1.1.

The SpotLight system supports one or two CDMA 1.1 Synthesis cages. Each Synthesis cage can accommodate up to four CDMA carriers. Each Synthesis cage can be configured independently of the other.

1.2.1.1 Receive Path

The CDMA receive signal enters the SpotLight 2000 system at the ANT port of the IDLS. Each IDLS is associated with one multibeam antenna, which is assigned to a CDMA sector by SpotLight 2000 software.

The IDLS module provides front-end filtering, low-noise amplification, and eight-way signal splitting of the received signal. The IDLS has eight output ports on the receive path. One set of IDLS receive signals is routed to the Rx FRUs in the CDMA Synthesis cage. There is one active and one standby Rx FRU per Synthesis cage. The Rx FRU outputs provide diversity Rx signals to the CDMA RCUs.

1.2.1.2 Transmit Path

The Tx FRUs in the CDMA Synthesis cage receives transmit signals from the base station CDMA RCUs.

The Tx FRU combines two sets of CDMA radio outputs on a per-sector basis. There is one active Tx FRU per sector, and one standby Tx FRU for added system reliability.

Signals from the CDMA Tx FRU are routed to the DMPA, where they are amplified and routed to the LPA input hybrid matrix.

Figure 1.1 SpotLight 2000 Dual-Mode Receive RF Path

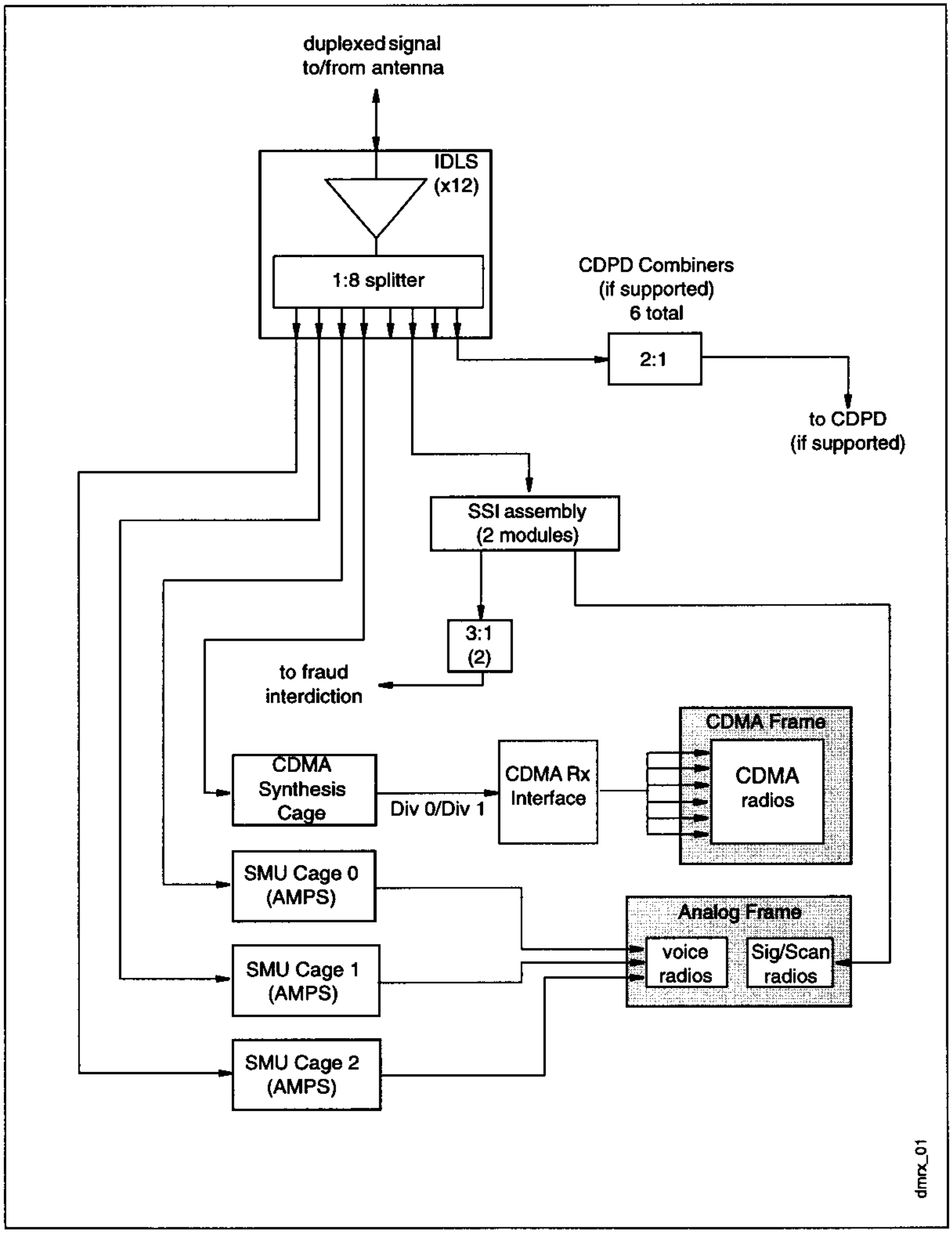
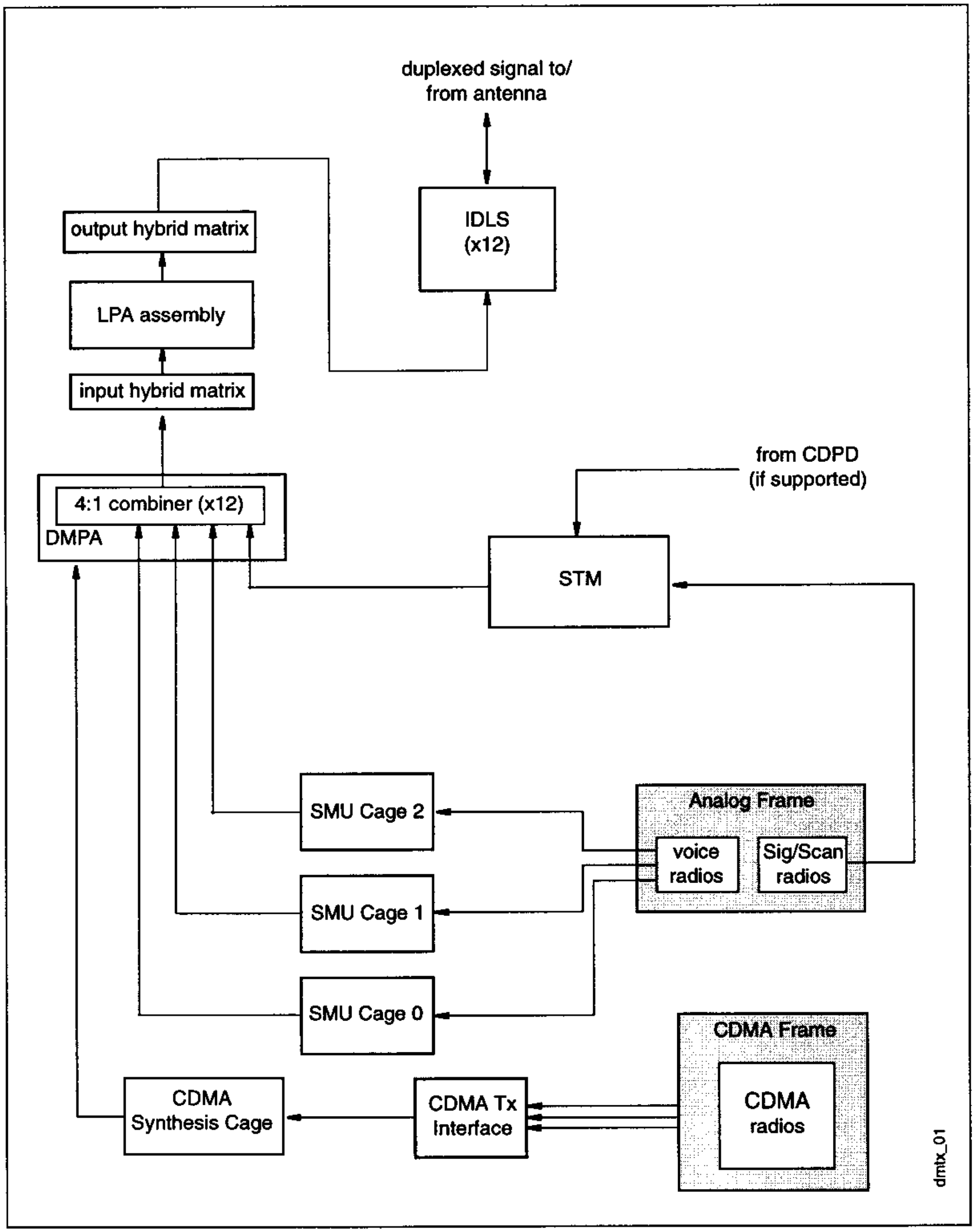


Figure 1.2 SpotLight 2000 Dual-Mode Transmit RF Path



1.2.2 Analog Operation

The analog signal path shares the same antennas, IDLS, DMPA, and LPA modules as the CDMA signal path.

1.2.2.1 Receive Path

The analog receive signal (Figure 1.1) enters the SpotLight 2000 system through the antenna port of the IDLS module. Each narrow-beam antenna has a corresponding IDLS module, which provides front-end filtering, low-noise amplification, and eight-way signal splitting of the received signal. These eight copies of the received signal are provided at the output ports (Rx1 through Rx8) on the back of each IDLS module. A complete set of output signals (that is, one signal from each of the 12 modules) is routed to the following destinations:

- One set is routed to each AMPS SMU cage. These signals are then routed to the AMPS Rx SMUs. Each Rx SMU provides six pairs of diversity receive-signal outputs to the voice RCUs of the HD II system. The Rx SMU measures the received signal strength and SAT codes for each RCU frequency and switches the two best narrow-beam antenna signals to each RCU receive-antenna input pair to optimize its performance.
- One set is sent directly to the SSI assembly. The SSI assembly consists of two identical modules that provide diversity inputs to the base station signaling RCUs. The SSI supports sector and omni configurations. The SSI also provides output ports for a fraud interdiction system.

Any unused IDLS output ports should be terminated.

1.2.3 Transmit Path

The SpotLight 2000 transmit signal path (Figure 1.2) originates with the CDMA voice radios providing signals to the Tx SMUs in the SMU cages. Each Tx SMU functions in coordination with a pair of receive Rx SMUs in the same SMU cage. Each Tx SMU is responsible for switching between one and 12 RCU transmit outputs to the best narrow-beam antenna, as determined by the Rx SMU receive signal measurements and local cell site configuration rules.

Transmit signals from the Tx SMU modules are combined in the DMPA. Each of the 12 DMPA RF paths consists of a 4-to-1 RF power combiner followed by an RF amplifier/driver to accurately establish the transmit power levels.

These transmit signals are then cabled to the input hybrid matrix on the LPA assembly, where they are processed and then distributed to the LPA assembly. This assembly is comprised of 16 high-quality ultralinear power amplifiers.

The outputs of these 16 LPA modules are combined by the output hybrid matrix to arrive at a single antenna output port. Transmit signals from the output ports of the LPA assembly are cabled to the transmit ports of the IDLS assembly, completing the connection of RF transmit energy to the narrow-beam antennas.

1.2.4 CDPD Support

The SpotLight system provides pass-through CDPD support. CDPD (if installed) is set up to meet the baseline (pre-SpotLight) configuration and performance.

The CDPD receives one full set of Rx signals from the IDLS modules. Receive diversity paths are provided by summing non-adjacent beams. For example, the alpha panel consists of beams 12, 11, 1, and 2. Beams 11 and 1 are summed to provide the alpha diversity 0 path and beams 12 and 2 are summed to provide the alpha diversity 1 path.

CDPD transmit signals are routed to the OSTM, where they are combined with output from the Scan RCUs and sent to the DMPA. From the DMPA they follow the same RF path as the voice data from the Analog SMU and CDMA Synthesis cages.

1.2.5 Diagnostics Support

The SpotLight system supports the diagnostics for all voice, Sig, and Scan RCUs.

To support diagnostics, idle RCUs must be "parked" on two different beams, one for each diversity. Park beams are designated as the middle two beams in each sector. When not transmitting, all RCUs are connected to these two beams to establish a path to the diagnostic subsystem. As a convention, Metawave recommends using even-numbered beams as the park beam for diversity 0, and odd-numbered beams as the park beam for diversity 1. To assign an RCU to a park beam, use the RCU Configuration dialog box in the LampLighter program.

1.2.6 CDMA Phase Calibration

The phase of each of the twelve CDMA output signal paths must be carefully calibrated in order to support variable transmit sectorization. Calibration is implemented using a test tone that is generated in the CDMA Synthesis cage, injected into selected transmit paths, collected at the antenna and returned through the antenna Calibration Out port to the IDLS for measurement.

1.3 Antennas

The standard SpotLight system antenna consists of three bi-directional antenna panels. Each panel contains an array of four narrow-beam (30°) antennas for a coverage of 120° per panel. Antenna panels designed to carry both analog and CDMA traffic are equipped with a fifth connection port. This port provides a loopback path for testing the transmit portion of the SpotLight system.

Metawave antennas should be mounted no closer than 18 inches from another antenna. The antenna tower must be capable of supporting the weight of the panels and cables, as wel as mast weight, the weight of other tower-mounted cel site equipment, and stresses imposed by wind. Metawave antenna panel mounting brackets are designed to withstand sustained winds of up to 125 miles per hour. Those stresses are transferred to the tower structure; therefore, the positions on which you mount each antenna array should be strong enough to withstand the same sustained wind stresses. Refer to site engineering documentation for antenna mounting information and requirements.

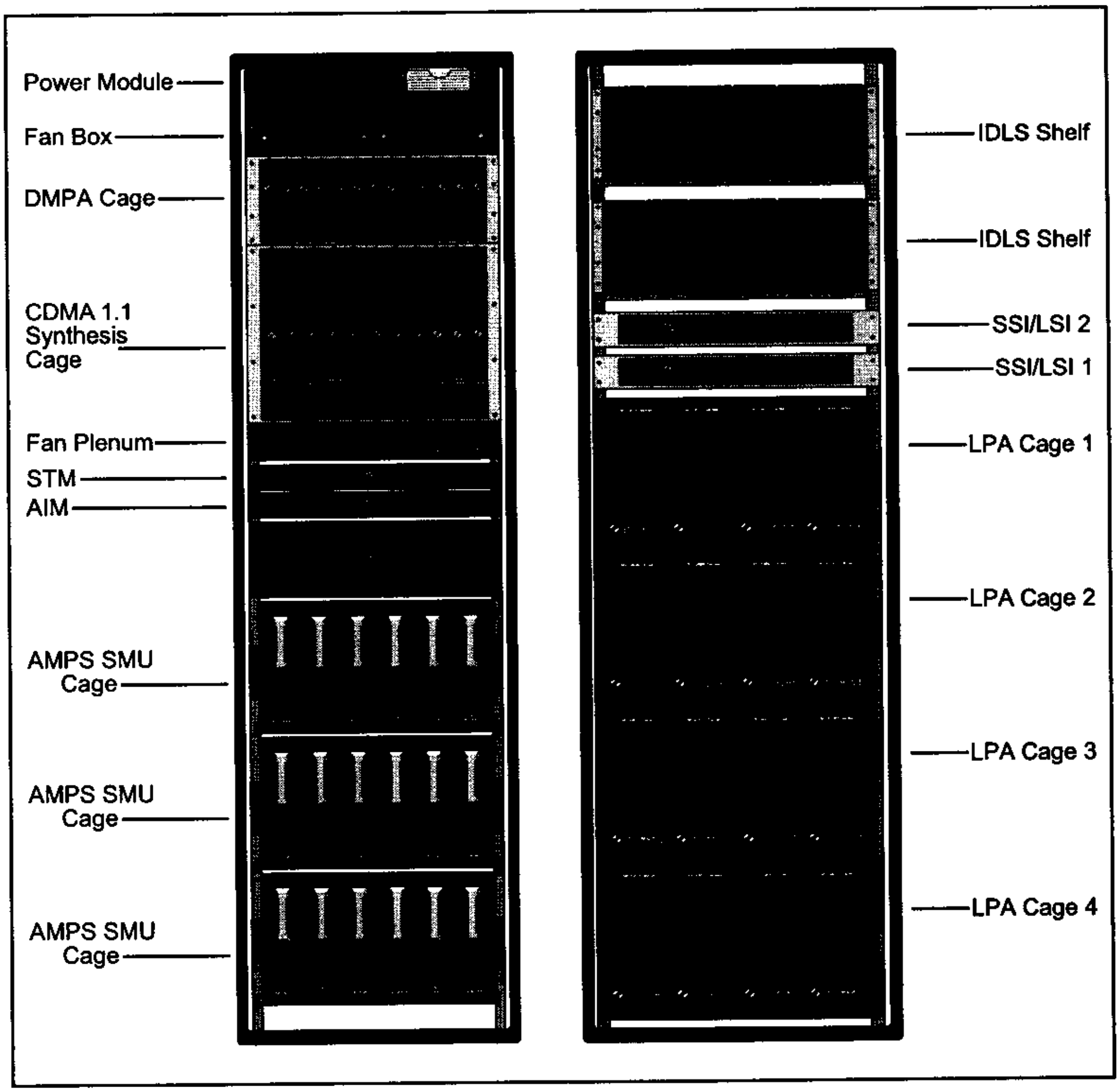
Because the azimuthal range of the Metawave antenna must be secured within a tolerance of ±1.5°, the mounting position should accommodate a stabilizing arm, if local conditions require it.

