

**SANDERS PROPRIETARY**

**PCS-OVER-CABLE CMI/HIC SYSTEM  
VERSION 1.85  
Implementation Manual  
for  
Headend Equipment (Primary/Expansion) Rack  
and  
Cable Microcell Integrator**

**Document No. 8337147**

**SEPTEMBER 1997**

**Revision -**



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**SEPTEMBER 1997**

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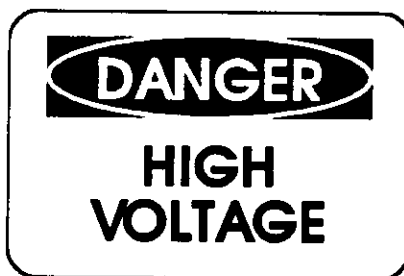
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- High leakage current: The rack must be connected to Protective Earth ground before any connection is made to +24V prime power.
- High Voltages (115 Vac and 24 Vdc) are present within the equipment rack. Use extreme caution when working inside the rack.
- High voltages may exist in the near proximity of the CMI location, use standard CATV industry safety practices when working on an installed CMI.
- High voltages (60 Vac RMS) exist on the AC power cable to the CMI. Use extreme caution when removing the AC power cable to avoid coming in contact with the center conductor.
- High voltages (60 Vac RMS) can exist on the CMI antenna connections during a fault condition.
- Laboratory tests conducted in accordance with ANSI/IEEE C95.1-1992 show that a transmitting CMI poses no radiation hazard to persons in close proximity to the transmitting antenna. However, for added safety when working near a CMI, maintain a minimum distance of eight inches from the transmitting antenna.

## SECTION 1. INTRODUCTION

### 1.1 SCOPE

This manual contains instructions for installing the two Headend Equipment (HEE) rack configurations and the Cable Microcell Integrator (CMI) for the Sanders PCS-Over-Cable CMI/HIC system, Version 1.85. Specifically:

- The PCS-Over-Cable CMI/HIC system requires equipment installation at the CATV Headend facility and at remote locations.
- The HEE rack is installed in the CATV Headend facility. Table 1-1 lists the two rack configurations.
- Each HEE rack configuration has the capability to have an optional +24V Power Supply installed for an internal prime power source.
- The CMI assemblies are installed on the messenger strands of the CATV plant throughout the service area.

**Table 1-1. PCS-Over-Cable Rack Configurations**

Rack	Part Number
Headend Equipment Primary Rack	8303703G1
Headend Equipment Expansion Rack	8303702G1

### 1.2 SYSTEM OVERVIEW

Table 1-2 lists the major assemblies and components installed for each rack configuration. For a detailed assembly list for each rack configuration, refer to section 2.

**Table 1-2. Major Assemblies For Rack Configurations**

Assembly item	Part No.	HEE 8303703G1	HEE 8703702G1
Headend Control Unit (HECU)	8301364G1	X	N/A
15 MHz Distribution Assembly	8303715G1	X	X
Headend Interface Converter (HIC) (QTY 1-14)	8303704G1	X	X
Cable Assemblies	See Table 2-2	X	X
Equipment Rack	8303739P1	X	X
Power Supply Assembly	8303743G1	(optional)	(optional)

#### 1.2.1 Headend Equipment Primary/Expansion Racks

The following paragraphs describe the major assemblies listed in Table 1-2 that are installed in the two rack configurations. The HEE expansion rack operates as a physical and functional extension of a primary rack, allowing for the use of up to 14 additional Headend Interface Converters (HICs).



### **1.2.1.1 Headend Control Unit (HECU)**

The HECU is only used in the HEE primary rack configuration. The major HECU hardware components are:

- Computer, Rack Mountable Pentium 100 MHz
- Monitor, Rack Mountable
- Keyboard, Rack Mount
- Mouse, PS/2
- Computer Power Cord
- Monitor Power Cord

The HECU monitors and controls the CMI and HIC units. It monitors various system parameters to verify that the units are operational and that the power levels are at the proper level. The HECU is the primary control/monitoring system that handshakes with the other units.

The HECU communicates with the HICs over an RS-485 interface via a Lonworks® card located in the computer.

The major software HECU components are:

- Microsoft® DOS Version 6.22
- Microsoft® Windows™ Version 3.11
- Software Drivers for custom HECU functions

### **1.2.1.2 15 MHz Distribution Assembly**

The 15 MHz Distribution Assembly is used in both rack configurations. The assembly requires +24V and 15-MHz input for operation. The distribution assembly accepts a single 15-MHz input from the Base Transceiver Station (BTS) and provides 16 reference outputs for distribution to the HICs. Signal amplification for each 15-MHz output is approximately unity gain (0 dB). Unused ports are terminated with 50 ohms. Each installed HIC uses the 15-MHz reference signal.

### **1.2.1.3 Headend Interface Converter (HIC)**

The HIC is the direct interface to the Base Transceiver Station (BTS) and CATV cable plant. It converts the PCS frequencies from the BTS to an Intermediate Frequency (IF) to communicate with its associated CMIs, and it converts the IF signals from the CMIs to PCS frequencies for the BTS. The HIC uses rear panel connectors to interface with the BTS and CATV cable plant. One HIC supports multiple CMI units. The HIC assigns each CMI its frequency and gain levels. Each HIC supports up to three Code Division Multiple Access (CDMA) channels.

Each HIC consists of a single circuit card assembly (CCA) that contains the components for the three sector interfaces. A DC-operated fan cools the HIC by pulling air into the front and exhausting the air via the rear side panels.

#### **1.2.1.4 Cable Assemblies**

Cable assemblies provided with the various racks interconnect the installed assemblies within the rack. Cable assemblies are not provided for external interconnection between the rack and BTS or CATV plant. Refer to Section 2 for cable assemblies that are provided with each rack.

#### **1.2.1.5 Equipment Rack**

The equipment rack is a standard EIA design that holds and secures standard 19-inch-wide rack-mounted assemblies. For the PCS-Over-Cable equipment, each rack configuration uses the identical equipment rack for assembly mounting. The equipment rack dimensions are:

- Height            76 inches
- Depth            30 inches
- Width            23 inches
- Weight           290 pounds (unpopulated)

#### **1.2.1.6 +24V Power Supply Assembly**

For installation sites that do not provide an external +24V prime power source, an optional +24V Power Supply, part number 8303743G1, is available for rack installation. The +24V Power Supply operates using 115 Vac and provides +24V for the rack internal distribution. (With the power supply installed in a rack, the maximum number of HICs allowed is 12).

#### **1.2.2 Cable Microcell Integrator**

The CMI is the communications link between the PCS handset and the CATV cable plant. The CMI Assembly, part number 8303750G1, is comprised of the following major hardware CMI assemblies:

- Power Extractor Module
- Transceiver Module
- Power Supply Module
- Power Amplifier Module
- Chassis

The power extractor routes the CATV power to the power supply and CATV cable signals to the internal CMI transceiver module. The power supply converts the CATV cable plant power to power levels required on the transceiver module assembly and by the power amplifier.

The CMI is controlled by the HIC assembly in the HEE. The power amplifier is enabled/disabled by the assigned HIC unit and is used to boost the CDMA signal sent to the PCS handset via an antenna. The transceiver module assembly performs the handshaking with the assigned HIC unit and converts the CDMA signals to the appropriate frequencies.

The chassis is an environmentally sealed fire enclosure.

### 1.2.2.1 Power Extractor Module

The Power Extractor is available in two configurations:

- The *Single Mode* configuration allows the CMI to operate with both the forward and reverse link CATV signals on a single CATV interface port (FWD/REV). In this mode the CMI can be configured to accept AC prime power from either CATV interface port.
- The *Dual Mode* configuration allows the CMI to operate with the forward and reverse link CATV signals on separate CATV interface ports. The forward link CATV signals are interfaced to the ALT/FWD CATV interface port and the reverse link CATV signals are interfaced to the FWD/REV CATV interface port. In this mode the CMI can be configured to accept AC prime power from either CATV interface port.

The AC power switch on the Power Extractor allows the installer/maintainer to select AC prime power for the CMI from either CATV interface port. The AC power switch also allows the user to shut off AC prime power to the Power Supply module without removing the Power Extractor.

The Power Extractor features a delay circuit that prevents a power surge on the reverse link when AC power is applied to the CMI. DC voltage for the delay circuit is routed to the Power Extractor through an integral two-conductor cable.

The Power Extractor accommodates field-replaceable, plug-in attenuator pads for both the forward and reverse CATV paths, and a field-replaceable, plug-in equalizer in the forward CATV path. These component locations are accessible when the CMI housing cover is open without the need to remove the Power Extractor. The CMI is shipped with no pads or equalizer installed. It will accept Scientific Atlanta model number PP-0 to PP-10 attenuator pads or equivalents and Scientific Atlanta model number EQ750 equalizers or equivalents.

The Power Extractor routes the following signals:

- External 60-Hz Quasi Square Wave input to the CMI Power Supply Module
- External 5–42 MHz CATV RF Reverse Link signals from the Transceiver Module
- External 52–750 MHz CATV RF Forward link signals to the Transceiver Module

### 1.2.2.2 Transceiver Module

The Transceiver contains a dual receiver and a transmitter, and incorporates both analog and digital signal processing and control. Reverse link RF signals, originating in the PCS wireless domain, are received by both the primary and diversity receivers, processed and sent, via the CATV cable plant, to a remote headend location. Forward link signals, originating at the headend, travel, via the cable plant, to the CMI, are processed by the Transmitter, amplified by the Power Amplifier, then broadcast to the PCS wireless users. There is one LED to indicate +5 Vdc and three LEDs to indicate status codes.

### 1.2.2.3 Power Supply Module

The Power Supply Module requires a 60-Hz Quasi-Square Wave (45–90 Vrms) input AC voltage. The power supply produces four DC voltages: +25V, +15V, +5V, and -15V. Test points are available for all input and output voltages. For overcurrent protection, the AC input is fused in the Power Supply Module. The fuse is accessible with the power supply cover removed.

#### 1.2.2.4 Power Amplifier Module

The Power Amplifier Module operates in the 1930-1945 MHz pass band. The Power Supply Module provides the required DC voltages for the amplifier. Power Amplifier Module parameters are:

- Gain approximately 60 dB
- Dynamic Range 15 dB minimum
- Power Output +34.8 dBm nominal

### 1.3 ACRONYMS

BTS	Base Transceiver Station
CCA	Circuit Card Assembly
CDMA	Code Division Multiple Access
CMI	Cable Microcell Integrator
Ctl	Control
FWD	Forward (downstream)
HECU	Headend Control Unit
HEE	Headend Equipment
HIC	Headend Interface Converter
IF	Intermediate Frequency
kbps	Kilobits per Second
PEGND	Protective Earth Ground
RCV	Receive
Ref	Reference
REV	Reverse (upstream)
RTN	Return
Rx	Receive
Tx	Transmit
XMIT	Transmit

## SECTION 2. HEADEND PRIMARY/EXPANSION RACK INSTALLATION

### 2.1 INSTALLATION TASKS

Installing the HEE primary or expansion rack involves the following major tasks:

- Preparing space for the individual rack
- Installing equipment in the rack
- Installing interconnecting cables in the rack
- Installing interconnecting cables between rack and CATV plant
- Installing interconnecting cables between rack and Base Transceiver Subsystem.
- Installing interconnecting cables between primary rack and expansion rack
- Installation checkout

### 2.2 TOOLS, TEST EQUIPMENT, AND SUPPLIES

Table 2-1 lists the tools and test equipment needed (but not supplied) to support the rack installation.

### 2.3 INSTALLATION PARTS LIST

Table 2-2 lists the parts shipped for each rack installation. Before proceeding with the rack installation, inventory the kit contents to ensure all parts are present for the applicable rack.

**Table 2-1. Rack Installation Support Needs**

HAND TOOLS	TEST EQUIPMENT
Philips Screwdriver # 2 head	Hand-held Digital Multimeter with test probes Spectrum Analyzer, HP
Flat Blade Screwdriver # 2 head	
Wrench, 5/16 inch	
Wrench, 7/16 inch	
Wrench, 3/8 inch	
Torque Tools	
Cable Tie Installation Tool, Panduit	
GS2B, or equivalent	

**Table 2-2. Rack Assembly Installation Kit**

Assembly Item	Part No.	HEE Primary Rack 8303703G1	HEE Expansion Rack 8303702G1
Equipment Rack (Blank panels shipped with Rack)	8303739P1	1	1
Headend Control Unit (HECU) Computer, Rack mount Pentium 100 MHz Monitor, Rack mount Keyboard, Rack mount (Attached to rack) Mouse, PS/2 Computer Power Cord Monitor Power Cord	8301364G1	1	N/A
Mouse Pad (Attached to Keyboard tray)	S600721	1	N/A
15 MHz Distribution Assembly (Attached to Rack)	8303715G1	1	1
HIC Communication Cable Assembly (Computer Wiring Harness)	8303718G1	1	N/A
Upper Communication Cable Assembly	8303716G1	1	1
Lower Communication Cable Assembly	8303735G1	1	N/A
Expansion Lower Communication Cable Assembly	8331059G1	N/A	1
Termination, RS-485	8302374G1	2	N/A
Hardware Package, Screws & Washers 10-32 x 0.50, Qty 36	HHHARD	1	1
Cable ties, 12 inches long	PLT3S-C	12	12
Cable ties, 5.25 inches long	SST1.5I-C	10	2
Cable Tie Mount	ABMM-AT-C	2	2
Cable Clamp, 3/8"	NAS1397P6N	5	2
Power Supply Assembly (See Table 2-3)	8303743G1	optional (see para. 1.2.1.6)	optional (see para. 1.2.1.6)
Headend Interface Converter (HIC)	8303704G1	1-14	1-14
Cable Assembly, 15 MHz Reference	8303717G1	1 per HIC	1 per HIC
Software, DOS, Version 6.22	Disk	1	N/A
Software, Windows, Version 3.1.1	Disk	1	N/A

## 2.4 POWER REQUIREMENTS

Each rack requires external 115V, single phase, 60 Hz, and +24V for prime power. Each rack has the option of installing a DC power supply in lieu of the external +24V. The +24V supply is required to operate the installed HICs.

### 2.4.1 External Prime Power Installation

At the installation site when both 115V, single phase, 60 Hz and +24V are available, a fully loaded rack with 14 HICs installed requires approximately 30 amperes for +24V. The primary rack configuration also requires approximately 2.0 amperes of 115 V, 60 Hz, single phase power for the HECU assemblies.

### 2.4.2 Internal Prime Power Installation

If the +24V is not available at the installation site, an optional +24V Power Supply, part number 8303743G1, is installed in the rack. Each rack uses the internal +24V Power Supply to power the rack assemblies in the absence of the +24V prime power at the installation site.

### 2.4.3 Protective Earth Grounding

The HEE rack(s) must be properly grounded to protect installers and operators from electrical shock. For this purpose there are two 1/4 in. x 20 ground studs located on the left and right rear of the rack floor panel. The right stud is used to ground the internal components to the rack. The left stud is used to connect the rack to the site ground. The site grounding cable should consist of UL-approved wire of no less than 14 gauge. The wire should attach to the ground stud by means of a properly sized ring terminal. The rack is supplied with a split washer and a 1/4 in. x 20 nut to secure the ground cable ring terminal to the stud.

## 2.5 . HEE CONFIGURATION AND SPACE REQUIREMENTS

### 2.5.1 Suggested Floor Space Requirements

Figure 2-1 shows the suggested floor space to support HEE primary and expansion rack installation, operator work space, and service area.

### 2.5.2 Typical Rack Configuration

Figure 2-2 shows a typical rack configuration as it appears before installation of the HECU and individual HICs. Both rack configurations use the identical equipment rack. The rack is 76 inches high, 30 inches deep, and 23 inches wide. A minimum of 36 inches of clear space behind the rack is recommended for servicing and proper ventilation. As shown in Figure 2-3, the primary rack configuration contains the HECU. For this configuration, when the HECU keyboard tray is extended, another 40 inches is suggested for operator workspace. It is recommended that the rack be bolted to the floor.

When the optional +24V Power Supply is installed in the racks, it occupies the two top positions (the two top panels), thereby reducing the maximum number of HICs per rack from 14 to 12.

(TOP-DOWN VIEW)

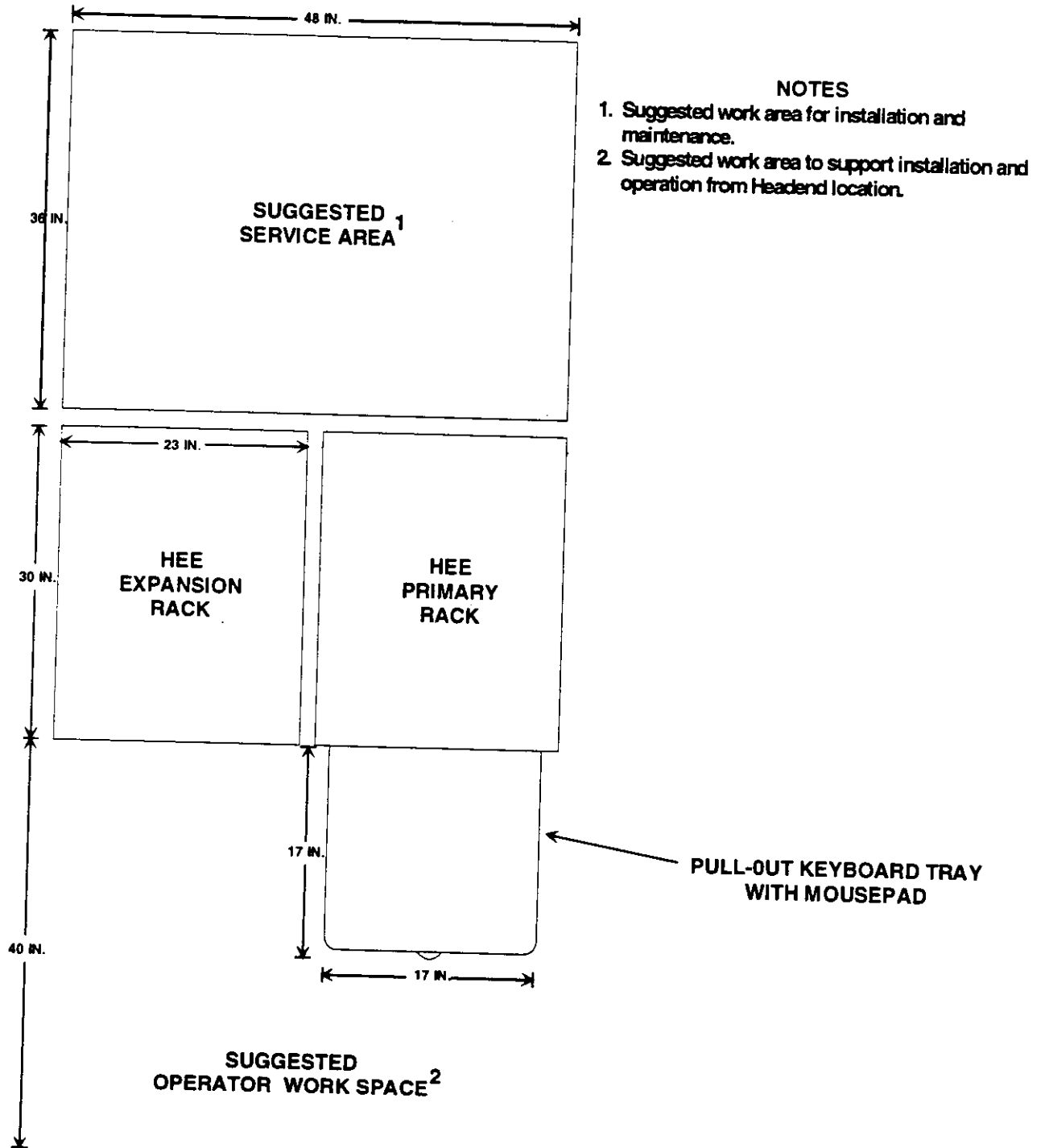
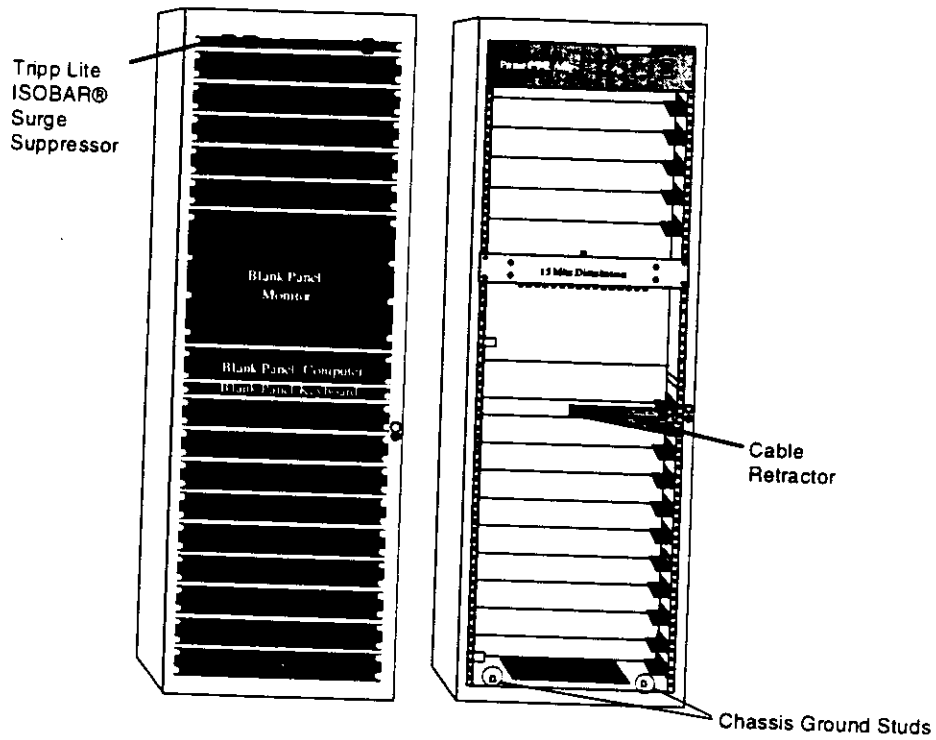


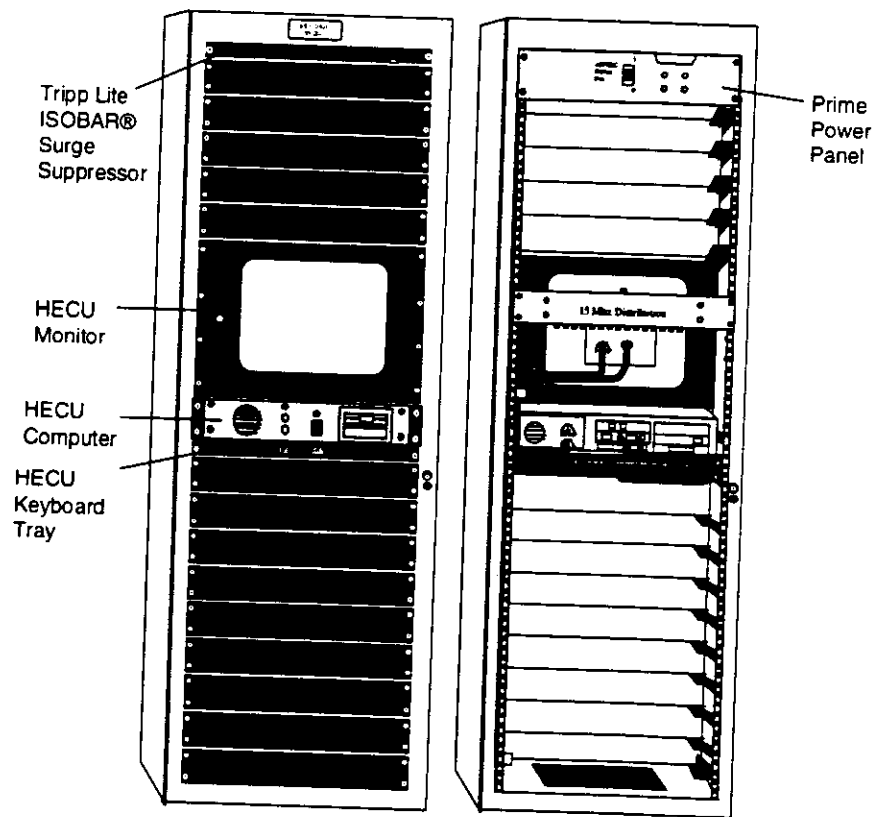
Figure 2-1. Recommended Headend Equipment Floor Space

HECU1.DS4.DS4





**Figure 2-2. Typical Rack Configuration**



**Figure 2-3. Typical Primary Rack Configuration**

## 2.6 INSTALLATION OF ASSEMBLIES IN EQUIPMENT RACK

Paragraph 2.6.1, Primary Rack Installation, provides step-by-step instructions for installing hardware assemblies, cables, wiring, etc. Since the installation instructions for the two rack configurations are similar, paragraph 2.6.2 covers only the differences between installation of the expansion rack and the primary rack and references paragraph 2.6.1 for installation procedures.

### 2.6.1 Primary Rack Installation

For installation sites that do not provide an external +24V power source, an optional internal +24V Power Supply, part number 8303743G1, must be installed in the primary rack. Paragraph 2.6.1.1 gives the instructions for modifying the rack to install the +24V Power Supply. If the installation site provides +24V power, proceed to paragraph 2.6.1.3.

#### 2.6.1.1 *Rack Modification for +24V Power Supply Installation*

Table 2-3 lists the parts required for the rack conversion.

**Table 2-3. Power Supply Assembly Installation Parts**

Item	Part Number	Quantity
24 Vdc Power Supply	8303743G1	1
Cable Assembly +24 Vdc Pwr Supply Out	8331058G1	1
Cable Assembly Power Supply (AC In)	8303740G1	1
Filler Panel (1U)	FP19-1.85 Black	1

- a. Remove and store the two uppermost blank panels located on the front of the equipment rack.
- b. Remove and store the top pair of angle brackets within the rack using a 3/8 inch wrench.
- c. Remove and store the four adjustable clamps located within the vertical channels

**NOTE**

The blank panels, angle brackets, and adjustable clamps should be retained at the installation site. The parts will be needed to reconvert the rack for +24V external power input. The angle brackets will be needed for the two previously unavailable HIC positions.

- d. Loosen the four bolts holding the second pair of angle brackets sufficiently enough to move the brackets.
- e. Align the top of the loosened brackets to the top of the highest remaining blank panel.
- f. Level the brackets using a tape measure, ensuring the distance from the front of the bracket to the next lowest bracket is the same as the rear.

- g. Tighten the bolts on the two brackets.
- h. Add the FP19-1.85B Black filler panel to the rack at the location just below the ISOBAR® Surge Suppressor.
- i. Secure the panel using two 10-32 x 0.50 screws and washers.
- j. Connect the external grounding cable to either the left or right chassis ground stud located on the primary rack rear deck.

**2.6.1.2 +24V Power Supply Installation (8303743G1)**

- a. Loosen the two screws and washers that secure Plexiglas protector over power input terminal board.
- b. Connect Power Supply Input Cable 8303740G1 to the terminal block located at the rear of the power supply as follows:
  - Black wire to the Line AC input (L1) of the terminal block.
  - White wire to the Neutral AC input (L2) of the terminal block.
  - Green wire to the GND input of the terminal block.
- c. Install Plexiglas protector over power input terminal board and secure with the two screws and washers.
- d. Loosen the two screws and washers that secure Plexiglas protector over V1 (+) and (-) terminals; remove the protector.
- e. Connect Power Supply Output Cable 8331058G1 to the V1 (+) and (-) terminals using the provided 1/4 inch hardware. Verify the polarity of the wires before connecting.
- f. Install Plexiglas protector over V1 (+) and (-) input terminal board and secure with the two screws and washers.
- g. Position and install the +24V Power Supply into the rack on the angle brackets just below the ISOBAR® Surge Suppressor. Adjust the angle brackets if necessary, and tighten the bolts securing the brackets.
- h. Secure the +24V Power Supply to the rack using four 10-32 x 0.50 screws and washers.
- i. Plug the 3-prong Power Supply Input Cable connector into one of the white ISOBAR® Surge Suppressor (75 dB) outlets.
- j. Do not connect the +24V Power Supply output to the bus bar at this time.

### 2.6.1.3 Headend Control Unit (HECU) Installation

#### NOTE

The keyboard slides, both the fixed rack half and the sliding keyboard tray half, are installed in the rack at the contractor's facility. As part of the HECU installation, the sliding keyboard section of the slides will be removed from the rack and installed on the keyboard tray.

#### 2.6.1.3.1 Keyboard Tray Slide Installation

- a. Remove the eight screws and washers securing the blank panel covering the location for the HECU Monitor (see Figure 2-2). Remove and store the blank panel and the hardware.
- b. Remove the four screws and washers securing the blank panel covering the location for the HECU Computer (see Figure 2-2). Remove and store the blank panel. Save the hardware to use later.
- c. Remove the two 10-32 x 0.50 screws and washers securing the blank panel covering the location for the keyboard tray (see Figure 2-2). Remove and store the blank panel.
- d. Remove the locking pin which secures the Cable Retractor to the left side sliding section of the slide to free the slide from the retractor.
- e. Remove the sliding section from the right side rack slide.
- f. Remove the keyboard tray from its packing carton, locate the bag of mounting hardware containing the ten 10-32 x 50 screws.
- g. Attach the right slide to the right side of the keyboard tray using five of the 10-32 screws. Locate as shown in Figure 2-4.
- h. Remove the sliding section from the left side rack slide.
- i. Attach the left slide to the left side of the keyboard tray using five of the 10-32 screws. Locate as shown in Figure 2-4.
- j. Clean the rear section of the left slide at the location of the adhesive-backed cable tie mount with isopropyl alcohol as shown on Figure 2-4.
- k. When the area is clean and dry, attach the ABMM-AT-C cable tie mount to the slide.
- l. Insert the sliding keyboard tray into the mounting rails attached to the rack until it stops. At this time, do not press the buttons on the slides that allow the keyboard tray to move to the fully closed position.
- m. Reattach the locking pin that secures the cable retractor to the left side sliding section of the slide.
- n. Press the buttons on the slides, and slide the keyboard tray into the rack until it reaches the fully closed position.

- o. Ensure that the keyboard tray slides freely without excessive resistance. Adjust the slides if necessary.