1.4 Rack-Mounted Components

The SpotLight system is typically installed in two equipment racks, as shown in Figure 1.3.

- A 19" x 90" rack for analog and CDMA RF components.
- A 25" x 90" rack for the IDLS and LPA modules.

Figure 1.3 SpotLight 2000 Dual-mode Configuration



1.4.1 IDLS (Integrated Duplexer and LNA Splitter)

The IDLS assembly is common to both the analog and CDMA Rx and Tx signal paths. It consists of two separate chassis in the 25" equipment rack. Each chassis comprises six separate IDLS modules. Each of the twelve SpotLight narrow-beam antennas is associated with its own IDLS module. Each module is a hot-swappable, field-replaceable unit (FRU).

Receive signals are split eight ways for distribution to various parts of the SpotLight system:

- The CDMA Synthesis cage for the two CDMA Rx SMU modules, each of which provides 12 receive signals to the Receive Interface Box (RIB).
- Each AMPS SMU cage for the analog Rx SMU modules. Each analog Rx SMU provides 12 receive-signal outputs to the receive diversity antenna inputs of the voice radios (RCUs).
- The SSI modules, which provide diversity inputs to the Sig/Scan RCUs.
- To six 2-1 CDPD combiner modules (if installed), which send receive diversity signals to the base station CDPD unit.

1.4.2 Spectrum Management Unit (SMU)

The SpotLight system intelligence is contained within SMU (Spectrum Management Unit) modules. A typical dual-mode SpotLight system has one to three SMU cages, depending on the number of analog traffic channels supported. Each analog SMU cage contains up to four Rx SMU modules and up to two Tx SMU modules.

Each SMU cage receives one full set of amplified voice signals from the IDLS assembly and passes a copy of these signals to the Rx SMU modules. Signals are then passed to and received from the cell site voice RCUs, and finally routed to the Tx SMU modules.

An external I/O board is attached to SMU cage backplanes. External I/O boards provide the interface to the cell site and peripherals, including the computer-based LampLighter application, which is used to configure the SpotLight system.

1.4.2.1 Rx SMU Module

The Rx SMU modules measure the received signal strength (RSSI) and supervisory auditory tones (SAT) codes for up to six RCU frequencies, then uses advanced software algorithms to determine the two best signals. These signals—up to six pairs for a total of 12 output signals—are routed to the receive diversity antenna inputs of between one and six RCUs. The Rx SMU also provides messages to the Tx SMU to guide it in connecting the best beam to the RCU's transmit voice signals.

Each Rx SMU includes:

- Four RSSI receivers. Two of these RSSI receivers perform RSSI measurements at 0.5-second intervals; the other two perform SAT/ DSAT verification at 0.5-second intervals.
- A controller card that powers and controls the rest of the Rx SMU. It contains the microprocessors that run the software algorithms for allocating beams to RCUs.
- A solid-state switch matrix that provides the physical RF connection between the beams and the RCUs, using instructions provided by the controller card.

The Rx SMU module is a field-replaceable unit. Each SMU cage houses up to four Rx SMU modules.

1.4.2.2 Analog Tx SMU Module

Each SMU cage contains one or two Tx SMU modules, for up to 24 transmit voice channels. Each Tx SMU module maps to two Rx SMU modules: Tx SMU 0 maps to Rx SMU 0 and Rx SMU 1 and Tx SMU 1 maps to Rx SMU 2 and Rx SMU 3. The Tx SMU communicates with the Rx SMU modules that it maps to for RSSI information in order to assign transmit signals to the appropriate beam.

The Tx SMU module is a field-replaceable unit.

1.4.2.3 External I/O Board

The external I/O board serves as the reference frequency conduit to the SMU backplane. It also contains the jumpers that determine the SMU cage ID, and it provides the alarm ports between the SMU cage and the cell site alarm reporting structure.

1.4.3 Dual-Mode Preamplifier Assembly (DMPA)

The DMPA provides the transmit driver amplifier and combiner functionality for both analog and digital radio signals. The DMPA accepts up to four sets of analog inputs, typically from three SMU cages and an Sig Transmit Module (STM). The DMPA also accepts input signals from one or two CDMA Synthesis cages.

Analog signals are combined on the backplane and routed to the DMPA FRUs. There is one DMPA FRU for each SpotLight beam. Each DMPA FRU accepts one RF analog input signal and two RF CDMA input signals. The CDMA signals are amplified and combined on the DMPA FRU, then combined with the analog signal. The analog signal path has an attenuator that is adjustable in 4 dB steps from 0 to 28 dB. The common analog/CDMA path also has an attenuator that is adjustable in 1 dB steps from 0 to 15 dB.

The output signals of the DMPA FRUs are routed from the DMPA backplane to the LPA Input Hybrid Matrix.

The DMPA also requires the use of a fan assembly, which consists of three components:

- A fan module, with an air spacer, which is mounted above the DMPA.
- A plenum/filter assembly which is mounted below the DMPA.
- A Flow FRU which is installed in a DMPA FRU slot to ensure proper air flow.

If more than four sets of analog inputs are needed, an external combiner board (ECB) mounts on the back of the DMPA cage. The ECB provides six sets of analog inputs. These are combined into three analog outputs which connect to the DMPA backplane. With the addition of this combiner board, the SpotLight system can accommodate up to six analog SMU cages plus the STM.

1.4.4 Linear Power Amplifiers (LPA)

The LPA assembly receives transmit voice signals from the DMPA and control signals from the signaling RCUs. It amplifies these signals, then passes them on to the IDLS assembly. The LPA assembly consists of the following:

- An Input Hybrid Matrix that splits the incoming signals
- Ultra linear, multi-carrier LPA modules that amplify the signals
- An Output Hybrid Matrix that combines the signals from the LPA modules
- Rack-Mounting Frames to support the LPA modules and hybrid matrices

LPA assemblies are packaged in two configurations:

- Sixteen modules
- Four modules

Two power options are available for the 4- or 16-module configuration:

- 50 W
- 30 W

The SpotLight system comes with a standard 16-module LPA system. You can add a modular 4-module LPA assembly to an existing 16-way matrix to create a 20-module system, which will increase the power going to the high-use antenna beams.

1.4.5 Sig/Scan

The Sig/Scan components of the SpotLight system extend the useful range of the cell site signaling and scanning in much the same way that the SpotLight system does for the voice radios. Sig/Scan is divided into two parts; the Sig/Scan Interface (SSI) assembly in the receive path and the Sig Transmit Module (STM) in the transmit path.

1.4.5.1 Sig/Scan Interface (SSI)

This assembly consists of two modules that provide diversity inputs to the Sig and Scan transceivers. Up to six Scan transceivers and six Sig transceivers (three primary and three secondary) are supported. Each SSI module handles six Rx inputs from the IDLS assembly; even-numbered beams are cabled to one module, and odd-numbered beams are cabled to the other module. This arrangement provides redundancy; if one module fails, the other module provides non-diversity signals to the Sig/Scan RCUs. The SSI also provides output ports for a fraud interdiction system.

1.4.5.2 Sig Transmit Module (STM)

The STM integrates with Sig/Scan analog radios on the transmit path. It also supports directional setup, routing signals to the appropriate beams in accordance with sector setup configurations. The STM assembly combines inputs from the cell site primary and secondary signaling transceivers. This combined signal is then split into 13 signaling transceiver outputs that are fed to the DMPA. The STM further provides samples of the signaling transceiver inputs that are routed back to the SMU assembly for measuring power levels.

Outputs from both the cell site primary and secondary signaling amplifiers are provided to the STM. These signals pass through two-way power dividers. One output from each power divider is provided as assembly outputs, which are passed to a transmit SMU for power level detection in order to determine if either transceiver is functional (based on the presence of RF power above a threshold). The others are combined, then split 12 ways. A thirteenth output is generated off a directional coupler in the path of the twelfth channel. The end result is thirteen signal transceiver outputs from the STM assembly, which can be tailored to each beams specific needs before being re-combined with a corresponding voice channel in the Tx C/D. The power level of the signaling RF on the thirteenth channel may be degraded, when compared to the levels on the other twelve channels.

The STM takes input RF signals from the Scan RCUs. Signals from each primary and secondary Scan RCU are combined and routed to an external connection where the output power is adjusted through the use of external attenuators.

The outputs of the STM are routed to the DMPA.

1.5 Lightning Arrestors

Lightning arrestors are required cell site equipment to protect Metawave components from lightning strikes or other high-voltage spikes. One lightning arrestor per antenna channel is required.

Caution: Proper grounding techniques must be followed in order for the lightning arrestor to be effective. Failure to do so may result in damaged equipment in the event of a lightning strike.

Metawave recommends the PolyPhaser IS-CT50HN-MA lightning arrestor. Equivalent arrestors may be used, but they should, at a minimum, meet the specifications in Table 1.1.

Table 1.1 Minimum Lightning Arrestor Specifications

Specification	Value
Impedance	50 ohms
VSWR	≤ 1.2:1
Connectors	Antenna port - Type N Male Equipment port - Type N Female
Turn-on voltage	1200 VDC
Turn-on time	7.0 ns for 2 kV/ns
Surge	20 kA IEC 801-5 8/20μs waveform 138 Joules
Max surge	20,000 A
Frequency range	800-900 MHz @ 750 W
Insertion loss	0.1 dB maximum
Peak Tx Input Power (PEP)	10 kw maximum
Power handling	750 W maximum (single channel)

1.6 Remote Access

SpotLight offers a remote access capability through the LampLighter program (Section 1.7) for system configuration and performance monitoring. To utilize this capability it is necessary to install a router and modem. A power supply may also be necessary for these components.

The type of router used will depend on the system configuration. A Cisco model 2501 router is offered for a system with a singel SMU cage. A Cisco model 2514 is required if the system has two, three, or four SMU cages.

A separate POTS (plain old telephone service) line is required for modem access.

1.7 System Configuration Tools

SpotLight comes with several programs for setting up and adjusting system operation.

1.7.1 LampLighter

LampLighter is an integrated graphical user interface that provides the analog side of the SpotLight system's operation, administration, and maintenance (OA&M) functionality. With LampLighter you can view the current system configuration, configure SpotLight SMUs to cell site RCUs, define which antennas are connected to SMUs, and specify individual transmit power settings for each of SpotLight's 12 beams. You can also define multiple configurations and save them as files for later use.

LampLighter is also used for monitoring and logging system performance statistics. For monitoring, you can view data in real-time or save it in a file for later review. A data tracking module provides you with a graphic display of the SpotLight system's operation, including RSSI, SAT values, and beam assignments for a selected channel/radio. You can specify the interval at which data is updated on the display.

You can configure LampLighter to automatically display a message window if an alarm occurs in one of SpotLight's powered assemblies. The message indicates the nature of the alarm and when it was activated. You can also save these messages to a log file.

1.7.2 CDMA Configuration Tool

This program allows the user to communicate with a CDMA Synthesis cage, using an RS-232 serial port or an Ethernet with TCP/IP protocols.

It allows a user to:

- View the connected CDMA configuration.
- Load another configuration to the CDMA Synthesis cage.
- Configure CDMA modules using a script file.
- Load a time versus sector mapping schedule using a script file.
- Log data to a file, or send it directly to the display.

1.8 SpotLight System Specifications

Table 1.2 through Table 1.4 provide specifications for the SpotLight system.

Table 1.2 RF Performance Specifications

Specification	Value
System gain	10 dB to 15 dB, excluding optional bandpass/notch filters
Receive path input third order intercept	-10 dBm
System noise figure	5 dB or less, excluding optional bandpass/notch filters
Transmit output power [a]	250 W (30 W LPA system) 415 W (50 W LPA system)

a. standard 16-way LPA configuration

Table 1.3 Environmental Specifications

Specification	Value
Operating humidity	From 5% to 95% R.H. not to exceed.024 grams of water per gram of dry air (non-condensing)
Operating temperature	5° to 40° C long term, full compliance. 0° to 50° C short term degraded performance (not more than 72 consecutive hours, not more than 15 days per year).
Shock /vibrations	Earthquake cabinetry option meets Bellcore specification TR-NWT-000063 zone 3
Storage temperature	-40° to 65° C
Acoustic noise	Meets acoustic noise specification ISO-3743

Table 1.4 Electrical Specifications

Specification	Value
RF signals	Supports 24 analog voice channels per SMU cage (minus a total of 2 channels for sig/scan support) and 3 CDMA carriers per CDMA Synthesis cage.
Input power	+25 VDC to +30 VDC, negative ground (+27 VDC nominal)
Dissipation	Less than 8.5 kW
Alarming	Alarm relays provided for all major assemblies with active (powered) components. Supports at least 1 amp of current at 30 VDC
Base station interfaces	Messaging, transmit power level selection, and transmitter active
Peripheral interfaces	One 10Base-2 Ethernet port and two RS-232 serial ports on the AIM .

The CDMA Call Processing test passes when the call set-up, softer handoff, and soft handoff has been demonstrated within the general coverage area of the cell site.

applied at the IDLS (–80 dBm from the –40 dBm signal into the –40 dB port).

3. Connect a PC running LampLighter to the Rx SMU under test and verify the proper value on the proper beam using the Scanning Strength dialog box.
4. Move the input to the "secondary parked beam" and repeat steps 3 and 4 to confirm proper operation of Rx diversity 1.

The Receive Test passes if the expected Rx power is measured at the IDLS –40 dB port for both diversity inputs.

6.5 Alarm Functionality Test

The purpose of this test is to demonstrate that all SpotLight alarms are functional at the NOC, or at the contacts within the cell site, by creating a condition for each of the alarmed components in the SpotLight system to verify alarm reception at the NOC or at the alarm relay contact for the cell site.

6.5.1 Equipment Required

- Small Philips screwdriver
- Multimeter

6.5.2 DMPA and AIM Alarm and Relay Test

1. Remove one DMPA FRU from the DMPA cage. Confirm that the amber WARNING LED on the AIM front panel lights, and that a minor alarm is detected at the cell site's central switch or NOC.
2. Remove a second DMPA FRU. Confirm that the red ALARM LED on the AIM front panel lights, and that a major alarm is detected at the cell site's central switch or NOC.
3. Replace both FRUs. Confirm that the AIM front panel alarm LEDs (amber and red) are no longer lit, and that the alarms cleared at the cell site's central switch or NOC.
4. Turn off power to one LPA module. After approximately one minute, confirm that the amber WARNING LED on the AIM front panel lights, and that a minor alarm is detected at the cell site's central switch or NOC.

range is –15 to 0 dBm, assuming a single carrier in the range of 0.5 to 10 watts.

2. Determine which RCU is to be tested. For example, an Alpha, Beta, and Gamma RCU may each be tested to demonstrate each face has the proper power setting configured.
3. Locate the RCU on the channel map to determine which SMU it is connected to.
4. Key up the RCU. This requires customer personnel using the CFR: command.
5. Connect a PC running LampLighter to the Tx SMU under test.
6. Access the LampLighter command line interface and type the command `DAS MODE OFF`.

Note: The SpotLight system will not process calls with the `DAS MODE OFF` command active. Once testing is complete, you must execute the `DAS MODE NORMAL` command to begin call processing.

7. Type `TXCONNECT` *(antenna) (RCU port) (frequency band) (power level).*

Note: The `TXCONNECT` command is executed from each Rx SMU and is zero-based. Antennas are numbered 0 through 11. RCUs are numbered 0 through 4. For this test, frequency band 0 is preferred and you should set the power level to 0.

Note: You must use the `DISCONNECT` command prior to moving to the next RCU and beam.

8. Using the link budget document as reference, verify the power measured with the power meter is within tolerance of the desired value (±2.0 dB compared to the measured signal in the Link Budget document).
9. On the PC running LampLighter, select the Channel/Antenna Usage dialog box from the Real-Time menu and verify that the appropriate beam is selected for transmit power.
10. Select the Transmit Configuration dialog box and change the beam power level.
11. Verify on the power meter that the output power did not change.

Note: RCU configurations will not change while a call is in progress.

12. Unkey and rekey the RCU under test, and verify that the power measured with the power meter has changed to the value selected in step 10.

6.1 Overview

The objective of the Commissioning Test Procedure (CTP) is to verify that the SpotLight system is ready to be placed into commercial service.

The CTP consists of a sample of the following tests:

- LampLighter and CDMA Configuration Tool Installation Test
- System Configuration Test
- Transmit Test
- Receive Test
- Alarm Functionality Test
- Call Processing Test

These tests are both sequential and cumulative. They should be performed in the order listed, and each test should be successfully completed before moving on to the next test.

Note: Before performing tests, confirm that any SMU being tested is not carrying any call traffic.

While performing the Commissioning Tests, fill out the Commissioning Certificate (P/N 995-2102-27). A copy of this certificate should be included in your site documentation. When completed, obtain the appropriate Metawave and customer signatures. Leave a copy of the Commissioning Certificate with the customer, and forward a copy to Metawave Customer Services.

6.2 CDMA Configuration Tools Installation Test

The purpose of this test is to demonstrate that the CDMA Configuration Tools software program can be successfully loaded onto the customer's laptop PC.

6.2.1 Equipment Required

- Laptop PC - 486 or Pentium PC with a minimum of 8 MB RAM (24 MB for Windows NT) and at least 10 MB free disk space
- Windows 95 or Windows NT operating system
- CDMA Configuration Tool on 3.5" diskettes

10. Connect a 150-watt, 50-Ω dummy load to the ANT port on IDLS Module 5. Connect the RF In/Out port on the HP 8921A to the –40 coupled port on IDLS Module 5.
11. Run the calibration command for Antenna 2, BBX 2. The following is an example of this calibration command:

    cal bts-bts# ant=2 dir=tx cha=cha# bbx_slot=2

12. Load the calibration data to BBX 2:

    loa bbx-[bts#]-bbx2 ima=data

13. Run the Tx Spectral Purity Mask ATP. Refer to the Motorola CDMA manual for details.
14. Run the Tx Rho ATP. Refer to the Motorola CDMA manual for details.
15. Run the Tx Code Domain Power ATP. Refer to the Motorola CDMA manual for details.
16. If needed, connect a 150-watt, 50-Ω dummy load to the ANT port on IDLS Module 9. Connect the RF In/Out port on the HP 8921A to the –40 coupled port on IDLS module 9.
17. Run the calibration command for Antenna 3, BBX 3. The following is an example of this calibration command:

    cal bts-bts# ant=3 dir=tx cha=cha# bbx_slot=3

18. Load the calibration data to BBX 3:

    loa bbx-[bts#]-bbx3 ima=data

19. Run the Tx Spectral Purity Mask ATP. Refer to the Motorola CDMA manual for details.
20. Run the Tx Rho ATP. Refer to the Motorola CDMA manual for details.
21. Run the Tx Code Domain Power ATP. Refer to the Motorola CDMA manual for details.
22. Run the Rx path ATP. Refer to the Motorola CDMA manual for details.
23. Ensure that the calibration file is transferred from the LMF computer to two floppy disks. Keep one disk stored at the cell site. The second floppy disk must be given to the switch prior to cutting over to SpotLight. Refer to the Motorola manuals for details on creating these disks.

Attention! If the original Motorola calibration data file is not available or is incomplete, do NOT perform steps 1 through 4. The customer must be notified that these ATPs cannot be performed until after SpotLight is permanently connected to the base station.

2. Load the calibration data to the Xcvrs:

   loaddev xcvr-bts#-xcvr# image=data

3. Run the Tx FREQ ATP for antennas 1.
4. Run the Tx DEV ATP for antennas 1.
5. Run the Tx PWRSTP ATP for antennas 1. Run more that one power step level only if the customer specifies to do so.
6. Repeat steps 2 - 4 for antennas 2 and 3.
7. Ensure that the original Motorola calibration data file is reloaded to the transceivers prior to placing the site back in service.

5.6.3 TCH, Sig and Scan Xcvr Rx Cal and ATP Procedure

Ensure that current Motorola calibration data for all RCUs is available on floppy disk at the cell site before starting this procedure.

Attention! If the cell site will be operated without SpotLight after these tests are run, ensure that the current Motorola calibration data file is reloaded to the transceivers prior to placing the site back in service.

1. Run the autocal command for each of antennas 1-6, applying the test signals to IDLS modules 1, 12, 5, 4, 9, 8 respectively. Make sure the 'load=no' option is used. The following is an example of the autocal command:

   autocal bts-bts# ant=1 dir=rx xcvr_slot=1..48 predict=yes load=no

2. Run the audit command for each of antennas 1-6, applying the test signal to IDLS modules 11, 2, 3, 6, 7, 10 respectively. Test only one transceiver slot. This test verifies the connectivity between the IDLS and the ESC for those IDLS modules not tested in step 3. The following is an example of the audit command:

   audit bts-bts# calibration ant=1 dir=rx xcvr_slot=1

3. Run the Rx AVL ATP for antennas 1 and 2 (beams 1 and 12).
4. Run the Rx SINAD ATP for antennas 1 and 2 (beams 1 and 12).
5. Run the Rx RSSI ATP for antennas 1 and 2 (beams 1 and 12).
6. Repeat steps 3 - 5 for antennas 2 - 6.

12. Repeat this procedure for each sector.

Table 5.12 Tx Power Test

Sector	Beam	Measured Tx Beam (dBm)	Measured Tx Beam Output (with Coupler Loss)		Measured Composite Tx Sector Output		SifPilotPwr (dBm)	Desired Composite Sector Output (dBm) See Table 5.13	Difference ± 2 dB (Measured – Desired)
			dBm	W	W	dBm			
α	11								
	12								
	1								
	2								
β	3								
	4								
	5								
	6								
γ	7								
	8								
	9								
	10								

Table 5.13 Equivalency Table

The measured transmit beam power is for all signaling channels (pilot, page, sync), or 1.85 x SifPilotPwr setting.	
SifPilotPwr (dBm)	**1.85 x SifPilotPwr (dBm)**
27	29.7
28	30.7
29	31.7
30	32.7
31	33.7
32	34.7
33	35.7

3. Press the PRESET button.
4. Press the DUPLEX button on the HP 8921A test set.
5. In Duplex mode do the following:
   - Set TUNE MODE to Manual.
   - Set TUNE FREQ to the specific test frequency (refer back to Table 5.8).
   - Set INPUT PORT to RF IN.
   - Set RF GEN FREQ to the same as TUNE FREQ.
   - Set AMPLITUDE to 40 dBm.
   - Set ATTEN HOLD to OFF.
   - Set OUTPUT PORT to DUPL.
   - Set AFGEN1 to OFF.
   - On the Tx Power screen, set units to dBm.
6. Press the SHIFT key followed by the CONFIG button on the HP 8921A.
7. In the Configure mode, set the RF LEVEL OFFSET to OFF.
8. Return to the Duplex screen.
9. Measure the RF power present at the RF IN/OUT port by reading the Tx power on the Duplex screen (do not use the Spectrum Analyzer screen). This value is your reference.
10. Subtract this value from 10 dBm to determine the loss of the cable (round to the nearest 10th).
11. Press the SHIFT key followed by the CONFIG button on the HP 8921A.
12. In the Configuration mode, set the RF LEVEL OFFSET to ON.
13. Scroll down to the RF IN/OUT selection and enter the recently determined cable loss (as a negative number).
14. Return to the Duplex screen. A value of 10 dBm should be displayed in the Tx Power field of the Duplex screen if the cable loss was adjusted correctly.
15. Set up the CDMA backpack in the following manner.
   - In the CDMA Analyzer screen set the TUNE FREQ to the center frequency of the carrier being measured (refer back to Table 5.8).
   - Set the Input Port to RF IN
   - Set the Channel Power measurement units to dBm

2. Run the Motorola Tx Bay Level Offset procedure described in the Motorola BTS Optimization/ATP SC 9600 CDMA manual. Use the relationships shown in Table 5.11 to respond to the prompts:

Table 5.11 SC 9600 to Motorola Antenna Equivalencies

SC 9600 Antenna Connection	Motorola Optimization Procedures
TX1	11
TX2	3
TX3	7

3. After the BLO testing is complete, the new BLO needs to be loaded into the CBSC prior to cutting over the system.

5.5.13 Transmit Power Verification

This test creates a script that synthesizes a pass-through configuration, with no beam weightings.This script is different than the Calibration Script used for the BLO test and will be termed the Tx Power Script. This script should be saved on a disk in the site documentation binder.

5.5.11 Preparing Bay Level Offset (BLO) Script

The Bay Level Offset (BLO) script , also referred to as the calibration script, is a CDMA script that connects one transmit beam to each sector.

1. Create a script that connects beam 11 to alpha sector , beam 3 to beta sector, and beam 7 to gamma sector. All of these paths use the NONDELAY path in the script. Since CDMA 1.1 does not distinguish between a HIGH and LOW path, this item is ignored in the script, so it doesn't matter which you specify. The beam weightings for each of the beams should be +6 dB (or +60 in the 10ths used in the script format).

   The following is a sample BLO script:

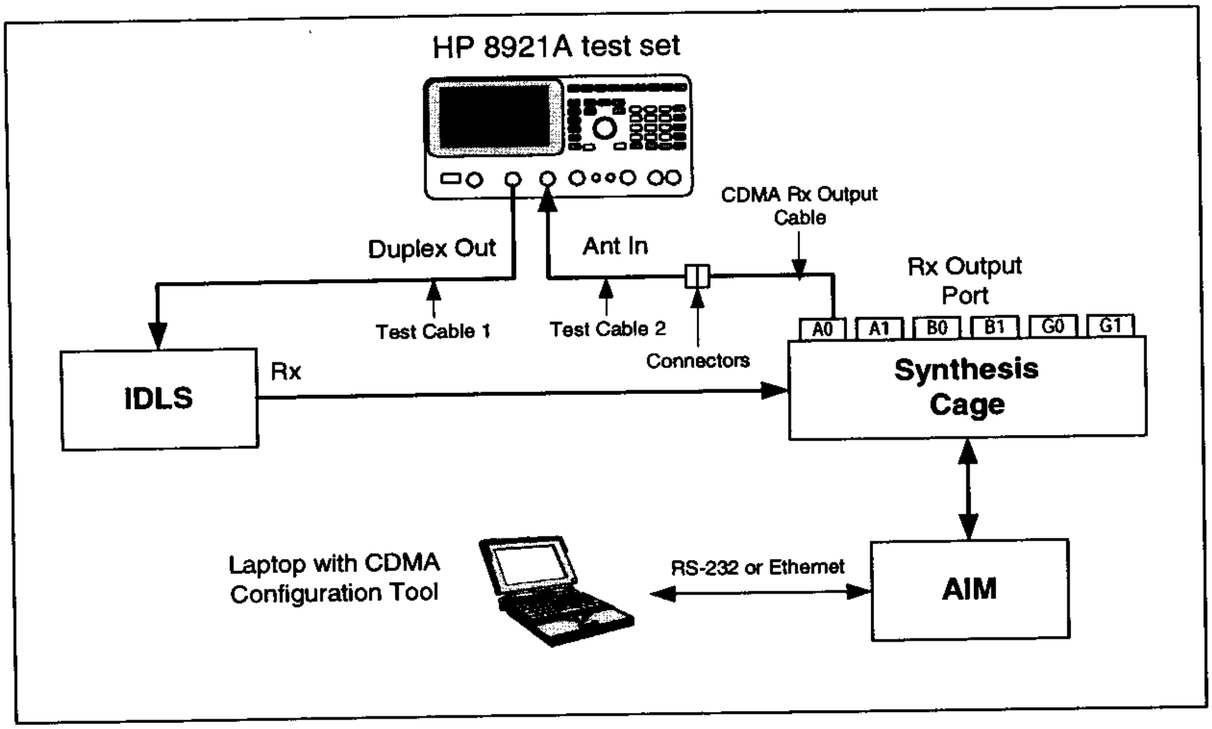
```
* Clear previous Tx and Rx connections
SET DISCONNECT ALL
*
* -------- Begin Set Tx Port Connections ------
*
** Alpha Sector Tx **
SET TXC 11 A NONDELAY LOW
** Alpha Sector Beam Weighting Gains **
SET RELGAIN TX 11 60
** Alpha Sector Path Balance Gain Corrections **
SET RELGAIN TX 11 0
*
** Beta Sector Tx **
SET TXC 3 B NONDELAY LOW
** Beta Sector Beam Weighting Gains **
SET RELGAIN TX 3 60
** Alpha Sector Path Balance Gain Corrections **
SET RELGAIN TX 3 0
*
** Gamma Sector Tx **
SET TXC 17 G NONDELAY LOW
** Alpha Sector Beam Weighting Gains **
SET RELGAIN TX 7 60
** Alpha Sector Path Balance Gain Corrections **
SET RELGAIN TX 7 0
```

2. Store the pattern in pattern location 1 in the CDMA Configuration Tool 1.1. To load the pattern, type:
   source_cdma10 filename 1.

   The filename should include the path if the script file is not in the same directory as the configuration tool. The integer entered after the filename specifies which pattern location you want the script stored in (1 - 10).

3. Type **execute**.

Figure 1 Rx Path Test Setup



5.5.10 Test Procedure

1. On the laptop PC, start the CDMA Configuration Tool 1.1 and login using your initials (example: **LOGIN BB**).
2. Type the command **MANCAL RX** to begin the Tx Path Calibration test.
3. Enter the input signal level (-40 dBm).
4. Enter the target system gain (20 dB to top of frame, 28 dB to CDMA radio).
5. Enter in the proper IDLS coupler values. (NOTE: This is actual value noted on the sticker attached next to the -40 dB coupled port.)
6. Enter -3.8 for each splitter loss.
7. Connect the test cable from the ANT IN port of the HP 8921A to the end of the 135-0257-20 Rx CDMA cable connected to the α0 input of the CDMA 1.1 synthesis cage.
8. Connect the test cable from the DUPLEX OUT port of the HP 8921A to the -40 dB coupled port of IDLS module 1.
9. Follow the instructions provided by the CDMA Configuration Tool 1.1 to adjust the FRU attenuation to the target level. This involves entering the value that is displayed on the Spectrum Analyzer screen on the HP

will also prompt you when it is appropriate to move the test cables to another beam or sector.

13. When you have completed the test, type **send_system** "**txbase finish**".

Note: The quotation marks must also be typed as part of the command.

14. Type **EXECUTE**. The information you have just generated will then be stored in flash memory.

5.5.7 Rx Path Calibration

This procedure should be performed after all SpotLight receive installation procedures are completed, or whenever a component in the receive path is replaced.

5.5.8 Test Cable Calibration

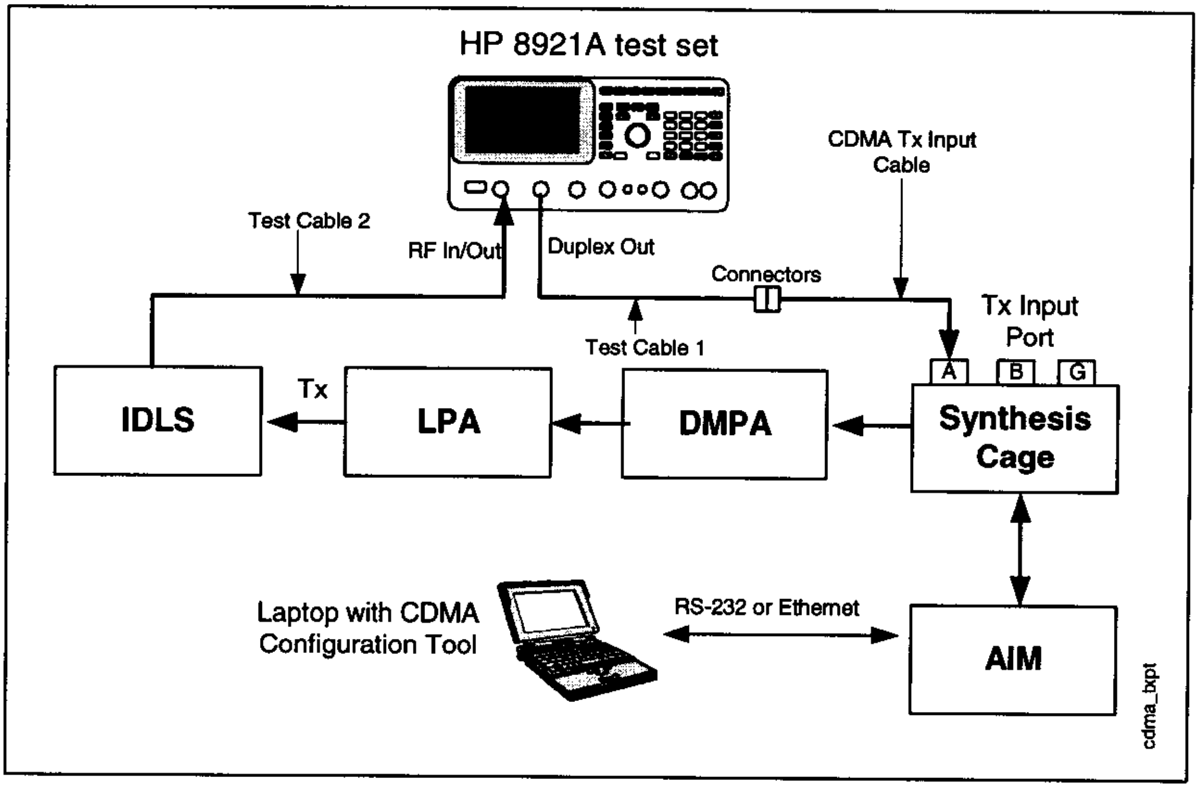
Before setting up the test, calibrate the test cable losses and enter them into the HP 8921A test set.