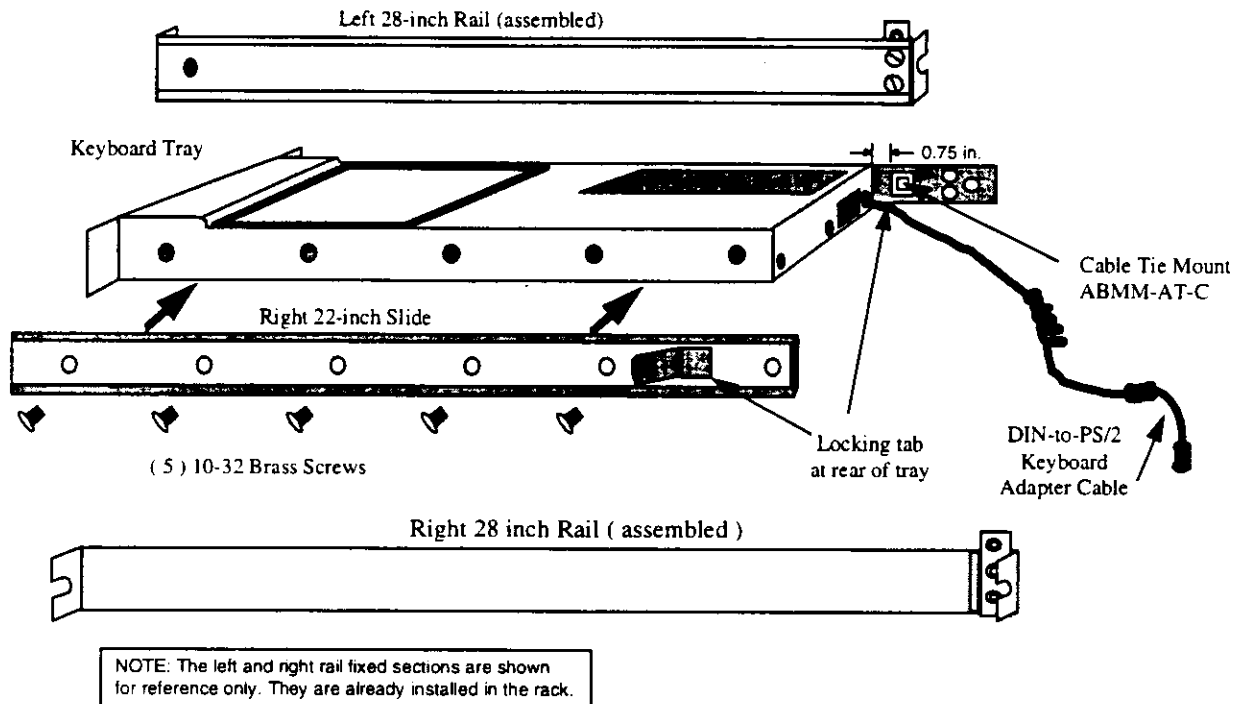
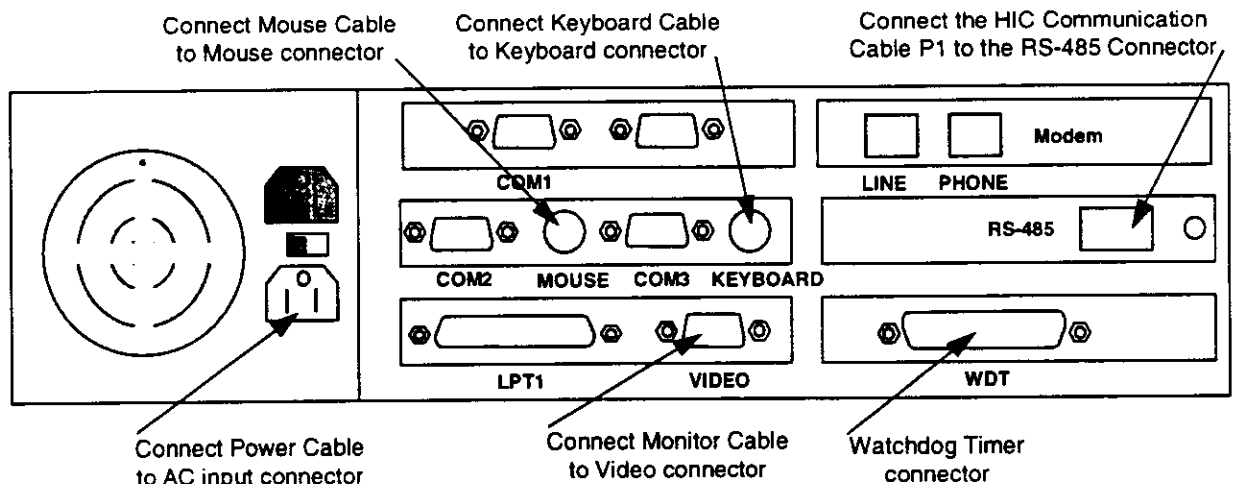


Figure 2-4. Keyboard Tray Assembly

#### 2.6.1.3.2 Installation of HECU Components

- a. At rear of rack, remove the 15 MHz Distribution Assembly. Set aside the assembly and attaching hardware for reinstallation after all other rack-mounted assemblies are installed.
- b. Locate the HECU mouse packed with the HECU Software.
- c. Set the mouse on the mouse pad. Pass the cable for the mouse through the opening in the pocket of the keyboard tray. Leave 12 inches of cable between the mouse and the pocket opening.
- d. Secure both the mouse cable and the keyboard cable to the cable tie mount on the rear of the left slide, using a short cable tie.
- e. Secure both the mouse cord and the keyboard cable along the length of the cable retractor using six short cable ties. Do not stretch the keyboard cable coils out.
- f. Locate the two HECU rack mounting brackets, packed with the HECU software.

- g. Remove the hardware from the bracket mounting holes on the left and right sides toward the front of the computer.
- h. Using the hardware removed above, attach the two brackets to the chassis and tighten.
- i. Insert the computer into the rack at the location specified in Figure 2-3.
- j. Slide the computer on the angle rails and bolt the computer to the rack using four 10-32 x .50 mounting screws and washers; tighten the screws.
- k. Connect the keyboard cable to the Keyboard connector on the rear of the HECU Computer. See Figure 2-5.
- l. Connect the mouse cable to the Mouse connector on the rear of the HECU Computer. See Figure 2-5.
- m. Using the long tie wraps, bundle any excess mouse and keyboard cable and attach it to the rear vertical mounting strips in the area of the cable retractor mounting bracket.
- n. While supporting the front and back of the monitor, carefully insert the monitor into the front of the rack at the location shown in Figure 2-3.
- o. Bolt the HECU monitor to the rack using the eight mounting screws and washers supplied with the monitor.
- p. Connect the HECU monitor video cable to the Video connector on the rear of the HECU Computer. See Figure 2-5.



**Figure 2-5. HECU Computer Rear View**

#### 2.6.1.4 Power Wiring Installation

The rack prime power is 115V, single phase, 60 Hz and +24V. The 115V interface is an AC power cord originating from the Tripp Lite ISOBAR® Surge Suppressor. The DC power interface is the terminal block located on the Prime Power Assembly. The Prime Power Assembly connects to the Busbar Assembly using five +24V wires and five return (RTN) wires. All rack equipment receives power directly from the busbar, except for the HECU computer and monitor.

The Busbar Assembly consists of four copper busbars encased in a plastic shield which protects the user from electrical shock, but allows FASTON® connectors to be connected to the busbars. The busbars are attached to the rack by three busbar mounting brackets. The brackets marked as PEGND (Protective Earth Ground), +24V, and RTN. Note the orientation in Figure 2-6.

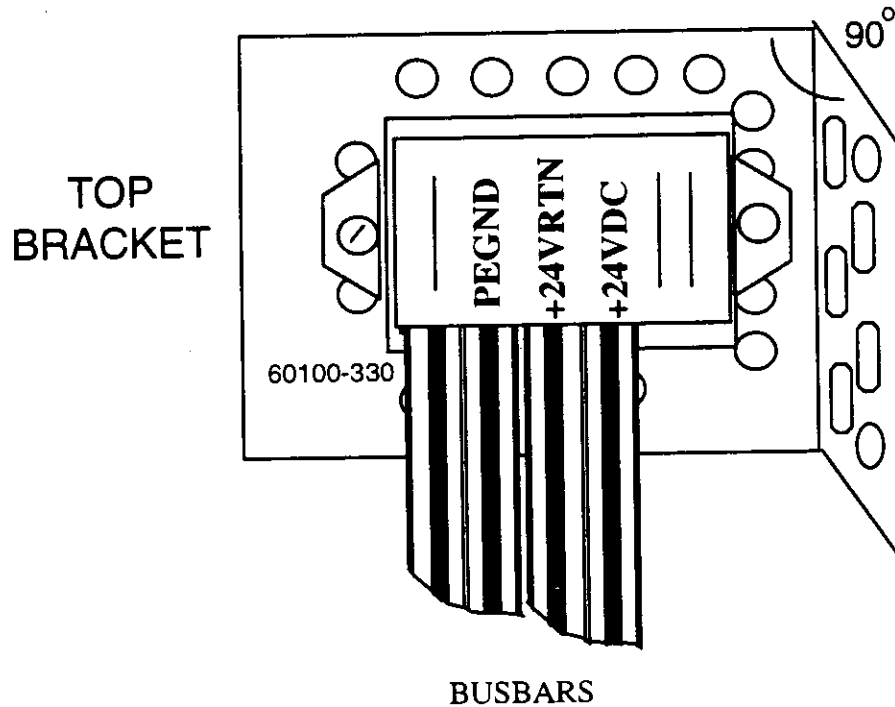


Figure 2-6. Prime Power Bracket

#### 2.6.1.4.1 115 Vac Prime Power Wiring Installation

**NOTE**

In this procedure, some slack is intentionally left in all cables attached to the ISOBAR® Surge Suppressor. The slack allows for removal of the ISOBAR® Surge Suppressor through the front of the rack in the event of its failure.

- Route the ISOBAR® Surge Suppressor AC Input cord, along the right upper side of the rack, above both angle bracket vertical support rails, and out the rear of the rack as shown in Figure 2-7.
- Secure the cord to the rear vertical mounting strip as shown in Figure 2-7, using two short cable clamps and two 10-32 x 0.50 screws and washers.

- c. If the site installation allows, use three additional cable clamps equally spaced to secure the AC Input cord down the remaining length of the vertical mounting strip to exit the rack at the bottom.
- d. Attach both the computer power cord and the monitor power cord to the right side angle bracket vertical support rail as shown in Figure 2-7, using a long cable tie.

**Note**

Both power cords are routed under the horizontal angle brackets. There should be 21 to 22 inches of free power cord beyond the attachment point.

- e. Plug the computer power cord 3-prong connector into one of the ISOBAR® Surge Suppressor black (40 dB) outlets.
- f. Plug the monitor power cord 3-prong connector into one of the ISOBAR® Surge Suppressor black (40 dB) outlets.
- g. Route the monitor and computer power cords down along the side of the rack as shown in Figure 2-7. Secure the two cords to the right rear side angle bracket vertical support rail using two additional long cable ties.
- h. Connect the monitor power cord to the monitor AC input. Any excess cord should be bundled and tied with a long cable tie close to the monitor.
- i. Connect the computer power cord to the computer AC input. Any excess cord should be bundled and tied with a long cable tie close to the computer.

**2.6.1.4.2 +24V Prime Power Installation**

The +24V interface for the rack 8303703G1 is a terminal block located within the Prime Power Panel on the upper rear of the rack. See Figure 2-8. The terminal block will accept two power cables, (+24V and +24V RTN) and distribute the power to the rack busbars. Wire sizes accepted by the terminal block range from AWG #14 to AWG # 4. **The rack must be properly grounded before any connection is made to prime power.** Two 1/4 in. x 20 grounding studs located on the left and right rear floor of the rack provide the interface to the Protective Earth ground at the installation site.



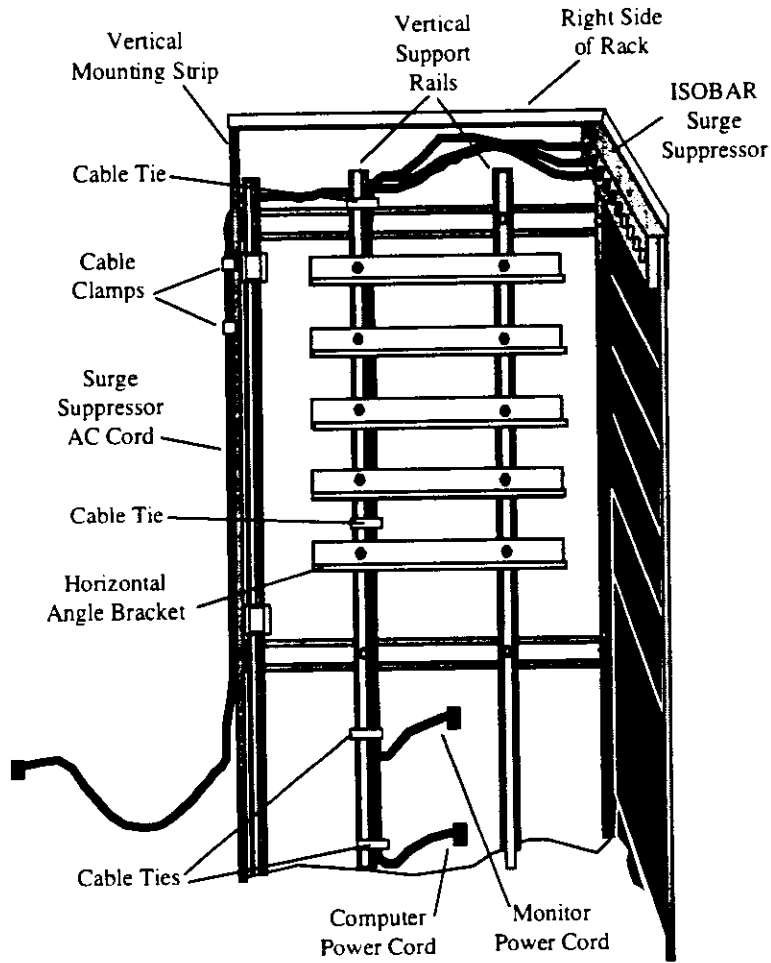


Figure 2-7. Primary Rack Rear Panel

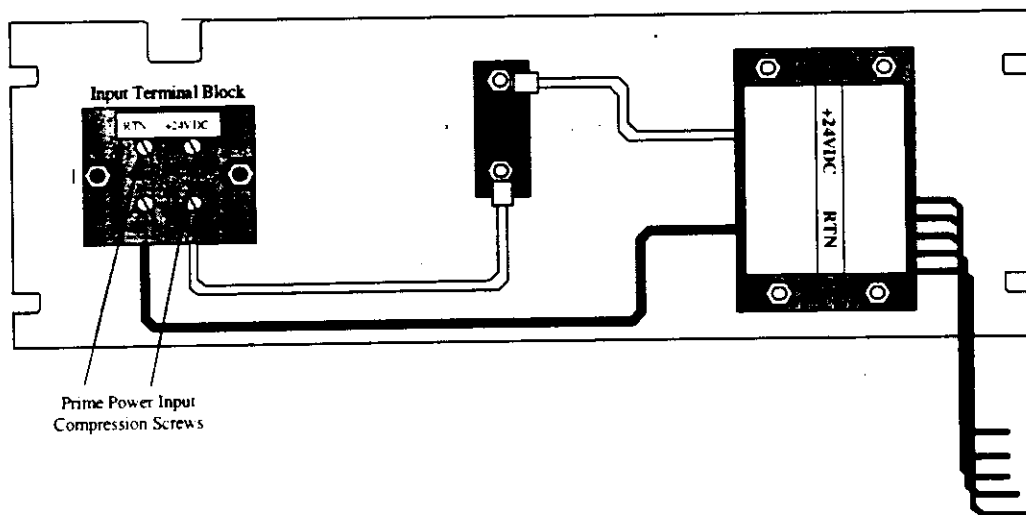


Figure 2-8. Prime Power Panel Inside View

**WARNING**

External +24V power is generated by battery and is capable of high current output. To prevent bodily injury, use extreme care handling +24V power lines.

- a. Ensure external +24V power is off before connecting power to rack.
- b. Remove and store the four screws securing prime power panel to the upper rear of the rack. The panel will still be attached to the rack by the busbar input wires.
- c. Carefully tilt the panel backwards to gain access to the +24V input terminal block on the inside of the panel.
- d. The +24V terminal block secures the wire by means of a compression screw within each section. Back off the two screws on the input section of the terminal block using a flat blade screwdriver.

**NOTE**

For racks using the +24V Power Supply, use the power supply output cable 8331058G1 in place of the on-site external +24V power cabling.

- e. It is highly recommended that the wires, when stripped, be crimped into ferules before inserting into the terminal blocks. The gauge of the wire determines the correct ferule size.
- f. Insert the ferruled ends of the prime power cables into the input section of the terminal block. Verify that the polarity matches the label on the terminal block.
- g. Tighten the compression screws on the terminal block to 35 in-lb.
- h. Inspect the connection to verify that no bare wire is exposed beyond the terminal block.
- i. Carefully tug on the prime power cables while holding the panel. Verify that the cables do not slip out of the terminal block.
- j. Replace the panel to its original position on the rack and ensure power switch is OFF.
- k. Bolt the panel to the rack using the four original screws and washers.
- l. Verify that all wires connecting the Prime Power panel to the busbar are secure. Reattach if necessary.