1. Connect the two test cables together.
2. Connect one end of the combined test cable to the DUPLEX OUT port of the HP 8921A test set.
3. Connect the other end of the combined test cable to the ANT IN port of the test set.
4. Set up the HP 8921A test set as follows:
   - Set RF GEN FREQ to specific test frequency (see Tables in previous section).
   - Set TUNE MODE to Manual.
   - Set AMPLITUDE to 10 dBm.
   - Set OUTPUT PORT to DUPL.
   - Set AFGEN1 and 2 to OFF.
5. Press SHIFT, then CONFIG on the 8921A test set.
6. In the Configure mode, set the RF LEVEL OFFSET to OFF.
7. Go to the Spectrum Analyzer screen and set it up as follows:
   - Set the Spectrum Analyzer Controls to MAIN.
   - Set the Input Port to ANT.
   - Set the Reference Level to 10 dB.
   - Set the Span to 200 kHz.

Caution: Make sure you change the amplitude of the test signal from 10 dBm to -30 dBm before connecting any cables between the SpotLight system and the HP 8921A test set. Failure to do so may damage your test equipment.

2. Connect the SpotLight components to the test set as shown in Figure 5.2.

Figure 5.2 Tx Path Test Setup



5.5.6 Test Procedure

1. On the laptop PC, start the CDMA Configuration Tool 1.1 and login using your initials (example: **LOGIN BB**).
2. Type the command **MANCAL TX** to begin the Tx Path Calibration test.
3. Enter the input signal level (-30 dBm).
4. Enter the target system gain (58 dB for SC 9600).
5. Enter 0 for each IDLS module coupler loss.
6. Enter -3.8 for each splitter loss.

Table 5.7 Receive Test Frequencies

Carrier	Rx A-band Frequency	Rx B-band Frequency
1	832.65	837.36
2	831.42	838.59
3	830.19	839.82
4	828.96	841.05

Table 5.8 Carrier Center Test Frequencies

Carrier	Center Frequency A-band	Center Frequency B-band
1	878.49	881.52
2	877.23	882.78
3	875.97	884.04
4		

5.5.3 Tx Path Calibration

This procedure should be performed after all SpotLight transmit installation procedures are completed, or whenever a component in the transmit path is replaced.

5.5.4 Test Cable Calibration

Before setting up the test, calibrate the test cable losses and enter them into the HP 8921A test set.

1. Connect the two test cables together.
2. Connect one end of the combined test cable to the DUPLEX OUT port of the HP 8921A test set.
3. Connect the other end of the combined test cable to the RF IN/OUT port of the test set.
4. Set up the HP 8921A test set as follows:
   - Press PRESET.
   - Press DUPLEX.
   - Set TUNE MODE to Manual.
   - Set TUNE FREQ to specific test frequency (see Tables in previous section).
   - Set INPUT PORT to RF IN.
   - Set RF GEN FREQ to the same as TUNE FREQ.

5.5 Configuration and Integration Tests (from SB 043)

Configuration and Integration (C & I) tests verify the installation by demonstrating that the receive and transmit paths are correctly cabled and configured between the SpotLight system and the base station.

To perform these tests, the following equipment is required:

- HP 8921A cell site test set with CDMA backpack
- CDMA LMF
- two RG-58 test cables with adapters for N and SMA ports
- RS-232 cable or Ethernet connection
- laptop with CDMA Configuration Tool 1.1
- GPIB with cable
- Xircom LAN connection
- DB9 to DB9 cable
- 250W dummy load

5.5.1 Before You Begin

The following should be done before you begin C & I testing.

5.5.1.1 Checking Software Version

Verify that the correct software version is loaded.

1. Connect the laptop to the AIM.
2. Start the CDMA Configuration Tool and connect to the CDMA synthesis cage controller FRU. Refer to the CDMA Configuration Tool 1.1 User's Guide for specific instructions.
3. At the % prompt type **login**. You will be prompted to type in your password.
4. At the % prompt type **version**. The current version of CDMA 1.1 software that is loaded in the CDMA synthesis cage is displayed.

Table 5.4 Calculating CDMA Tx Gain Correction Factors

Beam Under Test		α Sector			β Sector			γ Sector		
		Desired Output	Measured Output	Correction Factor	Desired Output	Measured Output	Correction Factor	Desired Output	Measured Output	Correction Factor
1	1st Test	–36.0 dBm								
	Verification									
2	1st Test									
	Verification									
3	1st Test				–36.0 dBm					
	Verification									
4	1st Test									
	Verification									
5	1st Test									
	Verification									
6	1st Test									
	Verification									
7	1st Test							–36.0 dBm		
	Verification									
8	1st Test									
	Verification									
9	1st Test									
	Verification									
10	1st Test									
	Verification									
11	1st Test	–36.0 dBm								
	Verification									
12	1st Test									
	Verification									
(Desired) - (Measured) = Correction Factor										

16. Move the attenuator to the ANT port on IDLS module 2.

Note: Even numbered IDLS modules are in a different chassis than odd numbered modules.

17. Reconnect the antenna cable to the previously tested antenna port.
18. Repeat Step 12 through Step 17 until all IDLS modules have been measured and recorded on the data sheet (Table 5.3).

Table 5.3 Example Data for the Port-to-Port Isolation Measurement

Beams Keyed	IDLS Module											
	1	2	3	4	5	6	7	8	9	10	11	12
1	-5	-23	-29	-34	-27	-25	-27	-26	-37	-24	-25	-28
2	-27	-8	-27	-27	-28	-26	-26	-27	-33	-31	-28	-28
3	-28	-26	-8	-27	-28	-27	-26	-27	-34	-33	-33	-27
4	-28	-24	-23	-3	-27	-22	-24	-21	-36	-24	-25	-32
5	-34	-22	-24	-33	-2	-20	-24	-23	-30	-25	-25	-34
6	-29	-27	-24	-34	-24	-5	-23	-32	-34	-24	-24	-31
7	-33	-27	-26	-33	-27	-33	-8	-35	-31	-27	-34	-30
8	-31	-22	-37	-35	-25	-25	-31	-4	-26	-27	-24	-30
9	-29	-26	-37	-29	-27	-33	-35	-27	-8	-30	-33	-33
10	-31	-32	-37	-29	-27	-29	-25	-25	-28	-7	-32	-36
11	-32	-32	-32	-30	-27	-30	-27	-29	-28	-27	-9	-27
12	-31	-21	-31	-29	-26	-20	-27	-26	-28	-27	-24	-2

19. Disconnect the channel under test from the antenna using the LampLighter command DISCONNECT.
20. Remove the attenuator from the last IDLS module and reconnect the antenna jumper to the ANT port.
21. Restore the cell site into service:

    21.1 Dekey the Xcvr with the following LMF command.

```
dekey xcvr-<bts_id>-<xcvr_id>
```

    21.2 Have the switch bring the site up.

22. Store a copy of the data sheet with the installation records.

1.1 Disconnect the antenna cable from the antenna port on IDLS module 1.

1.2 Attach the 30-dB attenuator to the ANT port.

1.3 Attach one end of the test cable to the attenuator.

1.4 Attach the other end of the test cable to the RF IN/OUT port on the HP 8921A test set.

2. Set up the HP 8921A test set:

   2.1 Use the site channel map to select a channel that is currently in use at the site.

   2.2 Set the HP 8921A test set to Spectrum Analyzer mode.

   2.3 Set the center frequency to match the selected channel.

   2.4 Set the span to 1 MHz.

   2.5 Select the RF IN/OUT port on the HP 8921A test set.

3. Have the switch bring down the cell site.

4. Put the test Xcvr under LMF control (see the LMF documentation for details)

5. Key the identified test Xcvr by entering the following commands on the LMF:

   ```
   Set bts-<bts_id> audio xcvr_slot=<xcvr_id>
   [mode=n]
   ```

   where:

   - **bts_id** is the cell site number
   - **xcvr_id** is the number of the slot occupied by the test Xcvr
   - **mode=n** is required only if the test Xcvr is set up for NAMPS (see the cell site documentation).

   ```
   Key xcvr-<bts_id>-<xcvr_id> antenna=1
   channel=<channel #> pwrlvl=+35 [band=<band>]
   ```

   where:

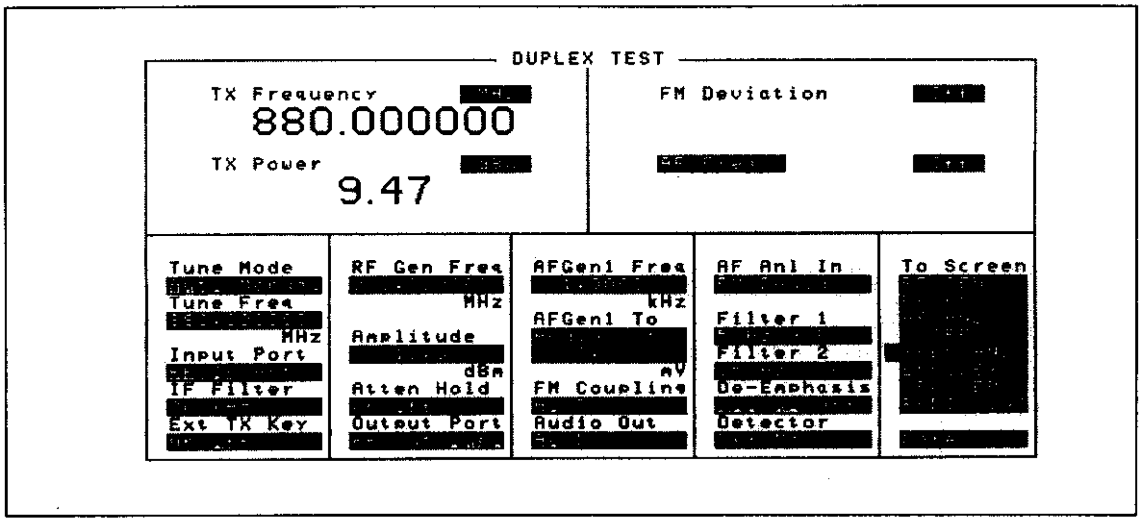
   - **bts_id** and **xcvr_id** are the same as above.
   - **Band=<band>** is required only if the Xcvr is set up for NAMPS, in which case <band> must be either u, m or l.

6. Verify that the Xcvr is keyed by verifying that the KEYED LED is illuminated on the front of the Xcvr.

7. Connect the PC to the SpotLight system and start LampLighter.

8. In the LampLighter Status Window, select the Rx SMU corresponding to the channel under test.

Figure 5.1 HP 8921A Duplex Test Mode Screen



5. Measure the RF power present at the RF In/Out port by reading the Tx Power (do not use the spectrum analyzer). This value, in dBm, is your reference value.
6. Turn the amplitude OFF in the RF generator.
7. Without changing the original cable, insert the cable under test into the circuit. You may add or change one adapter to connect to the cable under test.
8. Turn the amplitude ON in the RF generator and measure power again.
9. Subtract the difference to find the cable loss. Round to the nearest tenth of a dB.

5.3.2 IDLS to Synthesis Cage Rx Paths

1. Use a DB9-to-DB9 serial cable to connect the serial port on the LampLighter computer to one of the RS-232 ports on the CDMA Synthesis cage.
2. Start the CDMA Configuration Application and enter “CONNECT COM1”.
3. Set the HP 8921A to the RF Generator mode with the output on the RF In/Out port at –50 dBm on one of the following frequencies:
   - For A-band IDLS, 831 MHz (Channel 200)
   - For B-band IDLS, 840 MHz (Channel 500)

5.2 Alarm Functionality Test

This Alarm Functionality procedure creates a condition for each of the alarmed components in the SpotLight system to verify alarm reception at the NOC or at the alarm relay contact for the cell site.

5.2.1 SMU Cage Test

For each SMU Cage:

1. Remove one reference-frequency connection from the external I/O board and confirm that the minor alarm relay is activated at the cell site's central switch.
2. Remove the second-reference-frequency connection and confirm that a major alarm is activated at the cell site's central switch.
3. Clear the major alarm by reconnecting one reference-frequency input.
   3.1 Use LampLighter to acknowledge and clear the alarm logs for all SMU modules in the cage.
   3.2 Verify that the major alarm relay is cleared at the cell site's central switch.
4. Clear the minor alarm by reconnecting the second reference-frequency input.
   4.1 Depress the reset switch (SW1) on the external I/O board.
   4.2 Verify that the minor alarm relay is cleared at the cell site's central switch.

5.2.2 LPA and DMPA Test

The LPAs use special internal error detection circuitry for detecting failures. The SpotLight system communicates with these modules through the DMPA assembly. The relay contacts on the back of the DMPA activate for both LPA and DMPA alarms.

1. Remove a DMPA module and confirm that a minor alarm is activated at the cell site's central switch.
2. Remove a second DMPA module and confirm that a major alarm is activated at the cell site's central switch.
3. Replace both modules and confirm that the alarms are cleared at the cell site's central switch.
4. Turn off power to one LPA module. After about one minute confirm that a minor alarm is activated at the cell site's central switch.

5.1 Overview

Configuration and Integration (C and I) tests demonstrate that all components of the SpotLight 2000 system have been properly installed and cabled and that the receive and transmit paths with the SC9600-series base station equipment are correctly connected and configured.

Attention! These tests assume that you already possess a basic familiarity with LMF operation and related UNIX commands.

Before conducting any tests, the following prerequisites must be met:

- The SpotLight-to-cell site channel map is available.
- The configuration file has been created and downloaded.

Note: Before performing any tests, allow the LPAs to warm up for 30 minutes while injecting a signal (keying a voice channel).

These tests cover the following main areas:

- Section 5.2, "Alarm Functionality Test" verifies that all SpotLight alarms are functional at the NOC or at the contacts within the cell site.
- Section 5.3, "SpotLight Installation Verification" verifies correct signal flow within the SpotLight system and between SpotLight and the base station TCH, Scan and Sig transceivers.
- Section 5.4, "CDMA Tx Amplitude Calibration" covers CDMA Tx gain calibrations.
- Section 5.5, "Configuration and Integration Tests" verifies the calibration values of the SpotLight 2000 equipment.
- Section 5.6, "Motorola SC 9600 Calibration and ATP Tests" verifies the calibration values of the SC9600-series equipment.

5.1.1 Required Equipment

To perform all the tests in this chapter, the following equipment is required:

- HP 8921A cell site test set (Functionally equivalent test equipment may be used, but it is your responsibility to account for any measurement variances that may result from the substitution.)
- HP 8508A Vector Voltmeter
- Har-Pak 8 to SMA (J) adapter (250-0240-01)
- Har-Pak 6 to SMA (J) adapter (250-0241-01)
- Har-Pak pigtail assembly, male mini-coax to SMA-P (135-0341-01)
- DB9 to DB9 serial cable

3. Set the IP address:

```
set_network_parameter id_address
192.169.site id.16
```

4. Set the subnet mask:

```
set_network_parameter subnet_mask
255.255.255.0
```

5. Set the primary gateway (the IP address of the router):

```
set_network_parameter primary_gateway
192.169.site id.1
```

6. Set the secondary gateway:

```
set_network_parameter secondary_gateway
192.168.x.x
```

Addresses are either local or global. Local addresses may be used only to communicate within a local LAN. Global addresses may be used over interconnected LANs, locally, and for dial-in access.

In a Metawave network, the following conventions are used:

- Local addresses use a 0 for the third number
  192.168.0.H
- Global addresses use any number between 1-254 for the third number
  192.168.128.H

The H (host ID) designates routers or SMU modules. For the host ID, numbers 1-20 are reserved for routers and other equipment and numbers 64-254 are reserved for SMU modules. Table 4.3 describes the host parameters in detail.

If you do not know the IP address of your cell site, contact your network administrator.

Table 4.3 Host Parameters

Value	Description
1	Primary router
2	Secondary router
3	Reserved
4	Reserved
5	Site PC (if present)
6	Techs/Field Service PC
7	Dial-in
8-20	Field Service/Engineering use
21-63	Unused
64-254	Reserved for SMUs
255	Reserved (broadcast)

4.2.3 Setting Your Computer's IP Address

1. Select Control Panel from Settings in the Start menu.
2. Double click the Network icon. The Network dialog box appears.
3. Select TCP/IP → Dial-Up Adapter in the Configuration tab and select Properties.
   3.1 Click the IP Address tab for the IP Address and Subnet Mask address.

A few seconds after selecting no you will get the router prompt:

```
Router>
```

4.2.1.3 Erasing Old Configuration

1. It is recommended that you erase any old configuration stored in the router. Type the following commands:

   `Router> enable`

   `password: crypto` (you will be asked for a password only if the configuration file has been downloaded)

   `Router#: erase startup-config`

2. Wait for a confirmation.

   `[OK]`

3. Reset the router by turning it off and back on.

4.2.1.4 Terminating Autoinstall Configuration

As the router reboots, you will see the message:

```
Would you like to enter the initial configuration
dialog?[yes]: no
```

Wait for...

```
Would you like to terminate autoinstall?: yes
```

Wait for text to display, then hit the Enter key a few times. The `Router>` prompt appears.