**2.6.1.5 Initial Prime Power Test**

This test requires a multimeter capable of measuring +24V, and associated test probes. The +24V prime power at the site (if available) should be turned on at this time.

- a. Set the +24V busbar power circuit breaker to OFF.
- b. Set the switch on the ISOBAR® Surge Suppressor to OFF.
- c. Set the power switches on the computer and monitor to OFF.

- d. Plug the ISOBAR® Surge Suppressor power cord into a 115 Vac 60 Hz outlet.
- e. Set the ISOBAR® Surge Suppressor switch to ON.
- f. Set the +24V Power Supply switch to ON, if installed.
- g. Switch the +24V busbar power circuit breaker to ON.
- h. Using the multimeter, measure and record the busbar voltage. (The Rack/HIC data sheet at the end of this manual may be reproduced and used for recording.) Verify that the voltage is between 20 and 28 Vdc and that the polarity matches the labels on the busbar mounting brackets.
- i. Switch the +24V busbar power circuit breaker to OFF.
- j. Using the multimeter, verify that there is no power at the busbars.

#### **2.6.1.6 Initial HECU Test**

- a. At the HECU front panel, open door for access to the monitor. Turn on the monitor and observe that the power indicator lights.
- b. Turn on the computer and observe the power indicator lights.
- c. The computer should boot up within 45 seconds, observe that the monitor displays a Windows™ menu.
- d. Pull out the keyboard tray. Move the mouse to verify control over the cursor.
- e. Set the ISOBAR® Surge Suppressor switch to OFF.

#### **2.6.1.7 Headend Interface Converter (HIC) Installation**

##### **NOTE**

It is highly recommended that the HICs be installed into the rack in the following order so that the rack does not become top-heavy and unstable:

- The first HIC should be located in the slot immediately below the keyboard.
- HICs 2 through 9 should be installed serially below the first so that HIC 9 is at the bottom of the rack.
- HIC 10 should be installed in the slot immediately above the monitor.
- HICs 11 through 14 should be installed serially above the HIC 10 so that HIC 14 is at the top of the rack.

- a. Remove and store the blank panels on the front of the rack at the locations where HICs will be installed. Save the screws and washers for reuse.
- b. Install the HICs into the rack by sliding them onto the angle brackets and securing them with the screws and washers that were used to secure the blank panels.
- c. Locate the HIC PEGND cable 8331052G1 for the first HIC.

- d. Connect the FASTON® connector of HIC PEGND cable to the busbar marked PEGND at a location parallel to the HIC ground stud.
- e. Loosen and remove the wing nut and washers from the HIC ground stud (see Figure 2-9).
- f. Connect the green ground wire of HIC Power Cable 8332632G1 (Figure 2-10) to HIC by sliding ring terminal onto the HIC PE ground stud. Slide ring terminal of additional ground cable 8331052G1 onto HIC PE ground stud. Secure with washers and wing nut.
- g. Repeat steps *a* through *f* for the remaining HICs.
- h. Locate HIC Power Cable 8332632G1 for the first HIC.
- i. Connect the FASTON® connectors of the cable to the busbars marked +24 Vdc and RTN at a location parallel to the HIC PWR connector. Verify the polarity of the cables before inserting them into the busbar.
- j. Plug the mating connector of the power cable into the HICs PWR connector.
- k. Repeat steps *i* and *j* for remaining HICs.

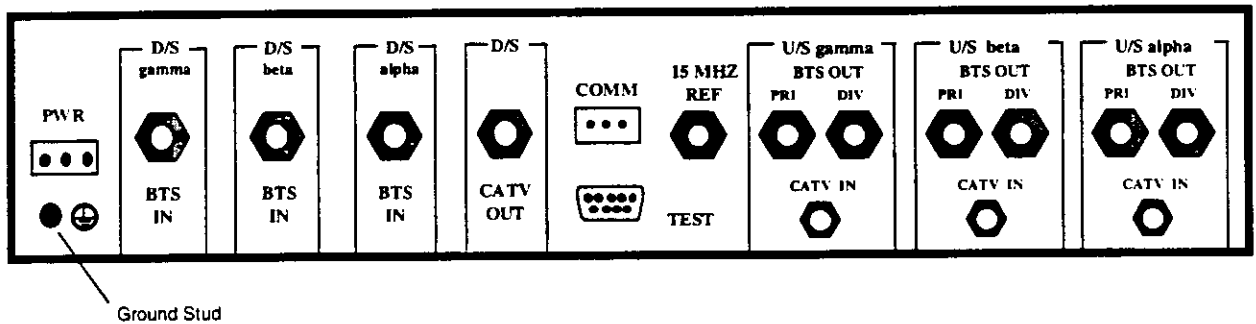


Figure 2-9. HIC Rear Panel

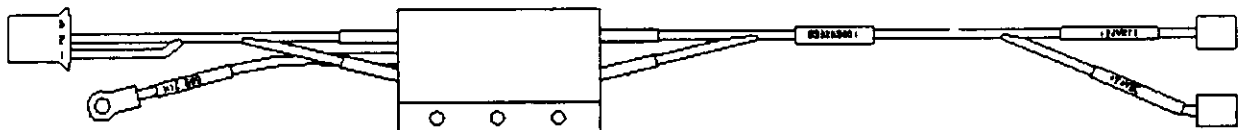
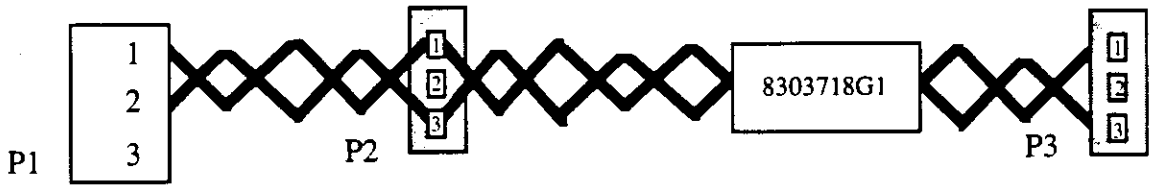


Figure 2-10. HIC Power Cable 8332632G1

### 2.6.1.8 Digital Communications Wiring Installation

The HIC communicates with the computer via an RS-485 interface using a LonWorks® protocol. The RS-485 interface uses twisted pair 22 gauge wire, beginning at the computer and connecting serially to the upper and lower HIC modules. Both ends of the line are terminated with a 120-ohm resistor assembly (8302374G1).

- a. Mate connector P1 of HIC Communication Cable 8303718G1 (Figure 2-11) to the RS-485 port on the computer rear panel.



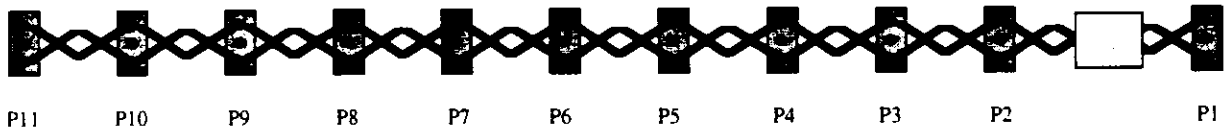
**Figure 2-11. HIC Communication Cable 8303718G1**

- b. Connect P3 of the 8303718G1 cable to P1 of the Lower Communication harness 8303735G1 (Figure 2-12).

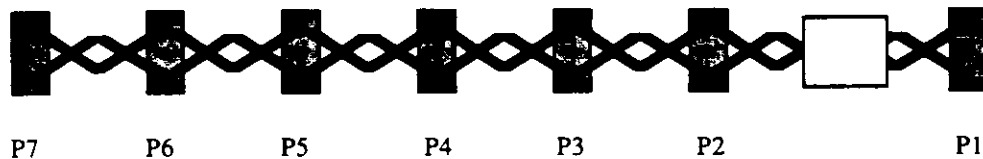
**NOTE**

Installations consisting of nine HICs or less do not require any HICs in the upper section of the rack. The Upper Communication cable should be removed and a 8302374G1 termination connected to P2 of the 8303718G1 cable assembly.

- c. If needed, connect P2 of the 8303718G1 cable to P1 of the Upper Communication harness 8303716G1 (Figure 2-13). Otherwise, connect a 8302374G1 termination to P2 of the 8303718G1 cable assembly.
- d. Attach one of the 8302374G1 termination assemblies to the connector following the last HIC installed within the rack. For example, an installation consisting of six HICs would require the termination to be placed at the seventh slot (P8 ) on the lower communication harness.



**Figure 2-12. Lower Communication harness 8303735G1**



**Figure 2-13. Upper Communication harness 8303716G1**

**2.6.1.9 15 MHz Distribution Assembly Installation**

- a. Position 15 MHz Distribution Assembly directly behind monitor and secure to rack with attaching hardware previously removed.
- b. Before connecting the 15 MHz Distribution Assembly power wires to the busbar assembly, verify the polarity of the FASTON® connectors.
- c. Starting with the PEGND connector, connect the three FASTON® connectors to the busbar assembly.

**2.6.1.10 15-MHz Cabling from Distribution Assembly to HICs**

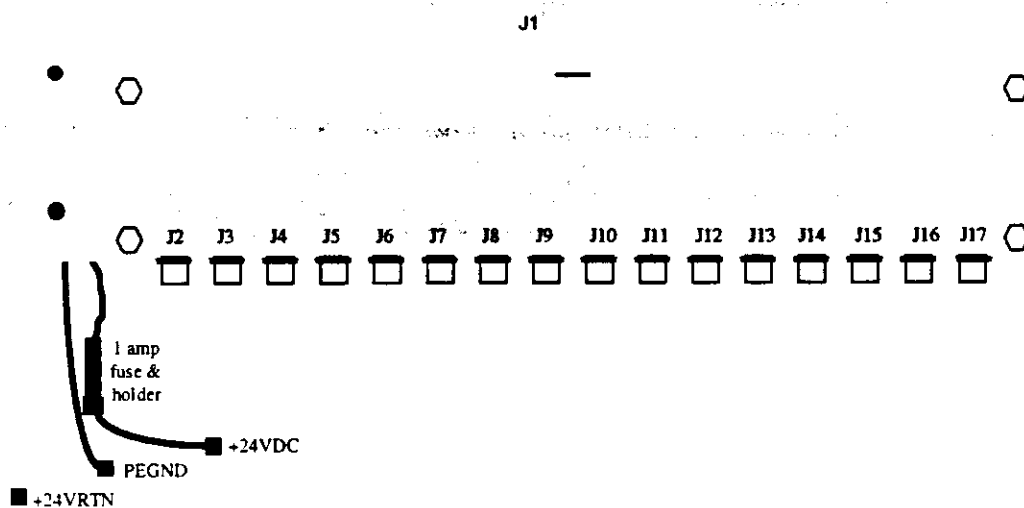
One five-foot 15-MHz Reference Cable assembly (8303717G1) is provided with each HIC. Refer to Figure 2-14 for the following procedure.

- a. Remove and save the 50-ohm termination from the appropriate output of the 15 MHz Distribution Amplifier. See the Note below.

**NOTE**

Although all sixteen outputs of the 15 MHz Distribution Assembly are identical, to simplify future troubleshooting the cabling must be consistent from unit to unit. Therefore, when connecting the cables between the HIC and the Distribution Assembly, the HIC on Shelf 1 (the top shelf) should connect to Distribution Assembly J2 (the leftmost connector when viewed from the rear), Shelf 2 should connect to J3, and so on down to J15 for Shelf 14.

- b. Connect a 15 MHz Reference Cable between the 15 MHZ REF input on the HIC rear panel and the appropriate output of the 15 MHz Distribution Assembly.
- c. Repeat for all installed HICs.



**Figure 2-14. 15 MHz Distribution Assembly Connector Designations**

### **2.6.1.11 System Tests**

#### **2.6.1.11.1 Initial Turn-on**

- a. Verify that the power switches on all the HICs, the computer, and the monitor are OFF.
- b. Verify that the +24 VDC BUSBAR PWR circuit breaker is set to OFF.
- c. Set the ISOBAR® Surge Suppressor switch to ON and observe that the red power indicator lights.
- d. If installed, set the +24V Power Supply power switch to ON and observe that DS1 indicator is ON. Ensure the power supply indicates +24V on the meter.

#### **2.6.1.11.2 HIC Initial Communication Test**

- a. Switch the +24 VDC BUSBAR POWER circuit breaker to ON.
- b. Set the first HIC front panel PWR switch to 1 (on) and verify that the front panel green PWR indicator is on.
- c. Observe the three HIC front panel LEDs, verify that they blink and go out. Normal indications for these LEDs are as follows:
  - ID Lights to identify selected HIC
  - FAULT Lights to indicate a operational fault in the HIC.
  - COMM Flashes to indicate communications between HIC and CMI. If indicator is always on, this indicates a probable fault in the HIC.
- d. Repeat steps *b* and *c* for the remaining installed HICs.
- e. Set the HIC front panel PWR switch to 0 (off) on all HICs.
- f. Switch the +24 VDC BUSBAR POWER circuit breaker to OFF.
- g. Turn OFF both the computer and the monitor.
- h. Turn OFF the ISOBAR® power switch.

### **2.6.2 Expansion Rack Installation**

An expansion rack may be used in conjunction with the primary rack. The expansion rack houses and provides the site with additional HIC units. The major difference between the primary and expansion rack is that the expansion rack does not contain an HECU and certain cable assemblies. Therefore, the expansion rack must interface with a primary rack for operation.

The rack installation procedures in the previous are applicable to the expansion rack configuration as well, with few differences. Table 2-4 lists the installation procedures applicable to the expansion rack. Differences in the procedure that affect expansion rack installation are identified in the comment column.

**Table 2-4. Expansion Rack Installation**

Procedure	Paragraph	Comments
Rack Modification for +24V Power Supply Installation	2.6.1.1	Optional
+24V Power Supply Installation	2.6.1.2	Optional
Power Wiring Installation	2.6.1.4	
115 Vac Prime Power Installation	2.6.1.4.1	
+24V Prime Power Installation	2.6.1.4.2	
Initial Prime Power Test	2.6.1.5	
15 MHz Distribution Assembly Power Connection	2.6.1.9	
Headend Interface Converter Installation	2.6.1.7	
Digital Communications Wiring Installation	2.6.1.8	Use Lower Communication Expansion Harness 8331059G1 instead of Lower Communication Harness 8303735G1. Also see paragraph 2.7.2.
15-MHz Cabling from Distribution Assembly to HICs	2.6.1.10	Also see paragraph 2.7.2.
HIC Initial Communications Test	2.6.1.11.2	

## 2.7 HEE CABLE INSTALLATION

With the exception of the primary and expansion rack interface cables, external HIC interface cables are not provided with the racks or HICs. The cables are provided locally by the user at the installation site. For the HEE primary and expansion racks, the user must provide 13 cables for each HIC installed in the rack. Four cables interface the HIC with the CATV Plant and nine cables interface the HIC with the Base Transceiver Station (BTS). Figure 2-15 shows the RF cable interconnection between a single installed HIC and the CATV Plant/BTS.

### 2.7.1 15 MHz Reference from BTS

The BTS provides the 15-MHz reference signal input to the 15 MHz Distribution Assembly in the primary rack. The reference signal is amplified and routed to all of the HICs installed in the primary rack, and to the expansion rack when used.

- a. Connect the RF cable to the 15-MHz output of the BTS and route the cable over to the vicinity of the 15 MHz Distribution Assembly in the HEE rack. Do not connect the cable at this time.
- b. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- c. Measure the power level at the output of the cable. Verify that the 15 MHz input level from the BTS is between 0 and -16 dBm at the J1 input to the 15 MHz Distribution Assembly.