4.2.1.5 Preventing Router from Getting Configuration from Network at Power-Up

Before downloading the configuration file, you must follow the steps below. If you do not, the router will try to download a configuration from the network.

```
Router> enable
Router# configure terminal
Router(config)# no service config
```

4.2.1.6 Downloading the Configuration File

1. Make sure the router is in config mode by following these commands:

   ```
   Router> enable
   Router# configure terminal
      Router(config)#
   ```

4.1 Overview

SpotLight configuration includes procedures for using LampLighter to configure your system software, installing and configuring a router for remote access of your SpotLight system, and adding attenuators into the RF path to customize the system performance to specific cell site requirements.

These procedures require that the system has been installed, cabled, and tested, as described in previous chapters.

4.2 Configuring Network Access

To use dial-up networking to access a cell site remotely, you must configure the LAN. Configuring the LAN involves the following steps:

- Configuring routers and modems
- Changing the address of your computer to match the network address of the router
- Defining the address parameters of the AIM module

4.2.1 Configuring the Router

Note: Ethernet cables must be connected before you can configure the router.

The configuration file sets the router with the default passwords shown in Table 4.1. However, Metawave recommends changing the passwords for security reasons. See Cisco documentation for password setting instructions.

Note: Passwords are case sensitive.

Table 4.1 Default Passwords

Function	Username	Password
enable	N/A	crypto
dial-in	Metawave	MetaNet
telnet	N/A	MetaNet

4.2.1.1 Editing the Configuration File

1. Start Windows 95 or NT.
2. Open Windows Explorer.
3. Insert the software diskette in the appropriate disk drive.

Note: If you use a DC power supply, you can connect either positive or negative wire to either input.

3. Use the table below to set the default switch settings on the back of the modem.

Table 3.13 Default Modem Switch Settings

Switch Position	up	up	down	up	up	up	down	down
Switch Number	1	2	3	4	5	6	7	8

3.17 Remote Access without Modem or POTS Line

If a Plain Old Telephone Service (POTS) line cannot be installed at the cell site, you can connect to the channel bank using SiteNet MP (a Metawave option). Follow these steps:

1. The customer should install a V.35 interface card in the existing channel bank at the cell site.
2. Install a V.35 router cable from V.35 interface card to the router.
3. Configure another router at switch.

3.18 Checking Your Installation

Inspect the installation to ascertain that it has been performed in accordance with the requirements of your site engineering documents. If you have any question about whether rack components are properly installed, contact the cell site engineering department or Metawave Technical Assistance Support Department.

Note: If you have a -48 VDC power supply installed at the cell site, skip to Section 3.16.3.2.

3.16.3.1 DC-DC Converter

Follow these steps to install the DC-DC converter:

1. Connect chassis ground point to halo ground using 14AWG or thicker green cable.
2. Connect input power cables:
   2.1 Measure and cut the ground (black) cable from common ground bar to negative input.
   2.2 Measure and cut the power (red) cable from +24V 10A breaker to positive input.
3. Connect output power cables.
   3.1 Measure and cut the ground (black) cable from positive output to the common ground bar.
   3.2 Measure and cut the power (red) cable from negative output to no more than 5A breaker/fuse panel.

3.16.3.2 Router

An optional router can be installed in the 19" rack, or in an alternate location depending on the availability of rack space.

1. Assemble the rack bracket to the router so that it mounts from the front and is nearly flush with the rack.
2. Attach it to the rack using standard rack screws (209-1001-01).

The Cisco router provided with the SpotLight system needs a -48V power source. To connect power to the router (Figure 3.28):

1. Connect chassis ground point to equipment rack using 14AWG green cable. Verify that the rack is properly grounded to the halo ground.
2. Measure and cut the ground (black) cable from common ground bar to positive input.
3. Measure and cut the power (red) cable from -48V (no more than 5A breaker) or fuse to negative input.

3.16.1 Requirements

Table 3.12 lists the equipment you need to install and configure network access.

Table 3.12 Network Access Equipment List

Description	Part Number	Comments
BNC T-connector	165-0199-01	N/A
Terminator (50 ohm)	135-0188-01	N/A
Transceiver (10Base2)	245-0005-01	N/A
Ethernet Cable (50 ft.)	135-0189-01	N/A
Ethernet Cable (20 inch)	135-0191-01	N/A
Router	245-2501-02 (Cisco 2501)	N/A
DB9 to RJ-45 (modem) adapter	N/A	Included with router
DB9 to RJ-45 adapter	N/A	Included with router
RJ-45 cable	N/A	Included with router; used for configuring router and connecting modem
Modem	245-0007-10 (+24V DC) 245-0007-20 (-48V DC) 245-0007-30 (120V AC)	POTS line should be installed before configuring the router and modem
-48 Volt power supply (optional)	140-2748-01	N/A
inline fuse (optional)	N/A	needed if you have -48V converter
14 min. AWG red and black wires	N/A	Build on site
14 min. AWG green csw wires	N/A	Build on site
14 min. AWG red and black wires	N/A	Build on site
Mounting Hardware	N/A	Type depends on router
PC with RS-232 async serial and 10Base2 port	N/A	N/A
Software diskette	270-014701	Contains configuration files for the router
V.35 cable (optional)	135-0202-01	Needed if site has no modem or POTS line.

3.16.2 Ethernet Cabling

Referring to Figure 3.27, complete the following setps:

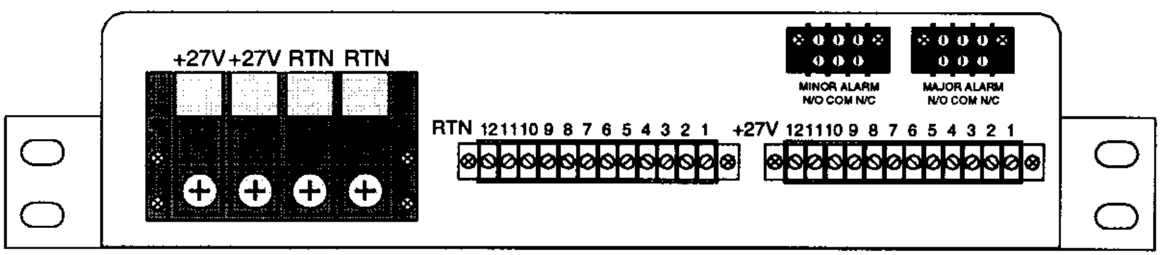
1. Insert a transceiver into the AUI port on the router.
2. Attach a T-connector to the transceiver.
3. Terminate one end of the T-connector with a 50Ω terminator (Optionally, you can extend the end to a local PC).
4. Connect a 10-foot coaxial cable from the other end of the T-connector to the Ethernet port on the AIM.

3.15 Power Cabling

Power (+27V DC) and return (RTN) cables for the DMPA fan module, DMPA, and AIM connect to the power distribution module at the top of the 19" equipment rack.

1. Connect +27V and RTN cables from the power distribution module to the DMPA fan module.
   - 1.1 Measure and cut a #14 black cable the appropriate length.
   - 1.2 Strip and insert one end into the right (RTN) input on the DMPA fan module power terminal.
   - 1.3 Measure and cut a #14 red cable the appropriate length.
   - 1.4 Strip and insert one end into the left (+27V) input on the DMPA fan module power terminal.
   - 1.5 Dress the cables to the power distribution module and attach them to the RTN and +27V taps for position 1, as shown in Figure 3.26.

Figure 3.26 19-Inch Equipment Rack Power Distribution Module (rear view)

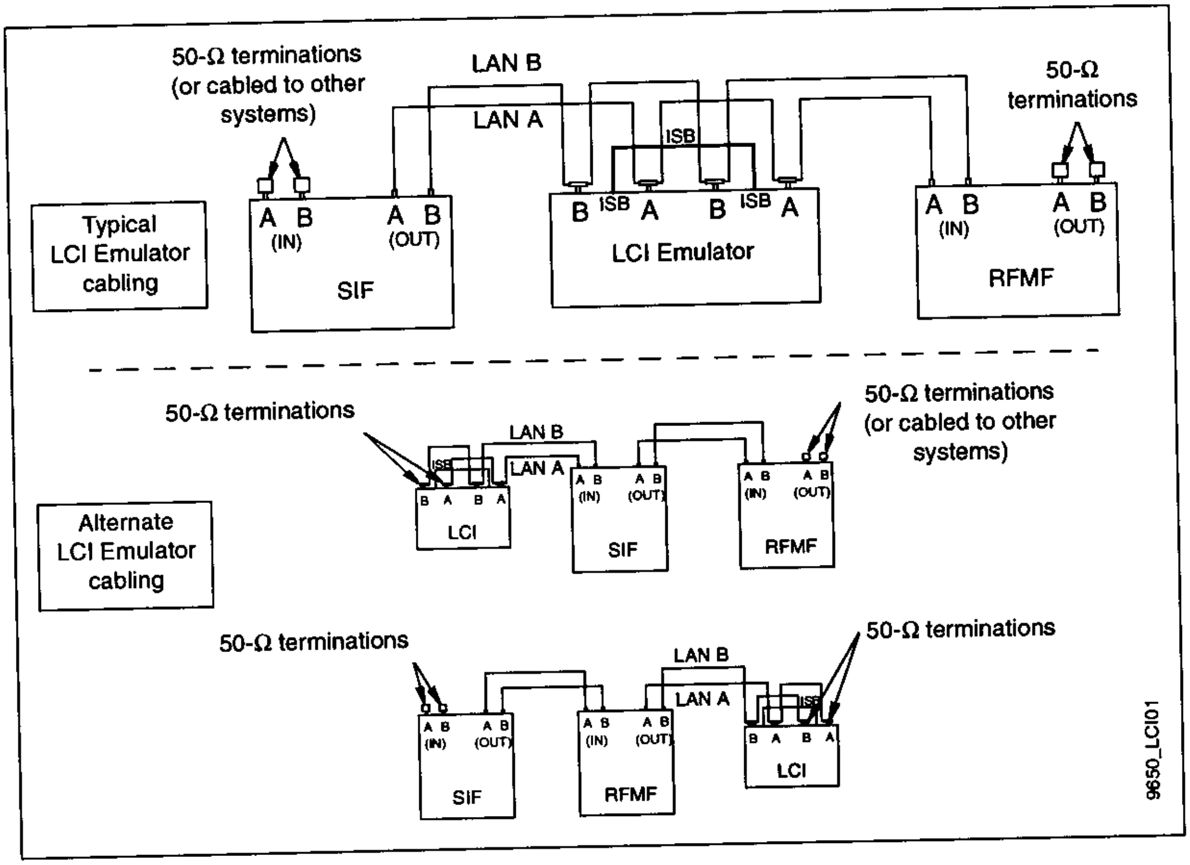


Module Assignments

Position	SpotLight module
1	DMPA Fan
2	DMPA
3	
4	
5	
6	AIM
7	Synthesis Cage
8	
9	
10	
11	
12	

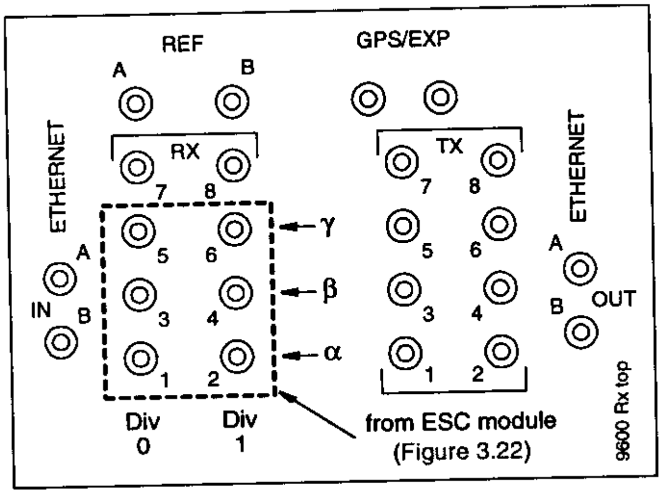
pdm_19

Figure 3.25 LCI Cabling to Motorola SC 9600 Mixed Mode or Analog-only



1. For cell sites equipped with the Enhanced LPA (ELPA) frame, work with the switch operator to ensure that the switch database is rebuilt to reflect that the site is now using LPAs rather than ELPAs. This process typically requires at least two hours.
2. Daisy-chain the LAN A and LAN B connections between the SIF, LCI Emulator, and RFMF. Ensure that 50-Ω terminations are installed at each end of the LAN A and LAN B cables.
3. Disconnect the ELPA/LPA frame from the LAN A and B connections.
4. Connect the power connector on each FRU to a +27VDC power source in the cell site. Turn on the circuit breaker, and verify that the power LED on each LCI FRU is on.
5. Enter the LCI version number (see the next section, Section 3.14.3, "Loading LCI Emulator Software").
6. The site can now be brought back up.

Figure 3.23 Rx Connections on top of RFMF frame



3.14 Cabling the LCI Emulator

The LCI Emulator (Figure 3.24) emulates up to 12 LCI cards (two Motorola LPA frames) and allows up to two Motorola LPA frames to be removed from the cell site.

Figure 3.24 LCI Emulator

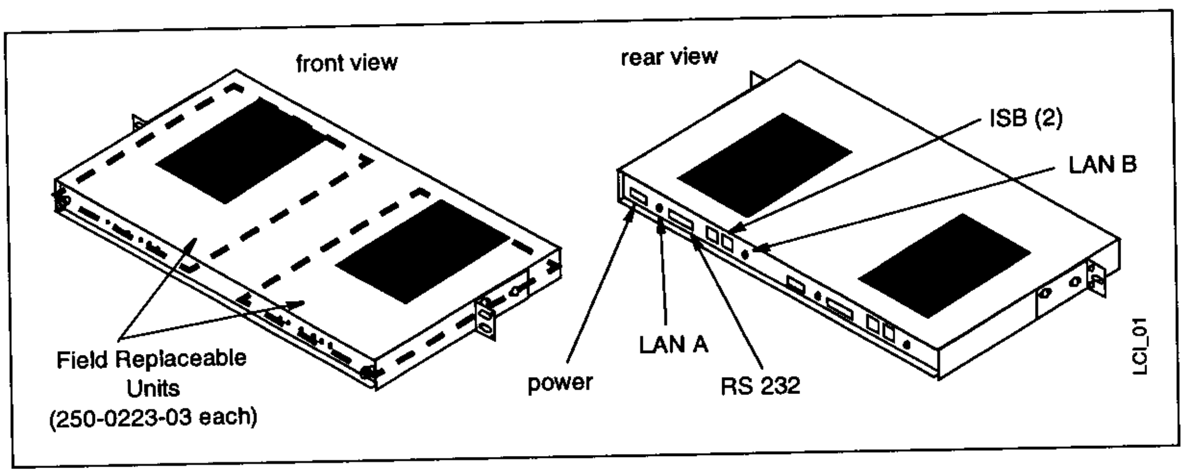


Table 3.9 Analog Path Attenuation Switches (4 dB per step)

Position	Attenuation (dB)	Analog Gain (dB)
0	0	27.5
1	4	23.5
2	8	19.5
3	12	15.5
4	16	11.5
5	20	7.5
6	24	3.5
7	28	-0.5

The top row of switches set the gain in the common analog and digital paths, as shown in Table 3.10. The common path switches are configurable in 1 dB increments from 0 to 15 dB.

Table 3.10 Common Path Attenuation Switches (1 dB per step)

Position	Attenuation (dB)	Analog Gain (dB)[1]	Common Gain (dB)[a]
0	0	27.5	28.5
1	1	26.5	27.5
2	2	25.5	26.5
3	3	24.5	25.5
4	4	23.5	24.5
5	5	22.5	23.5
6	6	21.5	22.5
7	7	20.5	21.5
8	8	19.5	20.5
9	9	18.5	19.5
A	10	17.5	18.5
B	11	16.5	17.5
C	12	15.5	16.5
D	13	14.5	15.5
E	14	13.5	14.5
F	15	12.5	13.5

1. The values shown are examples based on the assumption that the analog path switch setting is 0. Actual gain values depend on the position of the analog path switch.