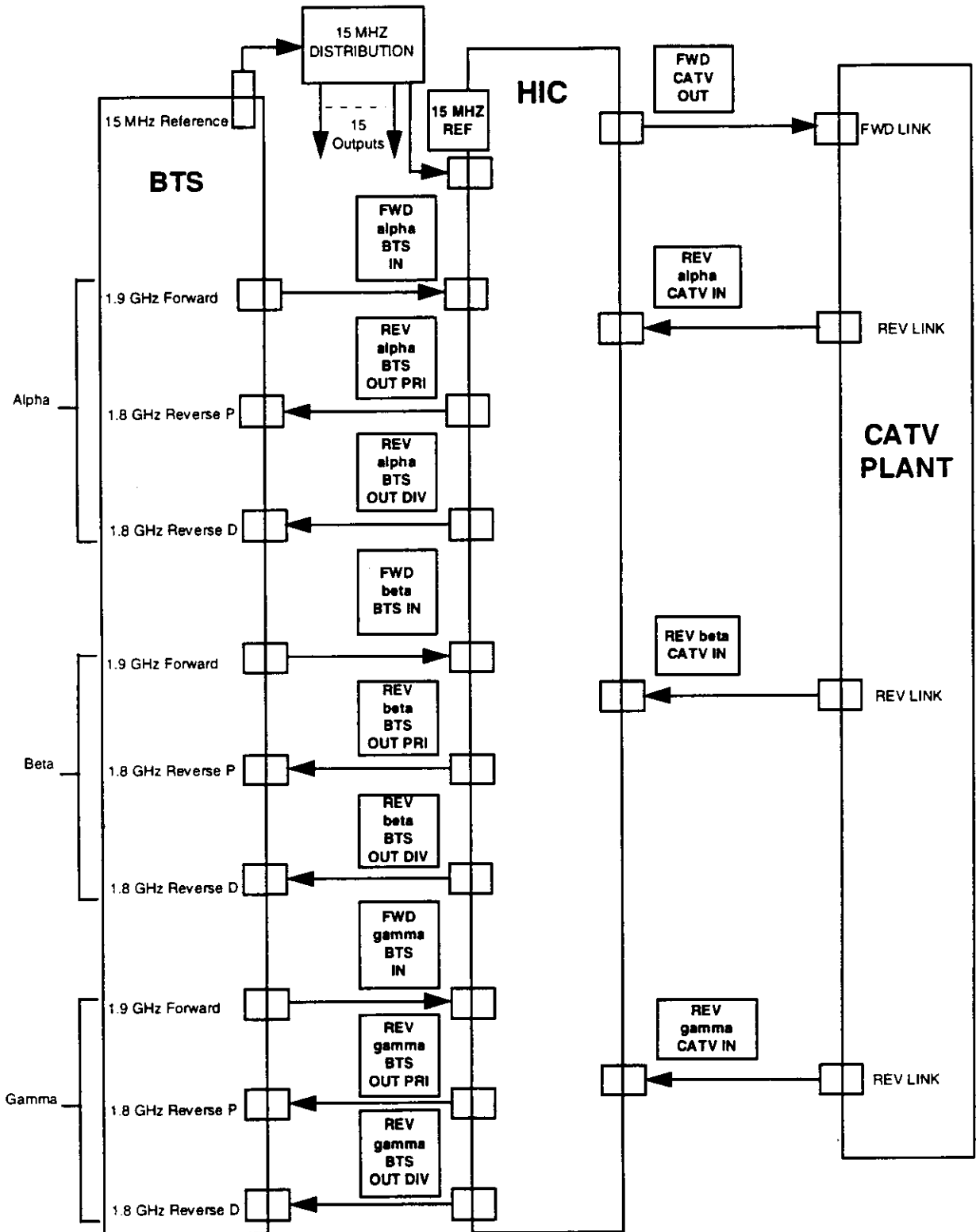


Figure 2-15. BTS/HECU/CATV Plant RF Cabling Diagram

- d. Record the measured power level. (The Rack/HIC data sheet at the end of this manual may be reproduced and used for recording.)
- e. Connect the cable to the J1 input (upper) port on the 15 MHz Distribution Assembly after the level has been verified and recorded.

### 2.7.2 Cable Installation between Primary and Expansion Racks

When the installation site uses both the primary and expansion racks, two interface cables are provided for the communications between the racks. The two cables are:

- Communication Extension Cable, part number 8331054G1
- 15 MHz Extension Cable, part number 8331053G1

These interface cables are approximately 10 feet long. The Communication Extension Cable can interface the primary and extension racks via either the upper or lower communication cable of the primary rack, depending on harness routing.

#### NOTE

Steps a – c assume cable harness routing is towards the overhead; therefore, the upper communication harness is used to interconnect the Communication Extension Cable, part number 8331054G1. If the cable harness routing is toward the deck, then the lower communication harness is used for the interconnection and upper communication harness for termination.

- a. Remove RS-485 termination from upper communication harness in the primary rack.
- b. Connect Communication Extension Cable, part number 8331054G1, between upper communication harness in each rack.
- c. Install previously removed RS-485 termination on lower communication harness in primary rack.
- d. At 15 MHz Distribution Assembly in primary rack, remove and store termination from the J17 output port. See Figure 2-14 for port location.
- e. Connect 15 MHz Extension Cable, part number 8331053G1, between 15 MHz Distribution Assembly J17 port in primary rack and 15 MHz Distribution Assembly input port in expansion rack.

### 2.7.3 Watchdog Timer Cable Installation

The HECU Computer is provided with a Watch Dog Timer Circuit Card capable of being connected to the BTS using a suitable twisted pair. The Characteristics of the interface are defined below:

- The Watchdog Timer provides a set of double-pole double-throw, Form C, relay contacts, allowing for the most flexibility when interconnecting to a BTS or other equipment.

- The Watchdog Timer output connector is a D Type, 25-pin female located on the HECU computer rear panel, labeled WDT (see Figure 2-5).
- Output pin assignments on the 25-pin connector are given in Table 2-5:

**Table 2-5. Watchdog Timer Output Pin Assignments**

Pin Number	Function
1	Common, Relay Pole 1
2	Normally Closed Contact, Pole 1
3	Normally Open Contact, Pole 1
14	Common, Relay Pole 2
15	Normally Closed Contact, Pole 2
16	Normally Open Contact, Pole 2

Refer to Watchdog Timer manufacturer's manual for further information:

Manufacturer	Industrial Computer Source
Model	WDT500-P
Manual Number	00650-132-2B

#### **2.7.4 Network Operation Control Center (NOCC) Interface**

The HECU computer has three serial ports for the remote user interface. The ports are located on the HECU computer rear panel (Figure 2-5):

- **Com1:** RS-232
  - Supports data rate of up to 9600 bps
  - Read Only Port (ROP)
  - All messages in ASCII text message format
  - Used to transmit alarms to the NOCC on an unsolicited basis
- **Com2:** RS-232
  - Supports data rate of up to 9600 bps
  - Read/Write Port (RWP)
  - All messages in ASCII text message format
  - Handles the remote operator interaction
  - Receives remote operator queries and control messages
  - Transmits status and statistics back to remote operator
- **Com2:** RS-232
  - Supports data rate of up to 9600 bps
  - General purpose port for remote graphical user interface

### 2.7.5 HECU Modem

The HECU Computer is provided with a internal modem which supports a data transmission rate of up to 28.8 Kbps. The Modem connector is located on the rear panel of the HECU computer (Figure 2-5).

### 2.7.6 Cable Installation Between HIC, BTS and Cable Plant

The following are recommended procedures for interconnecting the HICs with the BTS and the cable plant Headend.

#### **NOTE**

The cables needed for a full rack occupy a great deal of space and can interfere with normal equipment servicing by obscuring view and blocking access. As each HIC is installed, special care should be taken to bundle and route the cables in a manner that minimizes the space used.

#### 2.7.6.1 CDMA Forward Link Input from BTS

The BTS provides the CDMA forward link input signal to the installed HICs. Each installed HIC is divided into three sectors, designated alpha, beta, and gamma. The sectors operate independent of each other, communicating over separate cables with three BTS sectors, also designated alpha, beta, and gamma.

#### **CAUTION**

Because some BTS units are capable of generating an extremely high forward link power level, it is important to measure the forward link output of the BTS prior to connecting it to the HIC input.

- a. Connect a Forward link RF cable to the alpha sector (S1) Forward link CDMA output port of the BTS and route the cable over to the vicinity of the selected HIC in the HEE rack. Do not connect the cable at this time.
- b. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- c. Using a spectrum analyzer, measure the power level at the output of the cable. Verify that the CDMA Forward link input level from the Alpha sector of the BTS is between +3 dBm and -9 dBm (Pilot only) at the input to the HIC in the HEE rack. (CDMA levels are to be measured in a 1.23-MHz bandwidth.)
- d. After the level has been verified, connect the Forward link cable between the BTS alpha sector and the D/S alpha BTS IN port on the rear panel of the selected HIC (Figure 2-9).
- e. Repeat steps a through e for the beta and gamma sectors to complete one HIC/BTS pair. (The BTS beta sector is S2 and the gamma sector is S3.)

### 2.7.6.2 CDMA Reverse Link Output to BTS

The HIC provides the CDMA Reverse link input signals to the BTS. Each HIC provides a pair of reverse link signals for each sector, designated PRI (Primary) and DIV (Diversity).

- a. Connect an Reverse link RF cable to the alpha sector Reverse link Primary (Rx - S1D0) input port of the BTS and route the cable over to the selected HIC in the HEE rack.
- b. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- c. Connect the cable to the U/S alpha BTS OUT PRI port on the rear panel of the selected HIC (Figure 2-9).
- d. Connect an Reverse link RF cable to the alpha sector Reverse link Diversity (Rx - S1D1) input port of the BTS and route the cable over to the selected HIC.
- e. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- f. Connect the cable to the U/S alpha BTS OUT DIV port on the rear panel of the selected HIC.
- g. Repeat steps *a* through *f* for the beta sector of the HIC and the BTS, connecting to the S2D0 and S2D1 ports on the BTS.
- h. Repeat steps *a* through *f* for the gamma sector of the HIC and the BTS, connecting to the S3D0 and S3D1 ports on the BTS.

### 2.7.6.3 CATV Forward Link Output to Headend

The HIC provides the CATV Forward link signal to the Headend. Each HIC provides a single Forward link signal, the combined output of all three sectors.

- a. Connect a Forward link CATV RF cable from the appropriate forward link device in the Headend; route the cable to the selected HIC in the HEE rack.
- b. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- c. Connect the cable to the D/S CATV OUT port on the rear panel of the selected HIC.

### 2.7.6.4 CATV Reverse Link Input from Headend

Each sector of the HIC receives an Reverse link CATV input signal from the Headend.

- a. Connect an Reverse link CATV RF cable from the appropriate alpha sector reverse link device in the Headend and route the cable to the selected HIC in the HEE rack.
- b. Secure the cable to the appropriate cable troughs to eliminate any strain on the cable connectors.
- c. Connect the cable to the U/S alpha CATV IN port on the rear panel of the selected HIC.
- d. Repeat steps *a* through *c* for the Reverse link CATV beta and gamma sectors.

**NOTE**

It is recommended that after the installation of each HIC, the installed HIC be electrically checked before proceeding to the next HIC installation. This would prevent disturbing the rear rack cable routing if the installed HIC were found faulty after all HICs had been installed.

- e. Continue on to paragraph 2.8 to verify the HIC installation before proceeding with the cabling for the next HIC installation.

## **2.8 INSTALLATION CHECKOUT - INITIAL TURN-ON**

This procedure provides a confidence check that the installed HIC is functioning properly in the rack and that all cables are connected properly.

**NOTE**

The CMI data sheet at the end of this manual may be reproduced and used for recording the measured levels specified in the following procedures.

- a. Verify that the power switches on all the HICs, the computer, and the monitor are OFF.
- b. Verify that the +24 VDC BUSBAR PWR circuit breaker is set to OFF.
- c. Set the ISOBAR® Surge Suppressor switch to ON.
- d. If installed, set the +24V Power Supply power switch to ON.
- e. Turn on the Computer and Monitor.
- f. Pull out the keyboard tray.
- g. Switch the +24 VDC BUSBAR POWER circuit breaker to ON.

### **2.8.1 HECU Setup for HIC Checkout**

- a. Using the mouse, select the HECU Control Panel icon in the CATV Program Group.
- b. Observe that the CONFIGURATION OPTIONS dialog (Figure 2-16) appears on the monitor.
- c. Select No to accept the default system configuration and display the HEADEND CONTROL PANEL dialog.
- d. Observe that the HEADEND CONTROL PANEL: USER dialog (Figure 2-17) appears on the monitor.
- e. At the HEADEND CONTROL PANEL: USER dialog, select **Privileges/Increase Privileges**. The HECU SYSTEM ACCESS dialog appears.
- f. Enter super-user password and click OK to return to HEADEND CONTROL PANEL: SUPER-USER dialog.

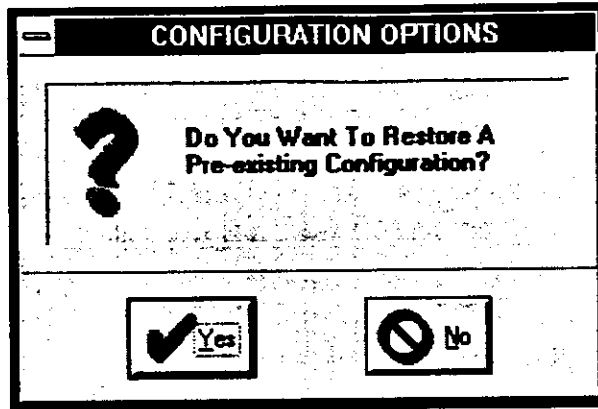


Figure 2-16. CONFIGURATION OPTIONS Dialog

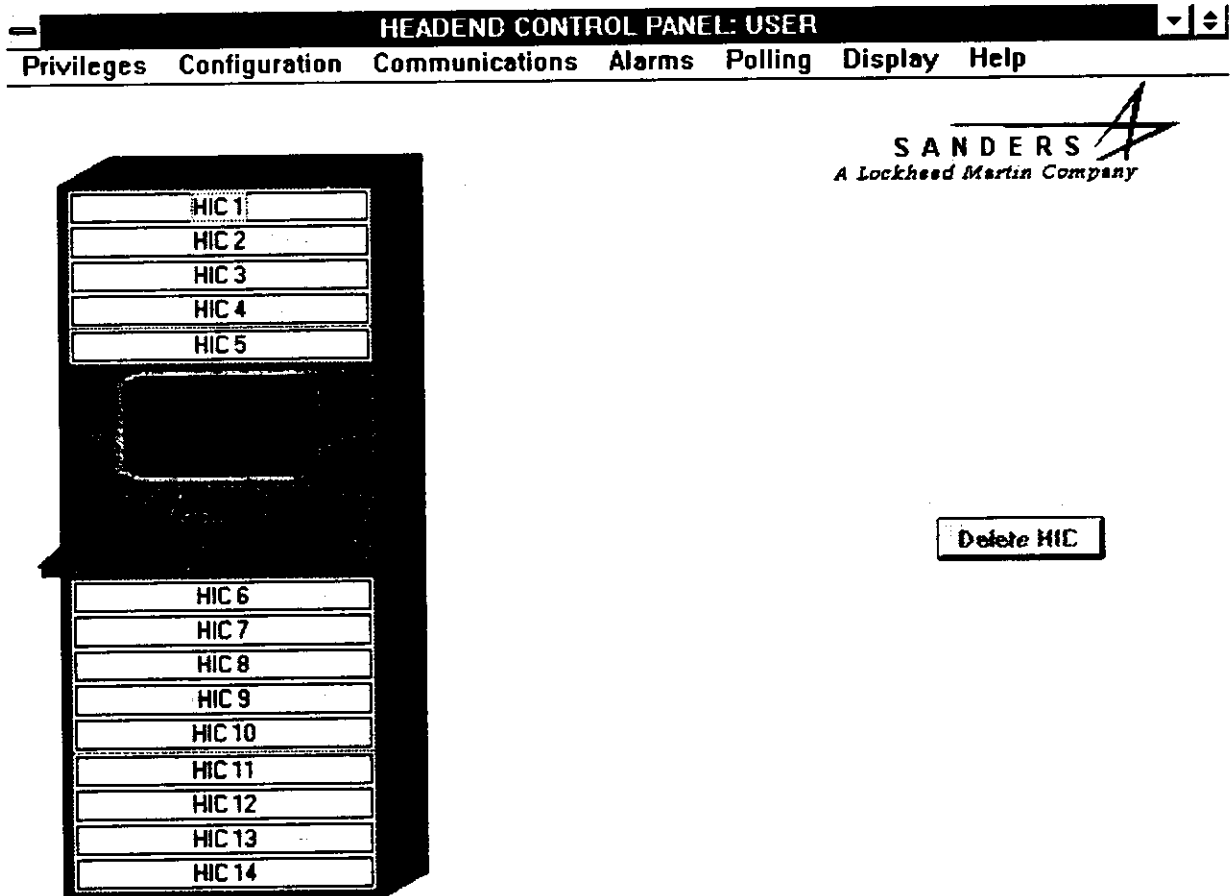


Figure 2-17. HEADEND CONTROL PANEL: USER Dialog

## 2.8.2 HIC Activation

This procedure, also referred to as *HIC acquisition*, adds the selected HIC to the database for monitoring and control by the HECU. The procedure also shows that the HIC and HECU are communicating and that all cable interconnections appear to be satisfactory.

- a. On the selected HIC, set the front panel power switch to on (1).
- b. Observe that the PWR indicator is lit and ID, FAULT, and COMM indicators are not lit.
- c. At the HEADEND CONTROL PANEL: SUPER-USER dialog, double-click on numbered panel representing desired HIC (HIC 1–HIC 14) in either the primary or expansion rack.
- d. Observe that the ADD HIC dialog (Figure 2-18) appears.
- e. Type in data in the following boxes (do not press ENTER):
  - *Enter Neuron ID* using 12 Hexadecimal characters (required data)
  - *Enter Cell ID* (reference data)
  - *Enter Serial Number* of the HIC (reference data)
- f. Type in *Upstream Frequencies* values for Alpha/Beta/Gamma sectors:
  - *Primary*: Range 6–41 MHz in 0.25 MHz steps
  - *Diversity*: Range 6–41 MHz in 0.25 MHz steps
- g. Type in *Downstream Channel* number: Range 62–94, 100–116.
- h. Select *Forward link Channel* mode: *STD*, *HRC*, or *IRC*.
- i. Type in desired *PCS Frequency*: Range 1930–1990 MHz in 0.05 MHz steps.
- j. Set the following options to the indicated position:
  - *Power Output* (Enable/Disable)
  - *Reference Tone* (Enable/Disable)
  - *Control Tone* (Enable/Disable)
  - *Reset* (Defaults/Last Values)
- k. Select OK to add the new HIC.
- l. Verify that the HEADEND CONTROL PANEL dialog appears, and that the numbered panel representing the added HIC appears in green.
- m. Observe that ID indicator blinks on the front panel of selected HIC.



**ADD HIC: PRIMARY RACK, HIC 1**

Parameter Ranges				
Upstream Frequencies: Range From 6 - 41 MHz in 0.25 MHz Steps				
Downstream Channel: Ranges From 62 - 94, 100 - 116				
PCS Frequency: Ranges From 1930 - 1945 MHz in 0.05 MHz Steps				

Upstream Frequencies			Downstream Channel	Reference Tone
Alpha	Beta	Gamma	100	<input type="checkbox"/> Enable <input checked="" type="checkbox"/> Disable
Primary	Primary	Primary	<input type="checkbox"/> STD <input checked="" type="checkbox"/> HRC <input type="checkbox"/> IRC	<input type="checkbox"/> Enable <input checked="" type="checkbox"/> Disable
16.00 MHz	20.00 MHz	24.00 MHz		
Diversity	Diversity	Diversity	PCS Frequency	<input type="checkbox"/> Reset <input checked="" type="checkbox"/> Defaults <input type="checkbox"/> Last Values
18.00 MHz	22.00 MHz	26.00 MHz	1937.50 MHz	

Enter Neuron ID	Enter Cell ID	Enter Serial Number
010010037000		

OK   
  Cancel   
  Help

Figure 2-18. Typical ADD HIC Dialog

### 2.8.3 HIC Integration with CATV Headend

**NOTE**

In order to complete the following HIC integration procedure, CATV Headend and BTS Technician on-site support is required.

The CMI data sheet at the end of this manual may be reproduced and used for recording the measured levels specified in the following procedures.

The procedures in this section provide the initial checks and adjustments needed to integrate an installed (acquired) HIC with the CATV headend in both Forward (Downstream) and Reverse (Upstream) directions. Figure 2-19 is provided for reference for the Forward link level check, and Figure 2-20 for the Reverse link level check. Cross reference tables for PCS channel to frequency and CATV channel to frequency are provided in Appendix A and Appendix B, respectively.

- a. At the HEADEND CONTROL PANEL: SUPER-USER dialog, double-click on desired installed HIC (green icon).
- b. Observe that the HIC CONTROL PANEL dialog appears (Figure 2-21).

**NOTE**

This procedure assumes all connections from the BTS and CATV Plant have been made and the external equipment RF signals and communication are functioning properly. If this is not the case, alarm surveillance messages may be present.

- c. Set the HIC CONTROL PANEL dialog controls as follows:
- *Downstream Channel* is set as needed by the user (STD, HRC, IRC, and channel values.)
  - Both *Reference Tone* and *Control Tone* enabled.

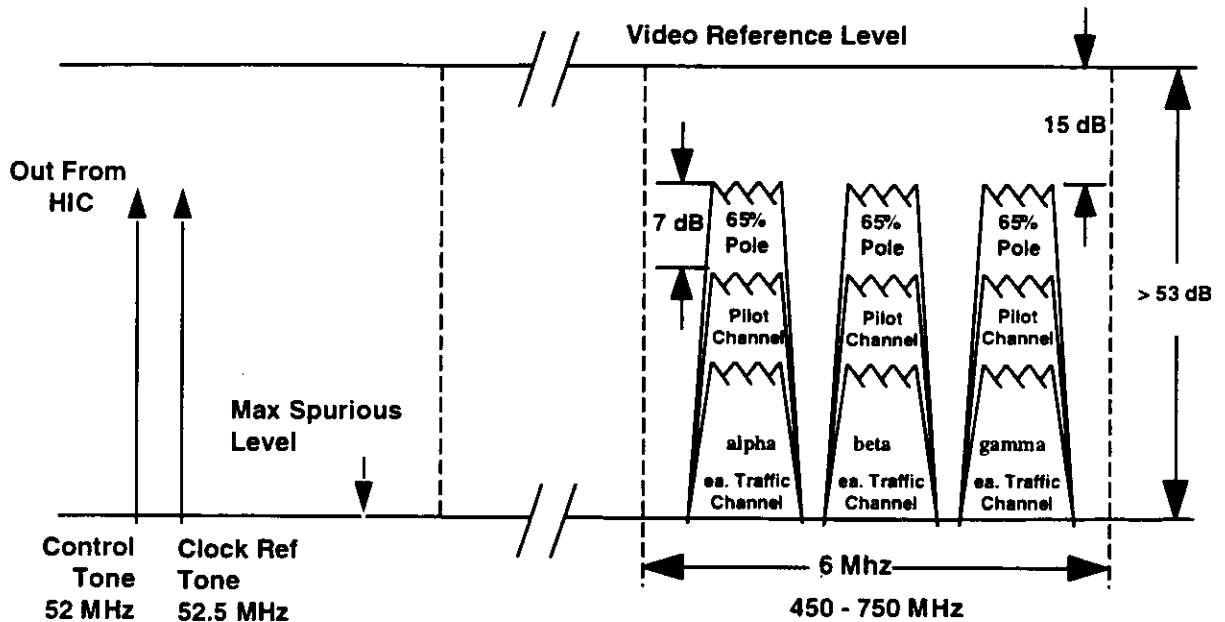


Figure 2-19. Typical Forward Link Levels

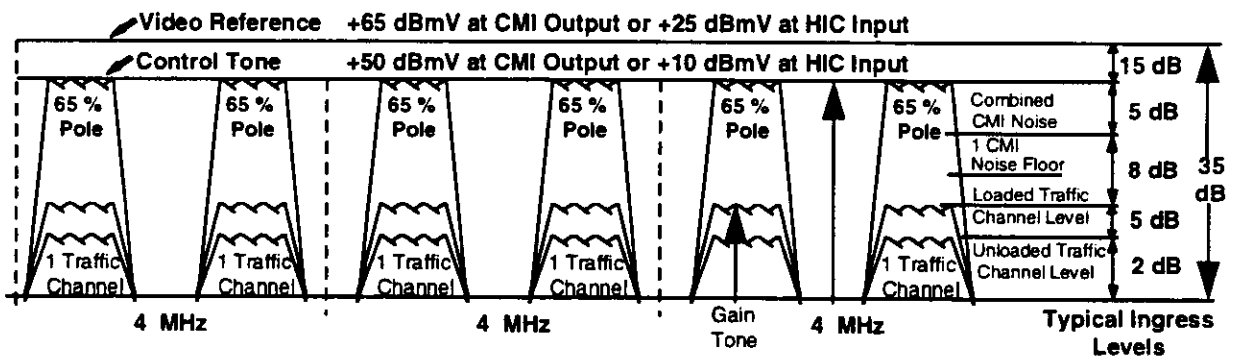


Figure 2-20. Typical Reverse Link Levels

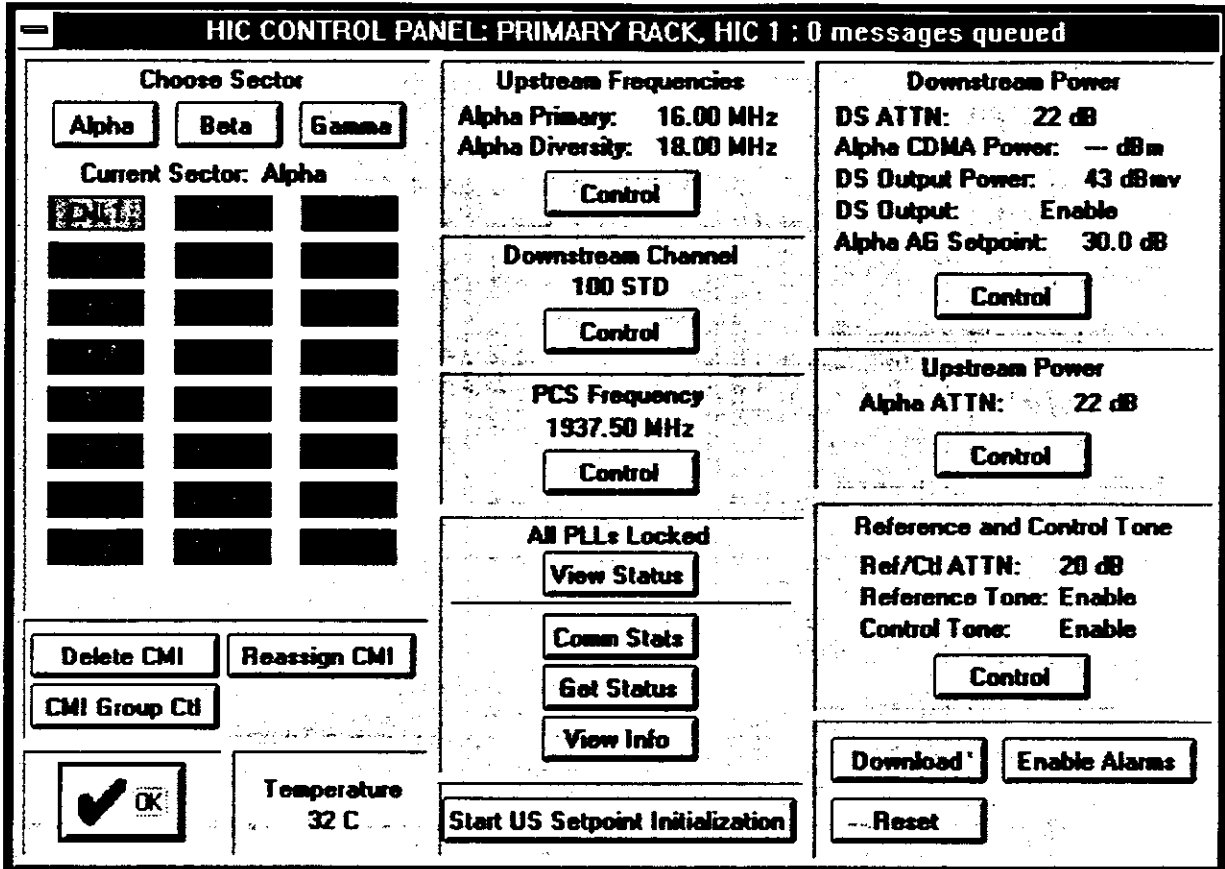


Figure 2-21. HIC CONTROL PANEL: Dialog

**2.8.3.1 HIC Forward Link CDMA Input Power**

The following procedure is used to measure the HIC forward link CDMA Input Power level.

- a. For the sector to be measured, connect the HIC downstream (forward link) CDMA input cable from the BTS to the Spectrum Analyzer input (50 Ω).
- b. Set the Spectrum Analyzer as follows:
  - Center Frequency: DS PCS Channel Frequency (PCS Ch. 250 = 1931.25 MHz)
  - Span: 6 MHz; 1.25 MHz (or 30 kHz RBW)
  - Scale: 2 dB/div
  - Input Impedance: 50 Ω
  - Units: dBm
  - Video Averaging: 100 Averages
- c. Measure the HIC CDMA input levels from the BTS using the display line after 100 averages. Ensure that the input levels are within specification:

**CDMA Carrier, 1.25 MHz RBW**

<u>65% Pole</u>	<u>Pilot Only</u>
Max.: +5.0 dBm	-2.0 dBm
Min.: -2.0 dBm	-9.0 dBm

**CDMA Carrier, 30 kHz RBW**

<u>65% Pole</u>	<u>Pilot Only</u>
Max.: -12.7 dBm	-19.7 dBm
Min.: -19.7 dBm	-26.7 dBm

- d. Record the measured level.
- e. Repeat the above steps for the remaining sectors.

**2.8.3.2 HIC Reverse Link Output to BTS**

- a. For the sector to be measured, disconnect the HIC BTS OUT PRI/DIV output cables from the HIC (if applicable).
- b. Disconnect the HIC CATV Input cable for the sector to be measured (if applicable).
- c. Connect a signal generator using a 75Ω cable to the HIC CATV input port of the sector to be measured. Set the signal generator as follows with the RF output DISABLED:
  - *Frequency:* CMI upstream Primary (or Diversity) pedestal center frequency for the sector being measured.
  - If measuring HIC upstream Primary BTS output, set to the CMI US Primary pedestal center frequency; if measuring HIC US Diversity BTS output, set to the CMI US Diversity pedestal center frequency.
  - *RF Output Power Level:* -38.75 dBm (+10 dBmV)
- d. Connect the Spectrum Analyzer to the HIC BTS OUT PRI/DIV output terminals using 50 Ω connectors, and set the Spectrum Analyzer as follows:
  - Center Frequency: US PCS CDMA Channel (Ch. 150 = 1857.5 MHz)
  - Scale: 2 dB/div
  - Span: 6 MHz
  - RBW: 1.25 MHz (or 30 kHz)
- e. Inject the CW signal into the HIC CATV IN port by enabling the RF output of the signal generator.
- f. Determine if the upstream output level of the CW signal is between -50 dBm to -60 dBm. Adjust the upstream attenuator of the HIC until the CW signal is -55 dBm ± 1 dB.

**2.8.3.3 HIC Reference and Control Tone Output**

This procedure measures and sets the Reference and Control Tone levels at the HIC DOWNSTREAM TEST POINT (20 dB down). At the REFERENCE AND CONTROL TONES dialog (Figure 2-22), set *Attenuator Setting* such that the power level is initially

+25 dBmV at the test point (+45 dBmV at the HIC D/S CATV OUT port). (Final adjustment of the Reference and Control Tone is 15 dB down from the video reference.)