Figure 3.19 Cabling the APT DMPA Module

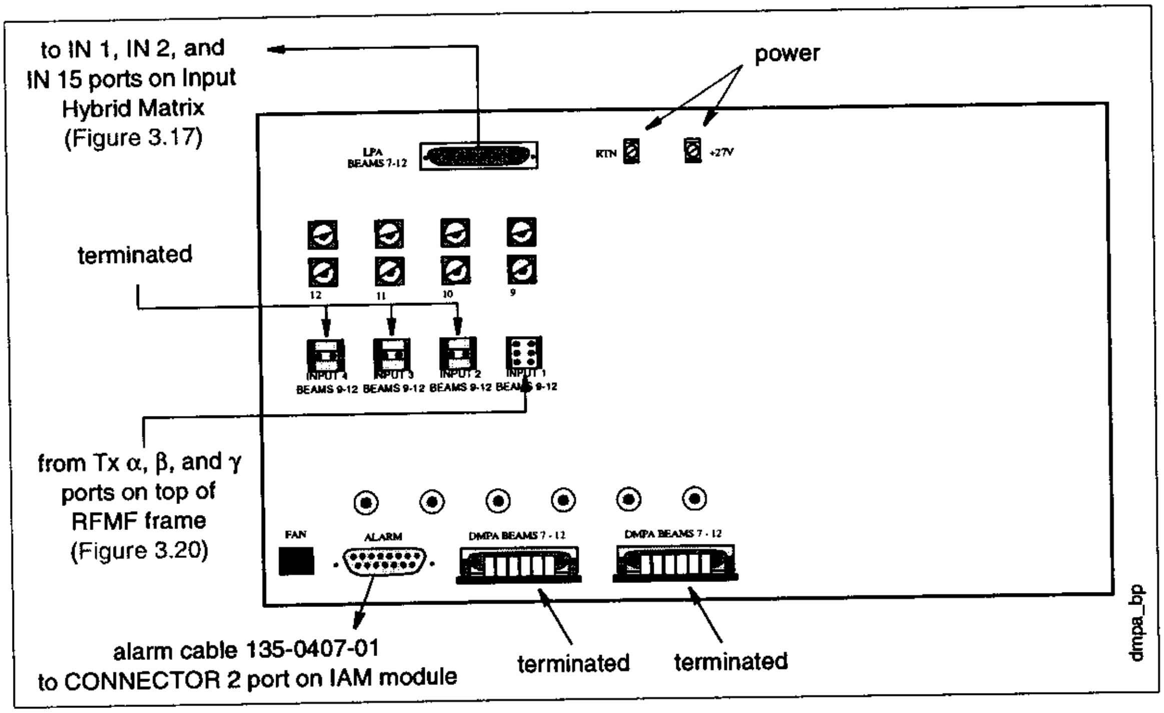


Figure 3.20 Cabling Tx Signals from RFMF Frame to APT DMPA

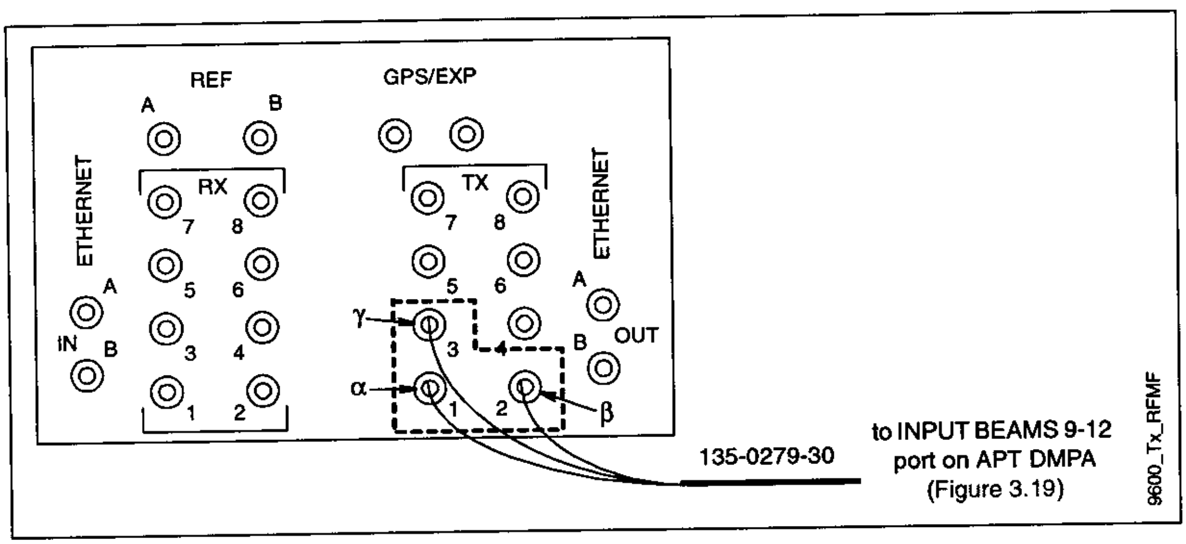


Figure 3.17 Cabling the Input Hybrid Matrix

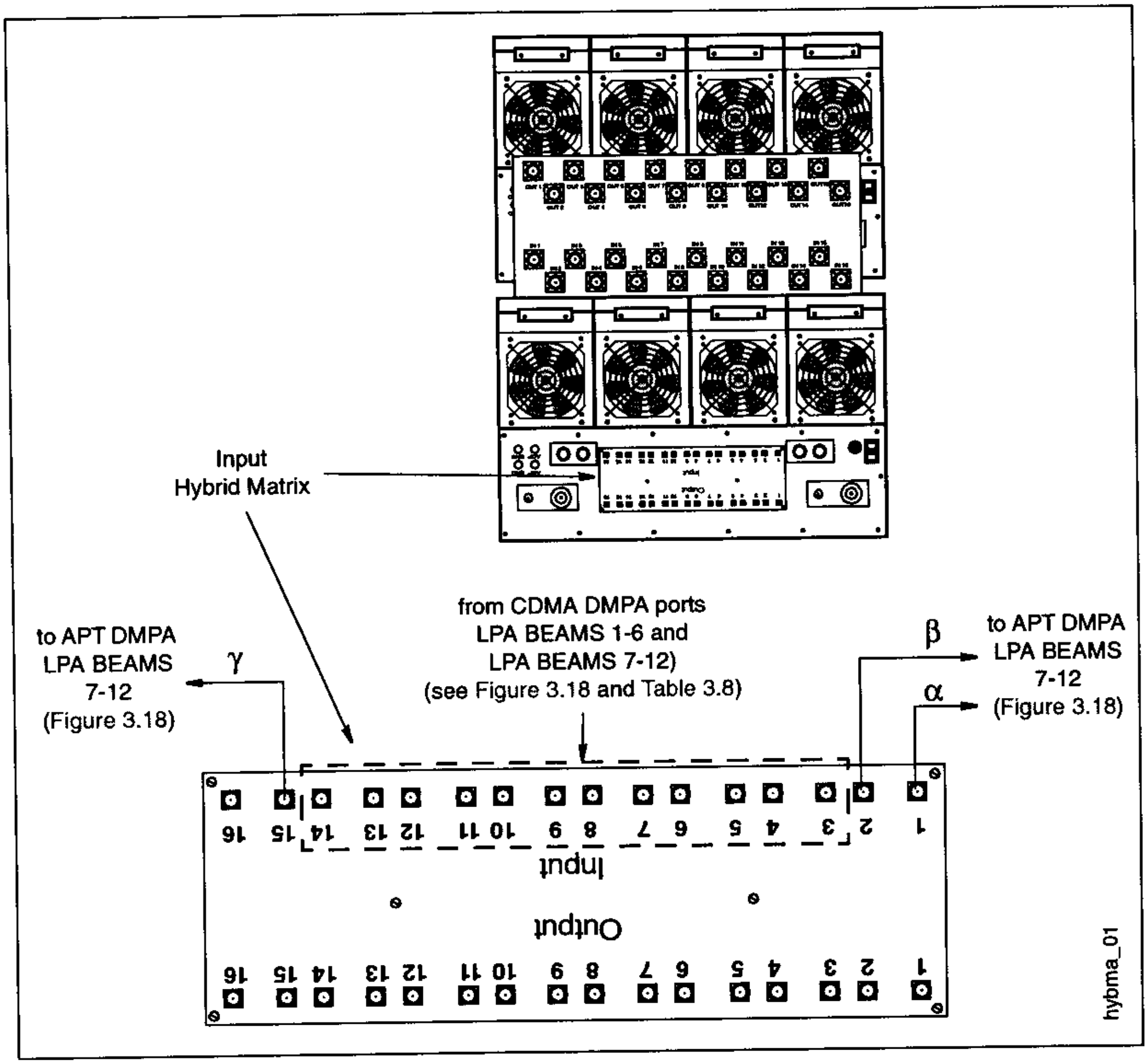


Figure 3.16 Cabling the Output Hybrid Matrix

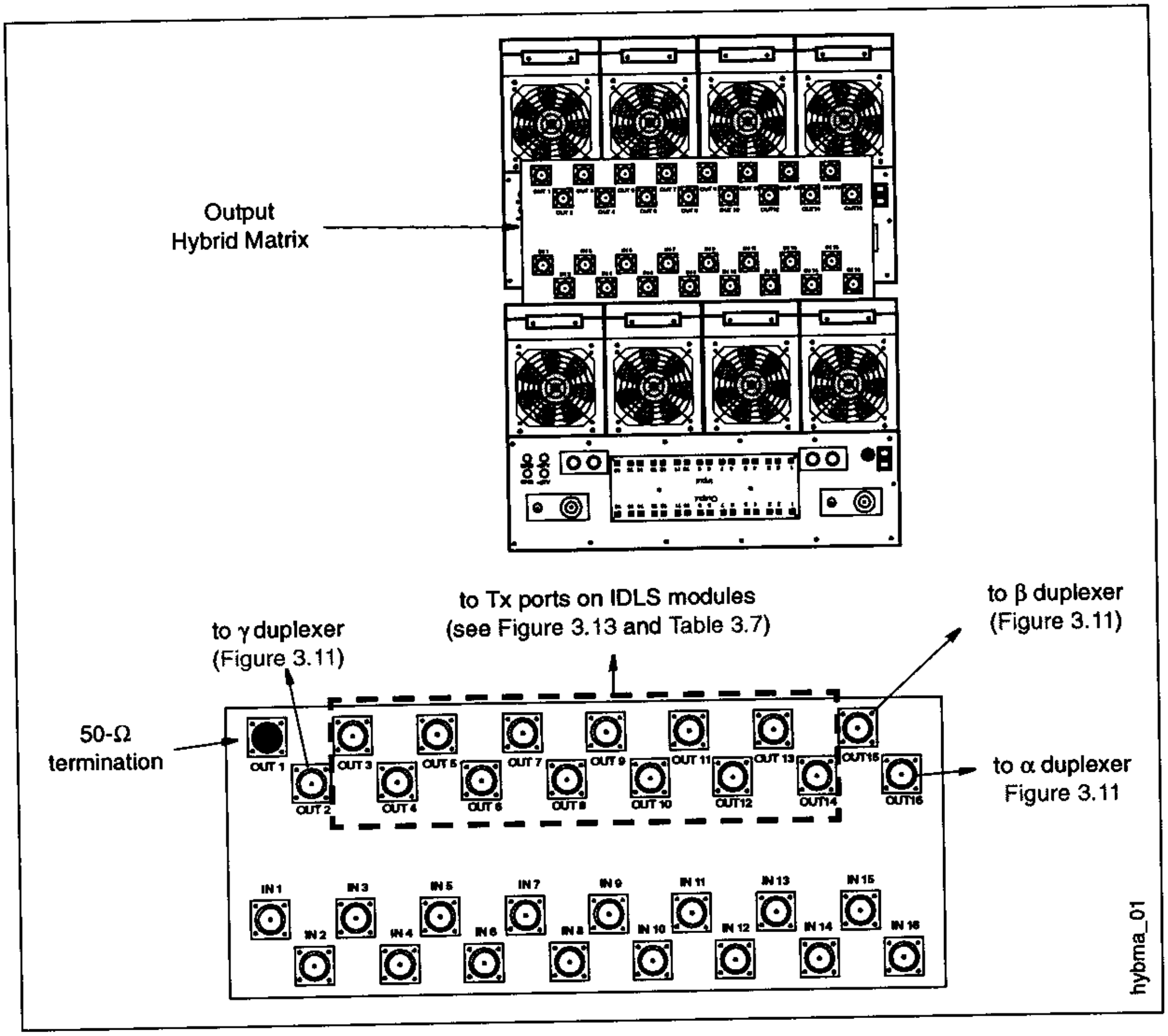


Table 3.6 IDLS to Output Hybrid Matrix Cable Specifications

Cable Description and Part Number	Qty	Source Connection	Destination Connection
1/2" coax, 27-inch P/N 135-0283-10	6	Tx ports on IDLS (upper chassis)	90° N male to even numbered OUT ports on Output Hybrid Matrix
1/2" coax, 17-inch P/N 135-0283-00	6	Tx ports on IDLS (lower chassis)	90° N male to odd numbered OUT ports on Output Hybrid Matrix

3.8 Cabling the IDLS Alarm Module (IAM)

The IAM module is used by the APT DMPA for alarm purposes. It is mounted on its side on the right side (rear view) of the 19" rack below the air plenum. The DIP switches must be set as shown in Figure 3.14.

Figure 3.14 IDLS Alarm Module

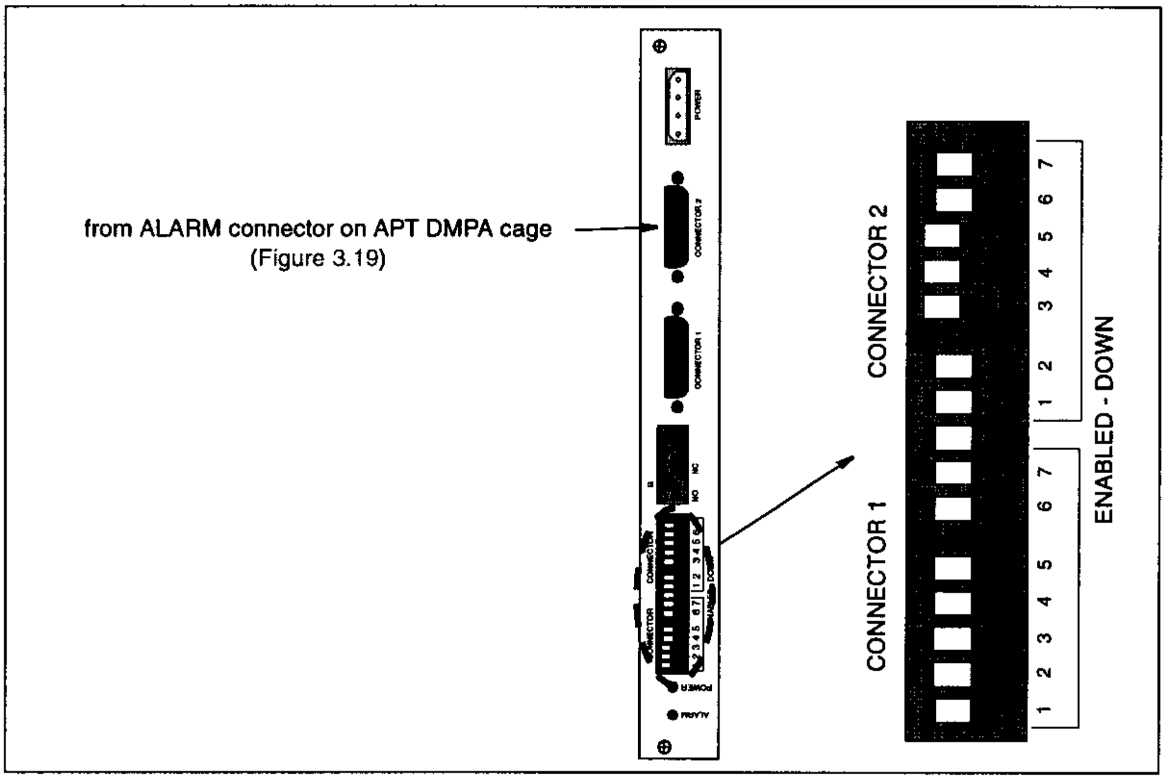


Figure 3.12 SIF Frame Analog Tx Connections (top view)

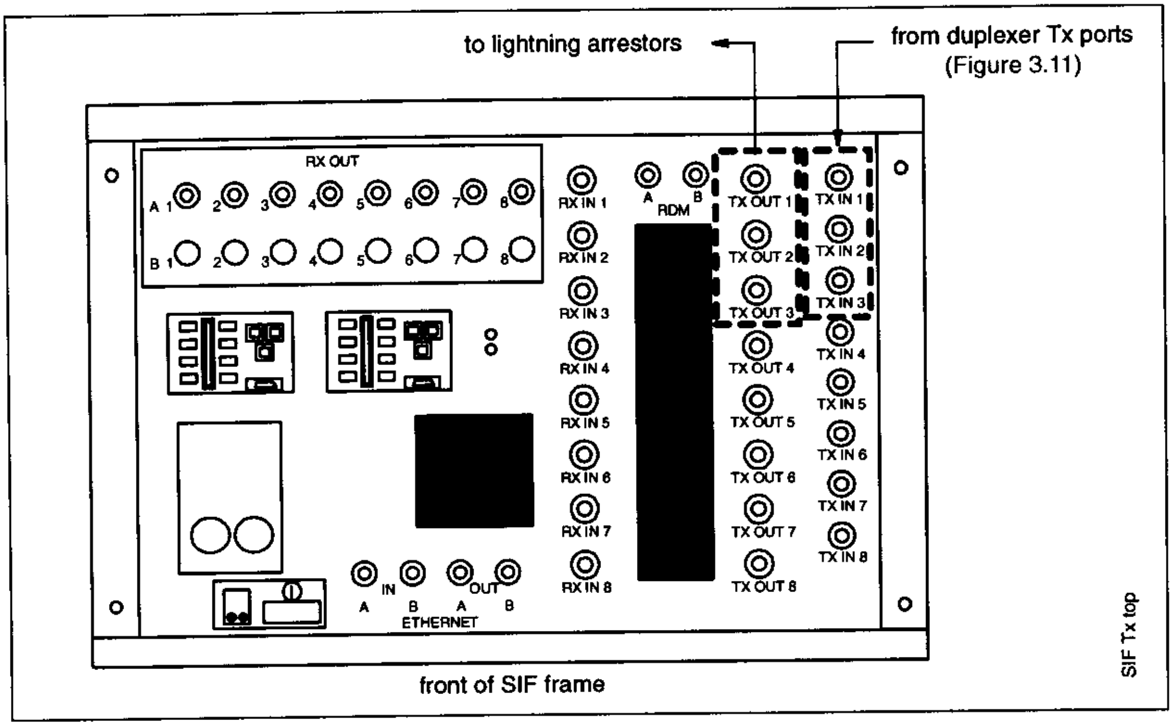


Table 3.5 Duplexer to SIF Frame Analog Tx Cable Mapping

Cable	Cable Label	SIF Frame	Duplexer
135-0263-20	α	TX 1	α
	β	TX 2	β
	γ	TX 3	γ

To cable the AIM module to the DMPA, IDLS modules, LPA bus, and ISB bus:

1. Connect one end of a 15-pin D-SUB cable (135-0264-00) to the ALARM port on the DMPA backplane, and connect the other end of the cable to the DMPA port on the rear of the AIM.
2. Connect the D-SUB ends of two cables (135-0232-20) to the IDLS EVEN and IDLS ODD ports on the rear of the AIM, and connect the AMPS 2-pin connectors to the IDLS alarm ports as shown in Table 3.3.