- a. Connect a Spectrum Analyzer to the DOWNSTREAM TEST POINT (75 Ohm).
- b. Set Spectrum Analyzer as follows:
  - Center Frequency: 52 MHz
  - Scale: 10 dB/div
  - Span: 10 MHz
  - Peak Search or Set Marker to 52.5 MHz
- c. Determine HIC Reference and Control Tone Output Level and set to +25 dBmV at the DOWNSTREAM TEST POINT:
  - Maximum Output Level = + 30 dBmV
  - Minimum Output Level = + 20 dBmV
- d. Record the attenuator setting.

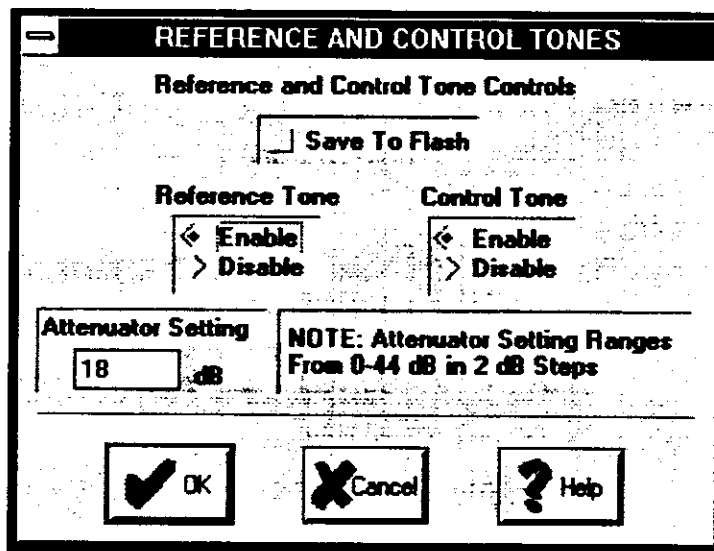


Figure 2-22. REFERENCE AND CONTROL TONES Dialog

#### 2.8.3.4 HIC Forward Link CDMA Pilot Level

Verify the CDMA Pilot Level at the HIC D/S CATV OUT port is between +13 to +23 dBmV.

#### NOTE

CDMA levels need to be measured in a 1.23-MHz Bandwidth, however a 30-kHz RBW can be used by adding a 16.1-dB correction factor to the measured level in order to obtain the actual level.

- a. Connect a Spectrum Analyzer to HIC DOWNSTREAM TEST POINT (75  $\Omega$ ).
- b. Set Spectrum Analyzer as follows:

- Center Frequency: DS CATV CDMA Channel (Refer to Appendix A)
  - Scale: 2 dB/div
  - Span: 6 MHz
  - RBW: 1.25 MHz (or 30 kHz)
- c. Adjust span and/or center frequency so that DS CDMA pedestals for all sectors can be seen.
- d. Measure HIC D/S CDMA output at HIC DOWNSTREAM TEST POINT with Spectrum Analyzer, using the display line and 100 averages. Determine if downstream CDMA power levels are within range:

**Single CDMA Carrier, 1.25 MHz RBW**

	<u>65% Pole</u>	<u>Pilot Only</u>
Max.	+30 dBmV	+23 dBmV
Min.	+20 dBmV	+13 dBmV

**Single CDMA Carrier, 30 kHz RBW**

	<u>65% Pole</u>	<u>Pilot Only</u>
Max.	+14 dBmV	+7 dBmV
Min.	+4 dBmV	-3 dBmV

- e. Adjust attenuation as needed in the HIC DOWNSTREAM POWER Dialog (Figure 2-23) to attain the required power level specification. Record the amplitude and attenuator setting.

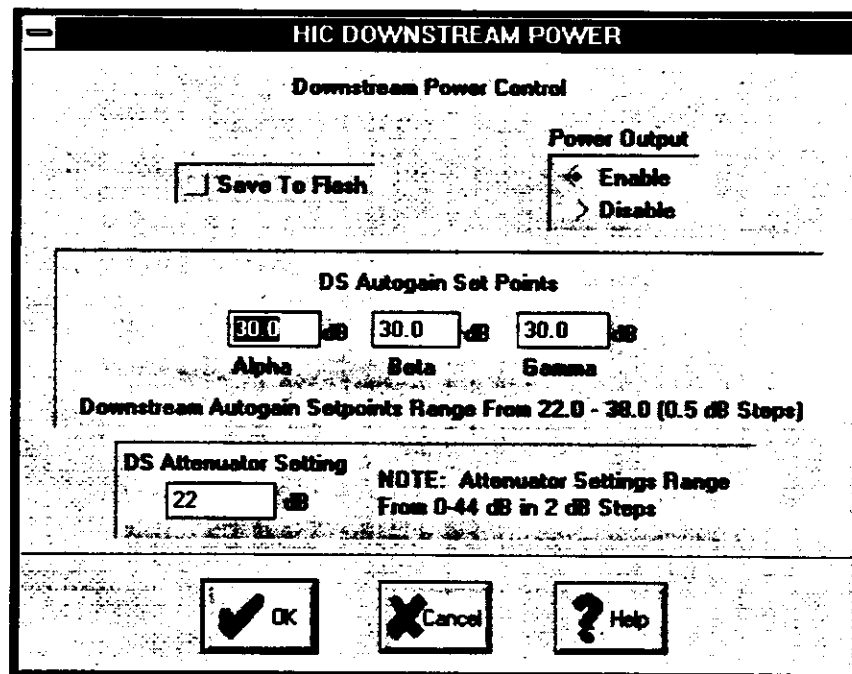


Figure 2-23. HIC DOWNSTREAM POWER Dialog

### 2.8.3.5 CATV Headend Measurements

This procedure measures the HIC Downstream levels at the Headend input prior to connecting to the CATV headend. It verifies that the losses from the HIC to the Headend are not excessive and that the level will not interfere with the live CATV network. Downstream amplification may be added at the Headend if required.

- a. Observe the Downstream signal at the Headend, after Video Combining. Verify that the Reference Tone amplitude is 15 dB below the Video Reference Level.
  - 1) If the level is within 5 dB of the required level, adjust the attenuation at the REFERENCE AND CONTROL TONES dialog.
  - 2) If the level requires more than 5 dB of adjustment, install the appropriate device (amplifier or attenuator) between the HIC output and the Headend input to reduce the error to less than 5 dB, then adjust the *Attenuation Setting* at the REFERENCE AND CONTROL TONES dialog.
  - 3) Record the final amplitudes and settings for:
    - Reference Tone amplitude
    - Reference and Control Tone attenuator setting
    - Video Reference Level
- b. Observe the Downstream CDMA signal at the Headend, after Video Combining. Verify that the Downstream CDMA Pilot Level is 22 dB below the Video Reference Level.
  - 2) If the level is within 5 dB of the required level, adjust attenuation at the HIC DOWNSTREAM POWER Dialog.
  - 3) If the level requires more than 5 dB of adjustment, install the appropriate device (amplifier or attenuator) between the HIC output and the Headend input to reduce the error to less than 5 dB, then adjust attenuation at the HIC DOWNSTREAM POWER Dialog.
  - 4) Record the CDMA Pilot Level.
  - 5) Record the final Downstream attenuator setting.
- c. If a CMI is installed for use with this HIC, proceed with CMI installation checkout, otherwise, continue installing HIC/BTS/Cable Plant cabling.
- d. If alarms occur and the cable plant/BTS signals are connected and at the correct levels, refer to Table 2-6 for a list of the alarms recognized by the HECU software and the probable equipment failure for each alarm.

**Table 2-6. Recognized Alarm List**

Alarm Name	State	Class	Eqpt. Type
CMI Out of Service *	Device attribute disabled	Out of Service	CMI
No Response from HIC	Exceeded retry limit	Critical	HIC
HIC Phase Lock Loop	PLL out of lock	Critical	HIC
HIC Flash Memory Checksum	Failed	Critical	HIC
HIC Flash Memory write	Failed	Critical	HIC
HIC Temperature Alarm	Exceeded threshold	Critical	HIC
HIC Downstream Attenuator	Out of range	Critical	HIC
HIC Watchdog Timer	Timed out	Critical	HIC
HIC Reset	Changed state	Critical	HIC
HIC Temperature Warning	Approaching threshold	Minor	HIC
Downstream CDMA Input Power (alpha)	Out of range	Minor	HIC
Downstream CDMA Input Power (beta)	Out of range	Minor	HIC
Downstream CDMA Input Power (gamma)	Out of range	Minor	HIC
No Response from CMI	Exceeded retry limit	Major	HIC/CMI
CMI Upstream Continuity Alarm	Exceeded threshold	Major	HIC/CMI
CMI EEPROM Checksum	Failed	Major	CMI
CMI is waiting EEPROM	Waiting for new code	Major	CMI
CMI EEPROM write	Failed	Major	CMI
CMI Phase Lock Loop	Out of lock	Major	CMI
CMI No Response Error	Time out after reset	Major	CMI
CMI Comm. time out	CMI Idle time out	Major	CMI
CMI PA Temperature Alarm	Exceeded threshold	Major	CMI
CMI Upstream Temperature Alarm	Exceeded threshold	Major	CMI
CMI Downstream Temp. Alarm	Exceeded threshold	Major	CMI
CMI Downstream Output Power	Exceeded threshold	Major	CMI
CMI Upstream Power	Exceeded threshold	Major	CMI
CMI Watchdog Timer	Timed out	Major	CMI
CMI Reset	Changed state	Major	CMI
Upstream Frequency	Mismatch	Major	CMI
CMI PA Temp. Warning	Approaching threshold	Minor	CMI
CMI Upstream Temp. Warning	Approaching threshold	Minor	CMI
CMI Downstream Temp. Warning	Approaching threshold	Minor	CMI

\* = Provisions are made for not allowing this alarm to be closed unless the device attribute is enabled.



## SECTION 3. CMI INSTALLATION

### 3.1 CMI INSTALLATION REQUIREMENTS

Installing the Cable Microcell Integrator (CMI) involves these major tasks:

- Determining physical site location for the CMI
- Selecting the CMI configuration required
- Installing the CMI with attaching antennas and cables
- Performing CMI electrical checks
- Activating CMI

#### NOTE

Prior to starting the installation procedure, locate and remove the 4-inch by 4-inch removable barcode label from the CMI carton, and attach it to the Installation Work Order or other appropriate documentation. This label includes critical identification data which will be required to activate the CMI after installation.

#### 3.1.1 Tools, Test Equipment and Supplies

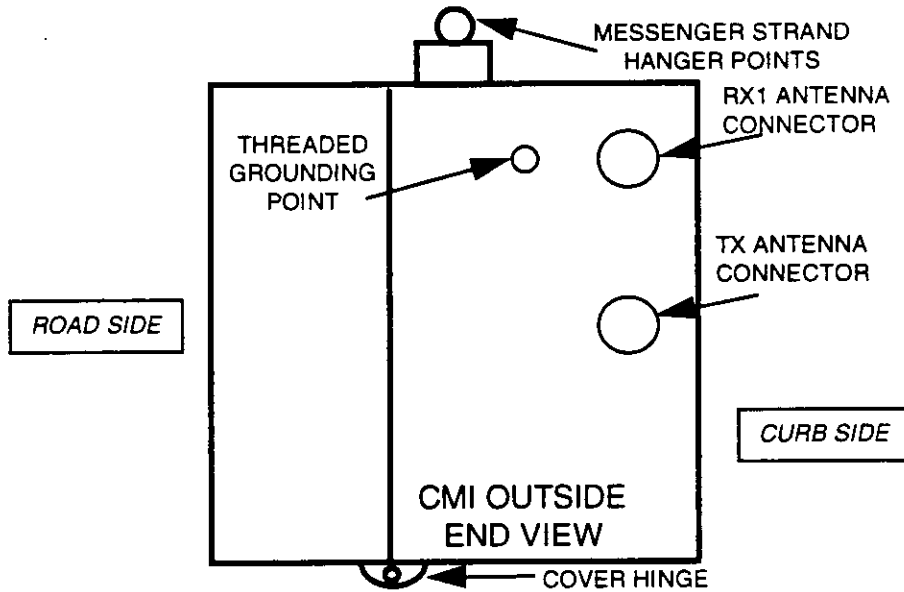
Table 3-1 lists the tools and test equipment needed to support the CMI installation.

**Table 3-1. CMI Installation Support Needs**

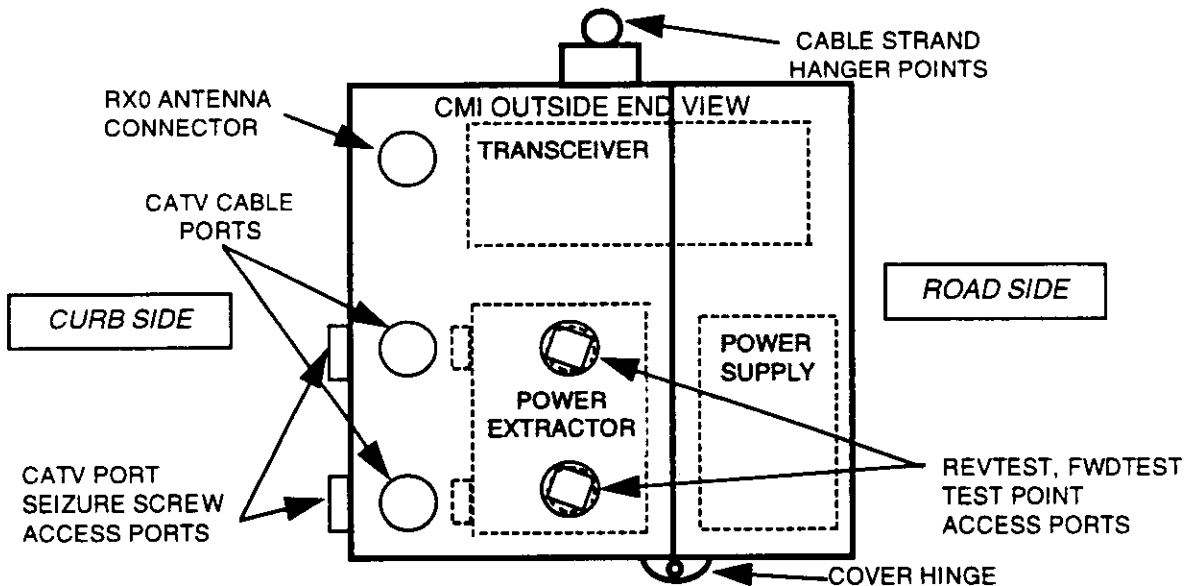
Hand Tools
<ul style="list-style-type: none"><li>• Wrench, 1/2 inch hex socket for CMI Cover bolts</li><li>• Wrench, torque (145 in-lb), 1/2-inch for CMI Hinged Cover</li><li>• Wrench, open-end 1/2-inch, for Seizure Screw Access Port</li><li>• Wrench, torque (30 in-lb), 3/4-inch</li><li>• Screwdriver, flat blade, medium, for Power Extractor mounting screw and CATV port seizure screws</li><li>• Long Reach Test Point Adapter, Antec No. SCI 039719 or equivalent</li></ul>
Test Equipment
<ul style="list-style-type: none"><li>• Hand-held Digital Multimeter with test probes</li><li>• Stealth meter, or equivalent (??)</li></ul>

**3.1.2 CMI External Connector Identification**

Figure 3-1 and Figure 3-2 show the locations of the CMI external connectors. For reference, approximate locations of major CMI subassemblies are shown in Figure 3-2 with dotted lines. Table 3-2 briefly describes the purpose of each external connection point.



**Figure 3-1. CMI Chassis Left Side View**



**Figure 3-2. CMI Chassis Right Side View**

**Table 3-2. CMI External Connections**

Connection Point	Description
Threaded Grounding Point	10-32 x 1/2-inch hole tapped into a boss, to secure a ground wire to Protective Earth grounding point. (Protective Earth is a UL term.) See paragraph 3.3.6.3.1.
RX1 Antenna Connector	Primary receive antenna connection; Type N (male), 50 ohm connector
TX Antenna Connector	Transmit antenna connection; Type N (male), 50 ohm connector
RX0 Antenna Connector	Diversity receive antenna connection; Type N (male), 50 ohm connector
REVTEST, FWDTEST Test Point Access Ports	Provides probe access for measuring reverse link (upstream) and forward link (downstream) signal levels. See paragraph 3.4. Weather-protected by 15/16-inch hex cover caps.
CATV Port Seizure Screw Access Ports	Access for tightening seizure screws on CATV center conductors. See paragraph 3.3.3.1.
CATV Cable Ports	Tapped holes provided for customer-supplied adapters; see paragraph 3.3.3.1. One or both ports are used depending on selected site configuration; see paragraph 3.3.4.