Table 3.3 AIM to IDLS Alarm Cabling

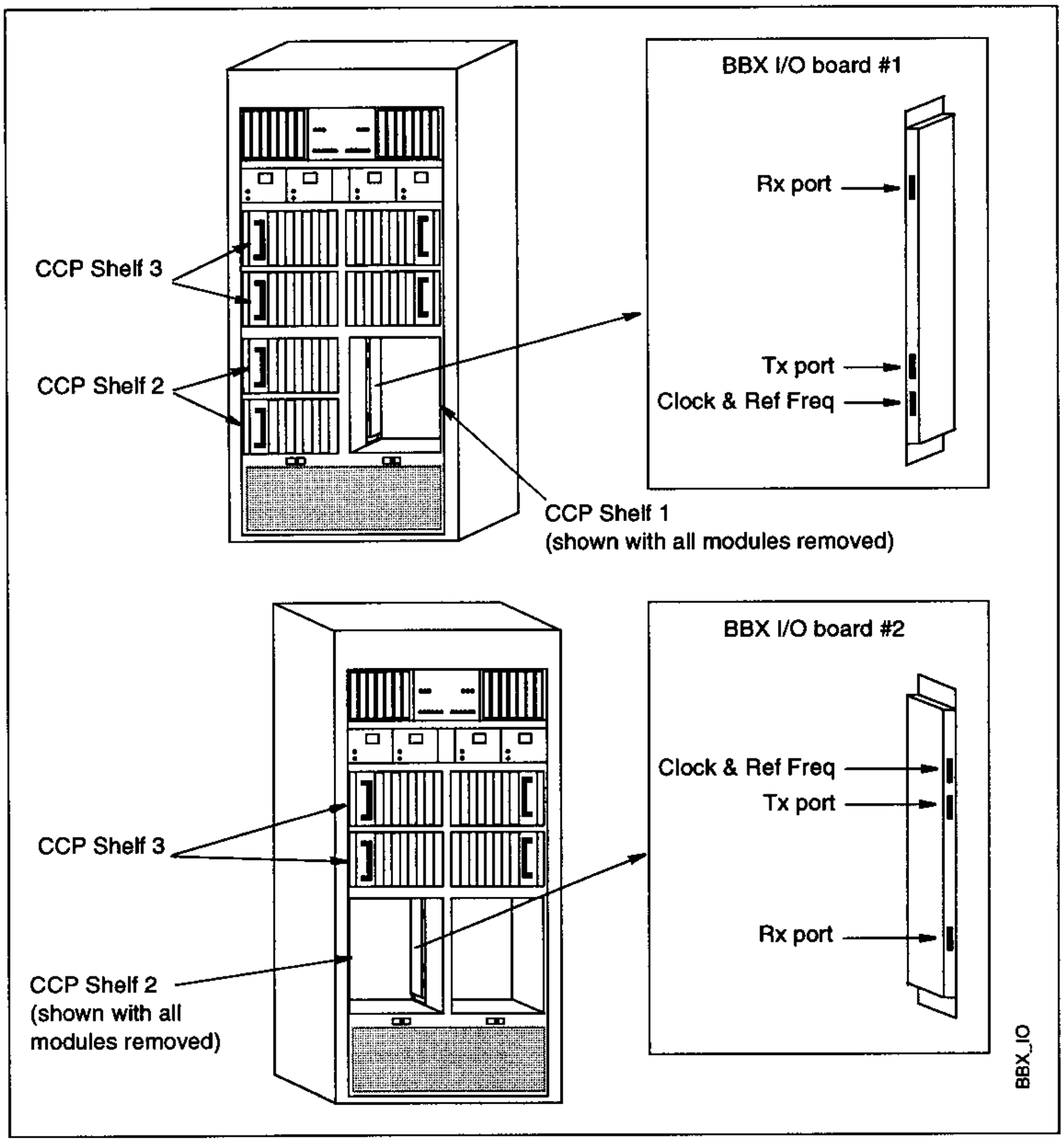
AIM Port	AMPS 2-pin Cable	IDLS Module
IDLS EVEN	1	2
	2	4
	3	6
	4	8
	5	10
	6	12
IDLS ODD	1	1
	2	3
	3	5
	4	7
	5	9
	6	11

3. Connect an RS-485 cable (135-0051-xx) between the LPA RS-485 port on the rear of the AIM and the J1 port on the LPA opto-isolator.
4. Connect an RS-485 cable (135-051-xx) between the ISB RS-485 (1) port on the rear of the AIM and the upper RJ-11 port on the external I/O board.
5. Connect a 120Ω termination (135-0054-01) to the ISB RS-485 (2) port on the rear of the AIM.

port on each Tx combiner in accordance with Table 3.2. Add some form of identification to the Harting connectors to identify the Tx cable from the Rx cable.

3. Install the interface panel on the back panel of the RFMF frame, and feed the Harting ends of the Tx and Rx cables in through the ventilation hole in the back of the RFMF frame to the BBX I/O cards (Figure 3.9).

Figure 3.9 BBX I/O Card Locations



Note: CCP Shelf #3 (if used) is identical to CCP Shelf #2.

3.2 Connect the other ends of the Rx and Tx cables to the second interface panel in accordance with Figure 3.6.

3.4 Installing and Cabling the CDMA Interface Panel

A CDMA interface panel must be installed on the back of each RFMF frame and cables to the Synthesis cage (see Section 3.3.4, "Synthesis Cage to the Interface Panel"). Each interface panel has connections for six Rx signals and three Tx signals.

- Each Tx signal goes through a 3:1 combiner in the interface panel to create a composite signal of each of the three sectors.
- Each Rx signal goes through a 1:3 splitter in the interface panel. The output(s) of each splitter support up to three BBX I/O boards inside the RFMF frame (Figure 3.6).

Figure 3.6 RFMF CDMA Interface Panel

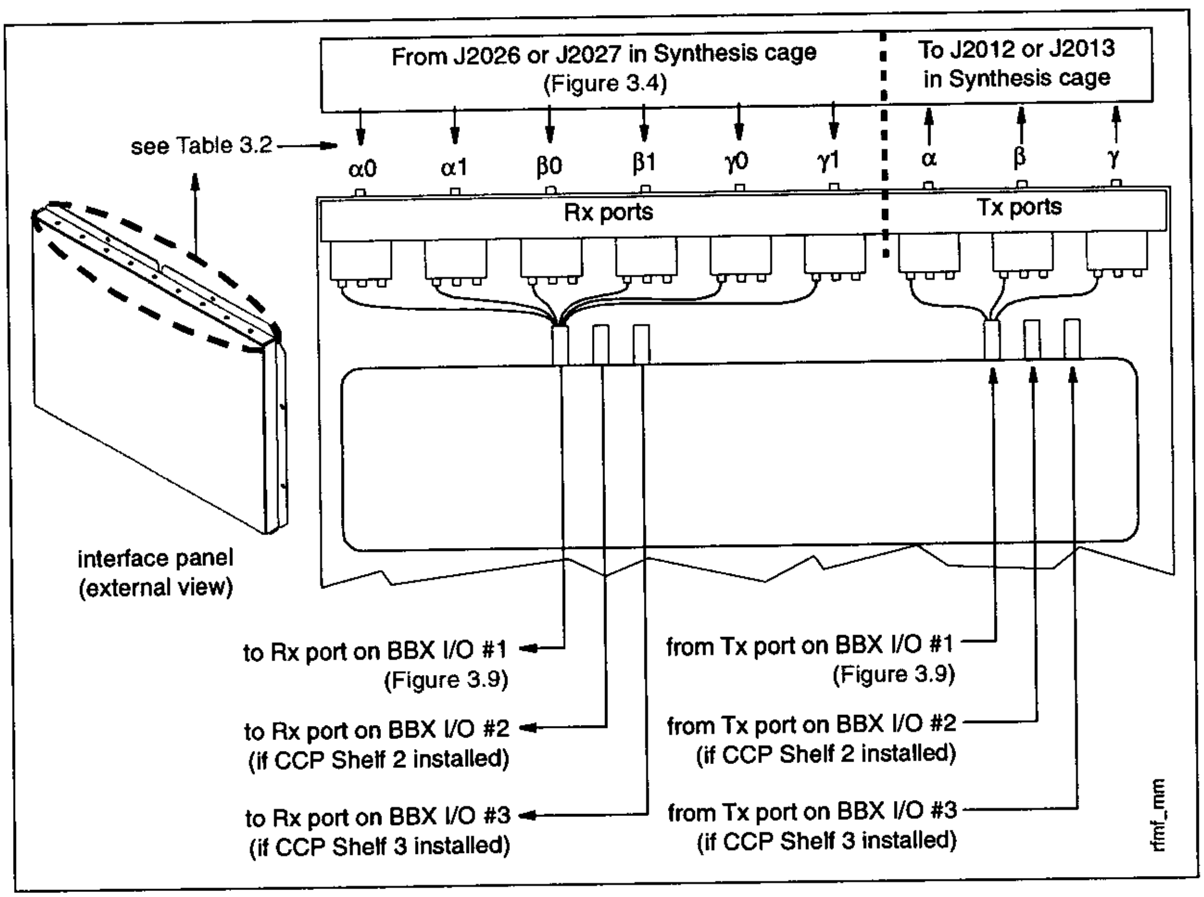
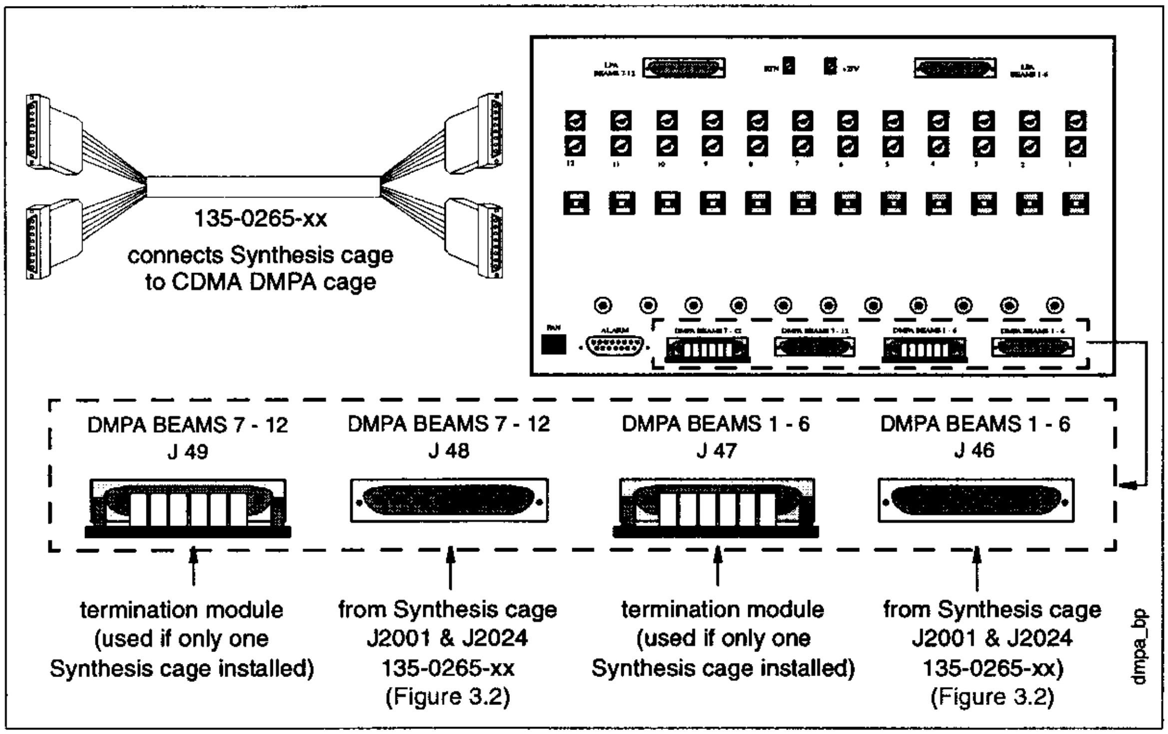


Figure 3.3 CDMA DMPA Cage Tx connections from Synthesis cage



3.3.3 Synthesis Cage to AIM

The AIM provides the alarm point of contact for the CDMA synthesis cage through the SpotLight Intrasystem Communications Bus (ISB). It also provides the control interface. A local PC can be connected to the AIM through the Ethernet or serial link, and communicate with the CDMA synthesis cage through the RS-485 ISB interface.

1. Connect an RS-485 cable (P/N 135-0051-10) between the ISB RS-485 PRI port on the Synthesis cage backplane and the ISB RS-485 1 port on the back of the AIM.
2. Connect a 120Ω termination (P/N 135-0054-01) to the ISB RS-485 SEC port on the Synthesis cage backplane.

3.3.4 Synthesis Cage to the Interface Panel

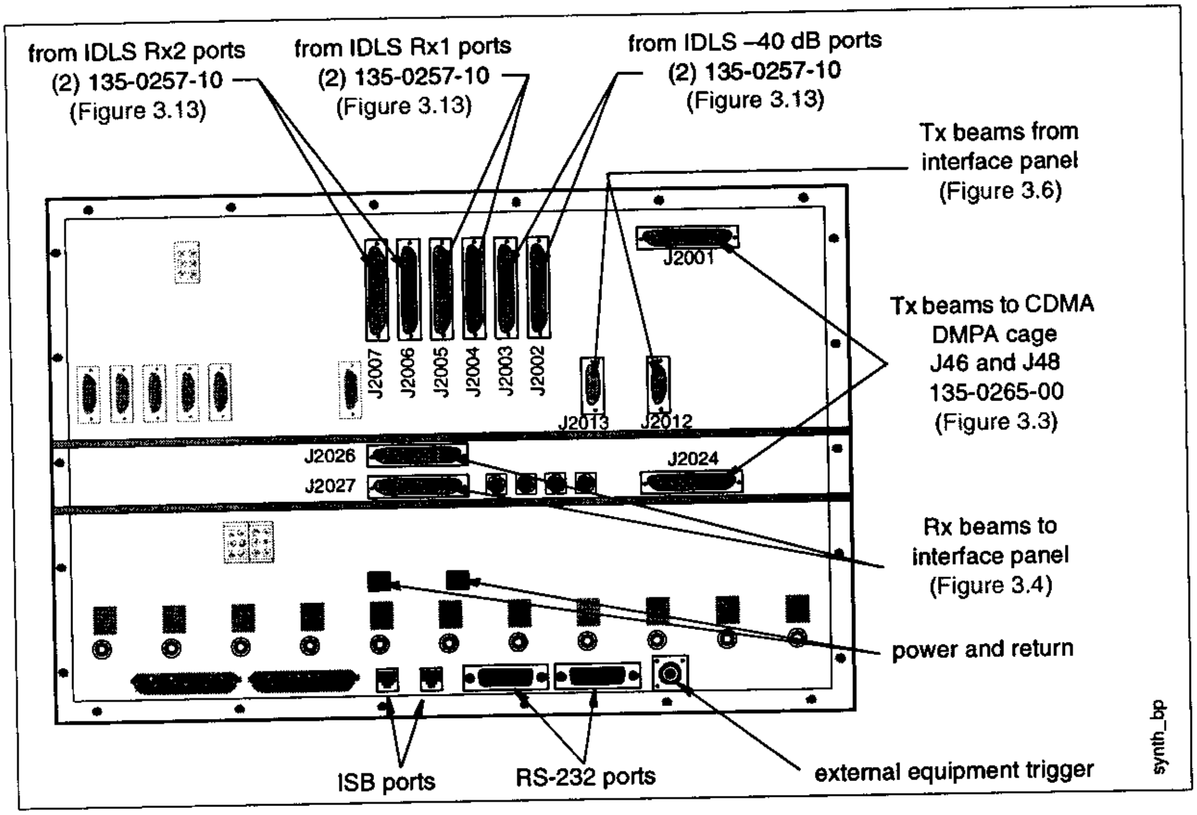
The interface panel takes CDMA Rx signals from the Synthesis cage and cables them to the RFMF BBX I/O board. It also takes CDMA Tx signals from the BBX I/O board and cables them back to the Synthesis cage.

1. After the interface panel has been installed on the back of the RFMF frame (Section 3.4, "Installing and Cabling the CDMA Interface

3.3 Cabling the Synthesis Cage

Figure 3.2 shows the cabling destinations for the Synthesis cage backplane ports.

Figure 3.2 CDMA 1.1 Synthesis Cage Backplane



3.3.1 Synthesis Cage to IDLS

Three identical sets of cables (135-0257-10) connect the IDLS modules to the Synthesis cage (Table 3.1). The active and standby Rx FRUs each get a set of signals from the IDLS Rx1 and Rx2 ports. The third set of signals connects the CDMA controller FRU to the IDLS –40 dB coupled ports for diagnostic purposes.

Dress all cables to the 19" rack.

3.1 Introduction

SpotLight system configurations vary widely, depending on the system type, the number of channels supported, and user requirements. Therefore this chapter discusses a typical installation consisting of two equipment racks, one 25" wide and one 19" wide, that are installed side-by-side with the fronts facing in the same direction.

- The 19" rack is shipped from the factory with all components already installed. It requires only cabling. For this reason, no component installation instructions are provided.
- For the 25" rack, the cage assemblies are already installed, but weight constraints require that the components be packaged separately and installed at the cell site.

Important: Before installing any rack components, inspect the shipping containers and components for any signs of physical damage. Report any damage immediately to the carrier, and to Metawave Customer Service. Inventory the components you received and check them against the packing list. Notify the carrier and Metawave Customer Services of any discrepancies.

3.2 Equipment Rack Installation

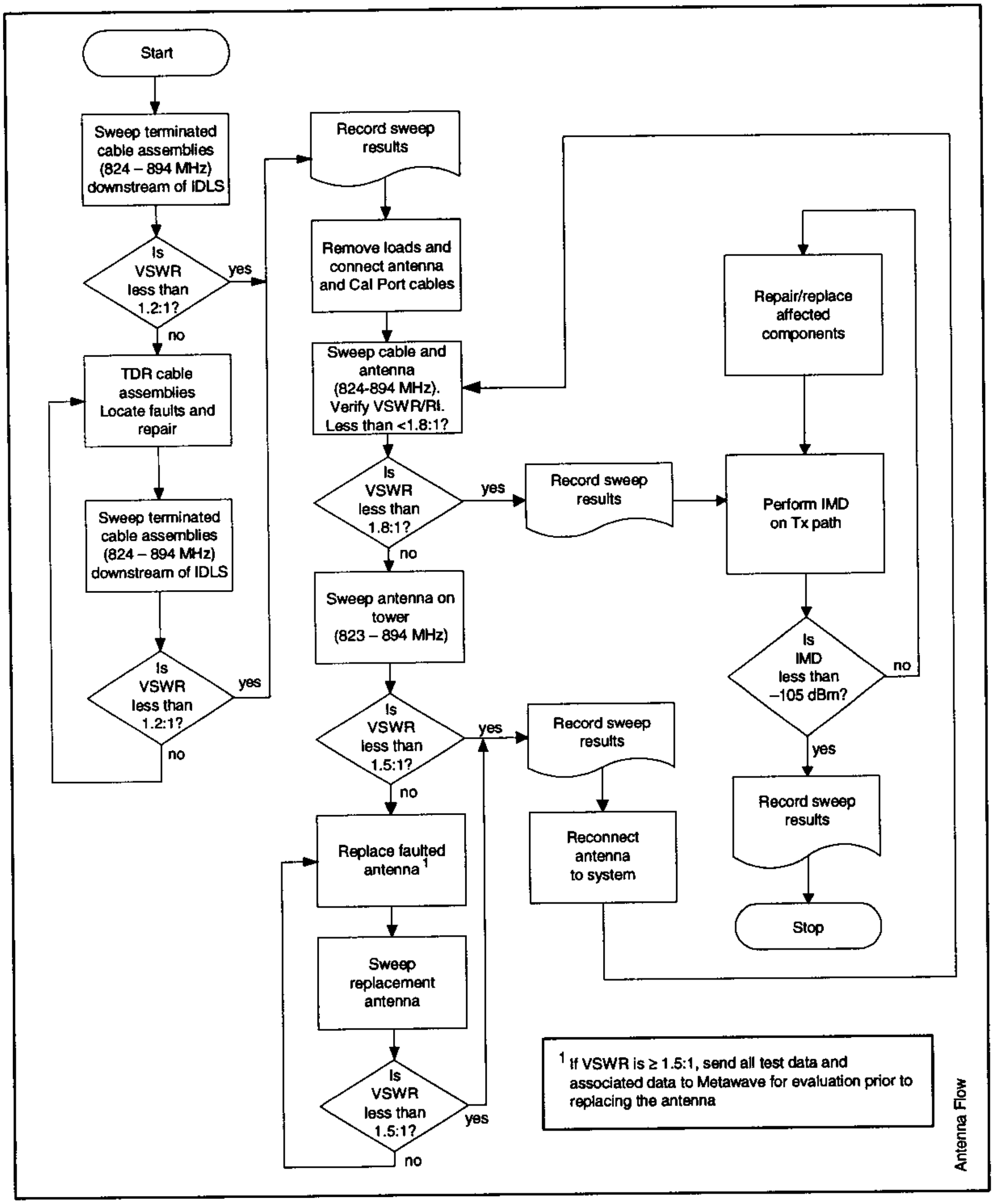
Typically, SpotLight equipment racks are installed side-by-side, with the front side facing the same direction. The rear of the SpotLight system requires a clearance of at least 24 inches (61 cm) to allow access for cabling and service.

The installation requirements for the equipment racks are dependent on the cell site requirements, local laws, and individual customer practices. Customer personnel and cell site documentation should be consulted prior to beginning the installation. At a minimum, the racks should be securely bolted to the floor, and in earthquake prone areas the top of each rack should be secured to the base station walls or to the cable ladder infrastructure.

Caution: Always verify that the equipment racks are securely installed and in compliance with local ordinances before proceeding with installation.

Isolation pads must be installed between the racks and the cell site floor. Use the isolation pads as a template for drilling the rack mounting holes in the cell site floor. Then install the isolation pads under both racks. The hardware required for mounting the racks and isolation pads is included in installation kit P/N 280-0096-01.

Figure 2.4 Antenna Test Flow Chart



2.3.2 Installing the RF Antenna Cables

The procedures for installing RF antenna cables are site dependent. Refer to your site engineering documents for full information on the antenna cabling installation procedures and the requirements associated with your cell site.

Caution: Do not install the RF main cable directly to Metawave antenna panel connectors if they are larger than 1/2" diameter. Doing so can cause serious damage to antenna panel connectors. Instead, install 36" jumpers of 1/2" RF cable to antenna panel connectors as shown in Figure 2.2, then connect the RF main cable to the jumper.

After installing cables, weather seal all RF connectors to the antenna panels.

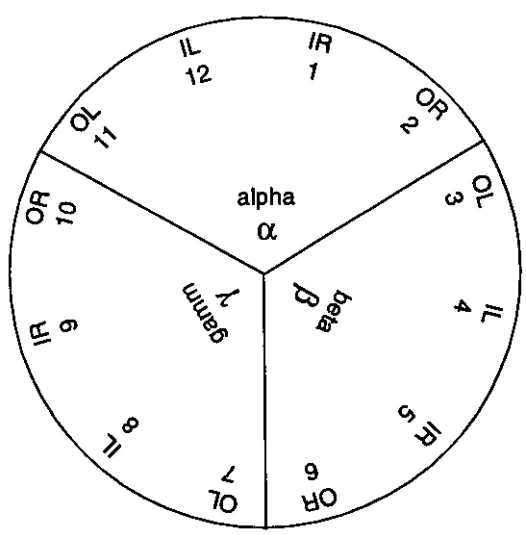
2.3.3 Inspecting the Antenna Installation

Inspect your installation to make sure antenna masts and antenna panels are securely installed and weather-proofed.

2.3.4 Antenna Cable Numbering Convention

Antennas and cables are assigned beam numbers according to Figure 2.3.

Figure 2.3 Antenna Cable Numbering



Beam	Sector	Connector Code
1	alpha	X - IR
2	alpha	X - OR
3	beta	Y - OL
4	beta	Y - IL
5	beta	Y - IR
6	beta	Y - OR
7	gamma	Z - OL
8	gamma	Z - IL
9	gamma	Z - IR
10	gamma	Z - OR
11	alpha	X - OL
12	alpha	X - IL

ant_06

5. Check the antenna VSWR, as measured at the antenna cable connector, for each antenna panel's connectors. Record the measurements for future reference.

2.3 Installing Antenna Cables

Antennas are connected to the SpotLight equipment using dielectric RF coaxial cables. These RF main cables are terminated short of the antennas, and smaller RF jumper cables are used to make the actual connections between the antennas and the RF main cables.

The diameter of the RF main cable (used for Tx/Rx of voice and Sig) and the diameter of the calibration cable depends on the total length from antenna to lightning arrestor. Table 2.1 provides physical specifications for common antenna cable sizes.

Table 2.1 Antenna Cable Specifications

Cable Use	Cable Diameter (inches)	Minimum Bending Radius (inches)	Cable Weight (lbs/ft)	Recommended Length (feet)
Jumper (Tx/Rx)	1/2	5	.15	2 to 6
Calibration	1/4	3	.06	< 200
Calibration	1/2	5	.15	> 200
Main	7/8	10	.33	< 100
Main	1-1/4	15	.67	<150
Main	1-5/8	20	.92	> 150

2.3.1 Preparing the RF Antenna Cables

Prepare the built-on-site antenna cables in compliance with your site engineering documents, your site RF engineering requirements, and site line diagram. Obtain the site line diagram from the site engineering department before beginning the installation. The site line diagram should contain full information on connectors, cable type, grounding kits, hangers, minimum bend radii, and any other information necessary to safely complete the cable installation.

Assemble and install antenna RF cables in compliance with cell site engineering documents and RF engineering requirements. Cable runs should be designed to minimize turns and bends, taking the most direct route possible. Any penetrations through walls should be sealed with a waveguide

2.1 Introduction

The typical SpotLight antenna system consists of three transmit/receive antenna panels. They are constructed of high-strength aluminum alloy backs, silver-plated brass elements, and high impact, weather and UV resistant ABS radomes. The antenna system also includes RF antenna cabling.

Each panel contains an array of four narrow-beam CDMA antennas plus an analog transmit antenna.

- Each CDMA antenna covers a 30° sector, for a coverage of 120° per antenna panel. Typically, the three antenna panels are installed to provide RF transmit/receive coverage to different 120° arcs of coverage.
- Each analog transmit antenna transmits the analog channels associated with the sector and covers approximately 80° ± 5°. The SpotLight beams used for APT do not interact with those used for CDMA.

The azimuthal orientation, elevation, and tilt of each antenna panel should be specified by your cell site engineering department.

SpotLight antenna installation consists of:

- Installing three antenna masts (2-inch O.D. pipe and a downtilt mount for each antenna panel).
- Installing an antenna panel on each of the three antenna masts.
- Installing RF antenna cables between the antenna panels and the lightning arrestors.

2.2 Antenna Mast and Panel Installation Procedure

Install antenna masts and antenna panels in compliance with cell site engineering documents. Consult those documents for details on how to install antenna masts and antenna panels.

Warning! ***Installation of any antenna near power lines is dangerous. Electrical power lines, phone lines, and guy wires can look alike. For your safety, assume that any overhead lines can kill you.***

Install the antenna masts in a position that is completely clear of obstruction on the transmit/receive panel face, and for at least 18 inches left and right of the antenna. Figure 2.1 shows the organization of antenna masts and antenna panels on a typical antenna tower.

1.6.3 Configuring the System

Load the system configuration file and configure the network access hardware. Refer to Chapter 4, "Site Configuration Files" for instructions.

1.6.4 Testing the System

Perform the tests described in Chapter 5, "Configuration and Integration" to ascertain that the system is functioning properly.

1.6.5 Commissioning

Conclude the installation by performing the tests described in Chapter 6, "Commissioning Test Procedure". The purpose of the Commissioning Test Procedure (CTP) is to demonstrate the proper installation and operation of the SpotLight system. The successful completion of the CTP indicates that the SpotLight system is ready for cut-over to commercial service.

1.3 Tools Required for Installation

Installation of the SpotLight system requires only the tools normally contained in a cell site technician's tool kit. However, you should consult the engineering documents related to your cell site to determine if unusual circumstances require special tools.

1.4 Checking the Installation Kit

The SpotLight Installation Kit contains components, cables, installation materials and specifications of special circumstances that may prevail at the cell site. Precise specification of components and cables is dependent upon the configuration of the cell site and the SpotLight system being installed.

Before you begin installing the SpotLight system make sure all of the components identified in the Installation Kit packing list are actually in the Installation Kit. In addition, compare the packing list with the invoice to confirm that all ordered components and cables were shipped.

1.5 Unpacking and Inspection

Prior to beginning the installation, unpack the SpotLight system equipment and perform a visual inspection and inventory. Inspect shipping containers and parts for signs of physical damage. Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous material in connectors or fans. Inspect all connectors for bent or loose pins. Inventory all parts to make sure that you have what you need to complete the installation.

Attention! The DMPA and Synthesis cage all contain electrostatic sensitive elements. When handling these components, wear an ESD wrist strap connected to a properly grounded surface to prevent damage due to electrostatic discharge.

1.1 Introduction

The typical SpotLight installation involves the following steps:

- Preparing the site for SpotLight installation
- Installing the antennas
- Installing the SpotLight assemblies
- Cabling the SpotLight to the base station
- Configuring the system
- Performing system tests

This chapter provides an overview of each of these steps.

1.2 Installation Planning

Prior to an installation, a site survey will be performed by Metawave and customer personnel. A typical site survey provides information about the following cell site variables:

- Cell site configuration
- Antenna tower survey
- Internal and external grounding
- Primary power interconnection and distribution
- Floor space allocation
- Cabling layout
- Material requirements unique to the cell site

Use the site survey checklist and cell site engineering documents to make sure that you have the appropriate types and quantities of material to complete the installation.

In addition to this manual, the following documentation may be helpful to complete the installation:

- Product lists
- Metawave-supplied ancillary equipments lists
- Cell site power cabling diagrams
- Cell site RF cabling diagrams
- Cell site wiring diagrams
- Rack layout diagrams

Site-Specific Installation Notes

Important Safety Information

Ground Electrical Instruments and Components

Verify that equipment racks, equipment chassis, and appropriate tools are connected to the electrical ground network. If equipment has a three-conductor AC power line, plug it into an approved three-conductor outlet or plug it into a three-contact to two-contact adaptor with a green grounding wire connected to electrical ground at the power outlet. Power supply components must meet International Electrotechnical Commission safety standards.

Do Not Work Alone Around Exposed Power Circuits

Do not perform internal service on electrical equipment, even if you are authorized, unless a person trained in CPR is present.

Do Not Operate Equipment in an Explosive Environment

Do not operate the equipment described in this manual, or the electrical instruments associated with it, in an explosive atmosphere.

Do Not Work on Live Circuits

Cell site technical and operating personnel are not authorized to remove equipment covers from Metawave products. Only personnel authorized by Metawave may remove equipment covers to replace components or perform internal adjustment or repair.

Disconnecting Power Before Replacing Components

You can remove or install certain field replaceable units (FRUs) without removing power from the system (hot-swapping). Any other components must be disconnected from their power source before being removed from the equipment racks.

How this Manual is Organized

Chapter 1	Provides an overview of the installation procedure.
Chapter 2	Provides information for installing SpotLight system antennas.
Chapter 3	Provides information for installing the rack-mounted components of the SpotLight system. Describes how to install SpotLight system power, grounding, and RF cables, cell site-to-SpotLight power cables, and how to connect the SpotLight system to cell site radios (RCUs).
Chapter 4	Describes how to configure SpotLight to work with the Motorola SC 9600 cell site.
Chapter 5	Describes SpotLight system configuration and integration test procedures.
Chapter 6	Provides test procedures for commissioning the SpotLight system.

Revision History

Date	Version	Description
6/3/99	500-0030-Draft	Draft release of the SpotLight 2000 Installation Manual for Motorola SC 9600 and APT platform. This version also incorporates Service Bulletin 39, "DMPA and AIM Installation Instructions," and Service Bulletin 43, "CDMA 1.1 Installation for Motorola 9600".

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