**3.1.3 CMI Parts List**

The CMI Assembly is shipped for installation with cable strand hangers. Any additional required hardware is provided by the customer. Table 3-3 lists the CMI parts shipped by Sanders for CMI installation.

**Table 3-3. CMI Parts List**

Nomenclature	Part No.	Qty
CMI Assembly	8336701G1, or 8336701G2*	1
Hanger Bracket Kit	8333623G1	1

\* G1 - Single Mode G2 - Dual Mode (??)

**3.1.4 Customer-Furnished Equipment**

Table 3-4 lists Customer-Furnished Equipment required to complete CMI installation. Before proceeding with the CMI installation, inventory the contents listed in Table 3-4 to ensure all necessary parts are available for installation.

**Table 3-4. Customer-Furnished Equipment Installation List**

Nomenclature	Part No.	Qty
Antenna Assembly, Receive		2
Antenna Assembly, Transmit		1
Cable Assembly, Transmit		1
Cable Assembly, Receive		1
Cable Assembly, Receive		1
Cable Assembly, CATV Power		1*
Cable Assembly, CATV Signal		1*
CATV port adapters		1 or 2**

\* One or both cables, depending on installation requirements.

\*\* Quantity depends on CATV port configuration used.

**3.1.4.1 Antenna Requirements**

For proper CMI operation, the customer-supplied antennas must provide transmit-to-receive antenna isolation in excess of 40 dB. This is achievable with an antenna gain of 6 dBi and a minimum transmit-to-receive antenna separation of 15 inches.

**3.1.4.2 Cable Connector Requirements**

Cables that interface with the CMI connector ports must meet the following specifications:

- Transmit antenna: Type N (male), 50 ohms (Qty 1)
- Receive antenna: Type N (male), 50 ohms (Qty 2)
- CATV interface: 5/8-inch 24 thread male, 75 ohms

**3.2 SITE PREPARATION**

The following paragraphs are provided for information and guidance for the CMI Assembly installation. At the site, the installer must:

- Determine the CMI Assembly location on the messenger strand.
- Determine the CMI power configuration required for the CMI installation site.
- For installing the customer furnished-equipment, the installer should reference internal procedures for general, overhead, and underground installation of CATV components.

### 3.3 CMI HARDWARE INSTALLATION GUIDE

#### **WARNING**

Potentially dangerous High Voltage exists on the AC power cable to the CMI Assembly that could cause bodily injury or even death. During a line surge or fault condition, High Voltage also could be present on the antenna connectors. Use extreme care and required safety precautions while working on the CMI installation and handling the AC power cable.

To avoid any possibility of overexposure to RF emissions when working near a CMI, maintain a minimum distance of eight inches from the transmitting antenna.

#### 3.3.1 **CATV Cable Interface to the CMI**

CATV coaxial cable typically connects the CMI to the CATV cable plant through a directional coupler referred to as a cable tap. Each CMI uses a separate tap, with tap coupling varying according to the tap location in the cable plant.

AC voltage supplied by the cable plant is present on the coax center conductor along with the RF signals. The CMI internal Power Extractor routes the AC voltage to the CMI Power Supply and routes the reverse link and forward link RF signals between the cable plant and the appropriate CMI Transceiver ports.

#### 3.3.2 **CMI Access**

##### 3.3.2.1 **Opening the Assembly**

#### **WARNING**

The CMI hinged cover (road side) contains the Power Supply and therefore is **heavy**. If a CMI must be opened in the installed position, always support the cover with one hand when releasing the last captive screw to avoid equipment damage and/or personal injury.

The hinged CMI Assembly housing is secured with eight captive bolts. Place the CMI on any firm surface and release the bolts, using a 1/2-inch socket wrench. Open the cover carefully, keeping in mind that the cover (road side) portion contains the Power Supply and therefore is heavy.

**3.3.2.2 Closing the Assembly**

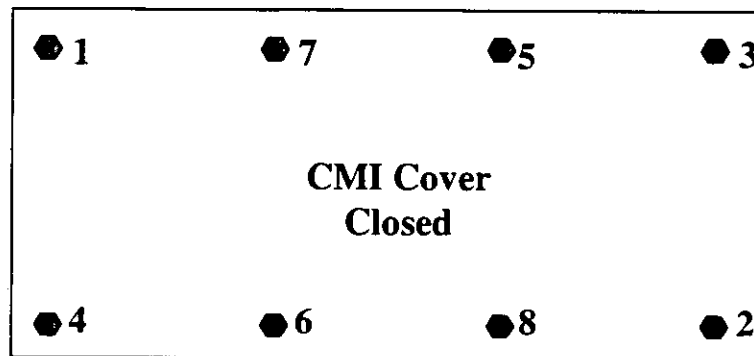
**CAUTION**

When closing the CMI Assembly, ensure that all internal wiring is clear of the housing seal before securing captive screws to avoid possible equipment damage.

**NOTE**

To restore the watertight seal on a CMI Assembly, the captive bolts must be torqued to 140–145 in-lb, in the proper sequence.

Place the CMI Assembly on any firm surface. Carefully close the cover, ensuring that all internal wiring is clear of the housing seal. Torque the eight captive bolts to 140–145 in-lb, in the sequence shown in Figure 3-3.

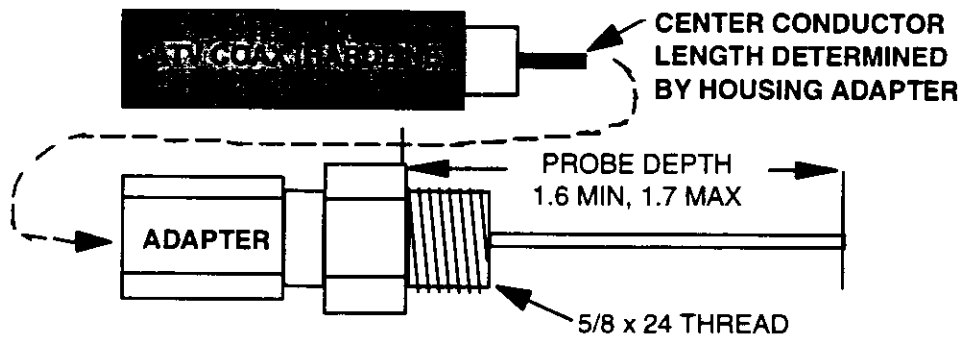


**Figure 3-3. CMI Bolt Tightening Sequence**

**3.3.3 CMI Configuration Options**

**3.3.3.1 CMI CATV Port Configurations**

There are two possible port configurations, each using either a *housing-to-F* adapter or a *housing-to-hardline* connector. One or both ports are used, based on installation requirements. The housing-to-F adapter or the housing-to-hardline connector (shown in Figure 3-4) is threaded into the CMI housing, with its center conductor secured to the internal CMI circuits by a seizure screw. The seizure screw is accessed by removing a threaded plug located at the rear of the CMI chassis (curb side). The seizure screw is tightened using a medium flat-blade screwdriver.

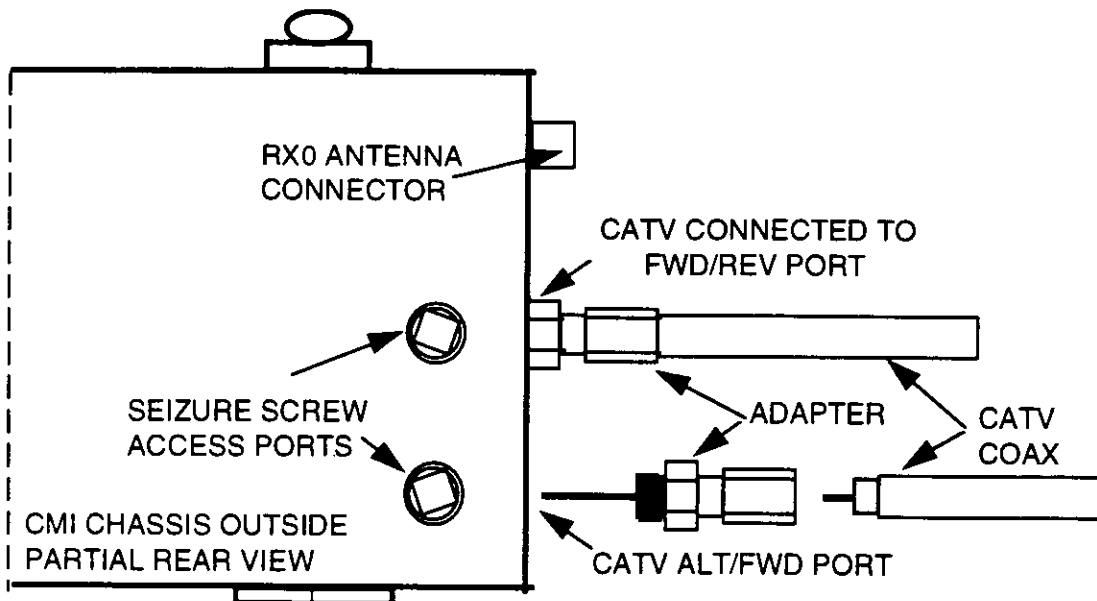


**Figure 3-4. Typical Housing Adapter Interface**

One configuration uses only the FWD/REV port and the other uses both the FWD/REV and ALT/FWD ports. Either port can accept AC voltage from the cable plant for the CMI. The FWD/REV port must be used to carry reverse link signals and can carry forward link signals. The ALT/FWD port may be used as an alternate to FWD/REV for forward link signals.

If the installation requirements dictate the use of housing-to F-adapter(s), it is strongly recommended that the adapter installation be performed on the ground prior to installing the CMI on the cable strand.

The assembly sequence of CATV coax and housing-to-hardline adapter to CMI is determined by mechanical constraints. Figure 3-5 shows an exploded view of these items. The housing-to-hardline adapter must be threaded into the CMI housing; therefore, it must be separate from the CATV coax during installation or removal. The seizure screw is tightened against the housing-to-hardline adapter center conductor after the adapter is installed. The CATV coax is joined to the housing-to-hardline adapter after the adapter is secured to the CMI. The adapter must be torqued to 30 in-lb.



**Figure 3-5. Assembly of Typical Housing to Hardline Connector**

### **3.3.3.2 Power Extractor Options**

The CMI is supplied from the factory with either a Single-Mode or a Dual-Mode Power Extractor. The Single-Mode configuration allows the CMI to operate with both the forward and reverse link CATV signals on the FWD/REV interface. The Dual-Mode configuration allows the CMI to operate with the forward link CATV signals interfaced to the ALT/FWD interface port and the reverse link CATV signals interfaced to the FWD/REV interface port. With either configuration, the CMI can be configured to accept AC prime power from either CATV interface port.

The Power Extractor module is shown in Figure 3-6. The outward appearance of the two configurations is identical except for the serial number (visible without removing the Power Extractor from the CMI): The eighth digit of the serial number for the single-mode configuration is always **1**, while the eighth digit of the serial number for the dual-mode configuration is always **2**. (The seventh digit of the Power Extractor serial number is always **2**.) For example, serial number 969T00210000 indicates a single-mode configuration.

The Power Extractor accommodates field-replaceable, plug-in attenuator pads for both the forward and reverse CATV paths, and a field-replaceable, plug-in equalizer in the forward CATV path. These component locations are accessible when the CMI housing cover is open without the need to remove the Power Extractor. The CMI is shipped with no pads or equalizer installed. It will accept Scientific Atlanta model number PP-0 to PP-10 attenuator pads or equivalents and Scientific Atlanta model number EQ750 equalizers or equivalents.

### **3.3.3.3 AC Power Connection Options**

The AC voltage supplied by the cable plant can be connected to the CMI through either CATV port. The position of the switch on the Power Extractor (see Figure 3-6) controls which port provides the AC voltage: The FWD/REV UP/DOWN position provides AC power through the FWD/REV port, and the ALT/FWD ALT/DOWN position provides it through the ALT/FWD port. The OFF position removes prime power from the CMI starting at the Power Extractor output. Refer to paragraph 3.3.2 for CMI access instructions.

AC voltage is routed from the Power Extractor to the AC input connector on the Power Supply via an integral cable with keyed 5-pin connector. The Power Supply AC input connector is shown in Figure 3-7.



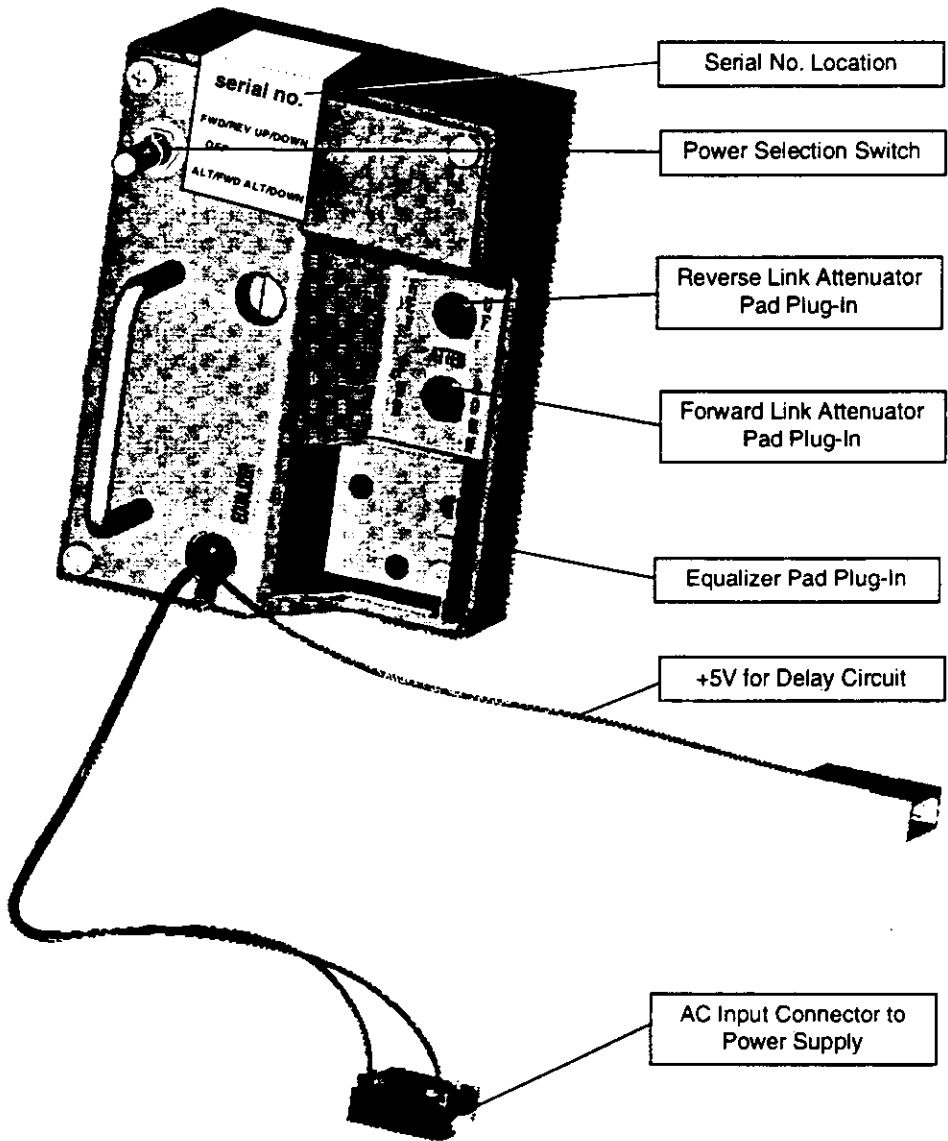


Figure 3-6. Version 1.85 Power Extractor

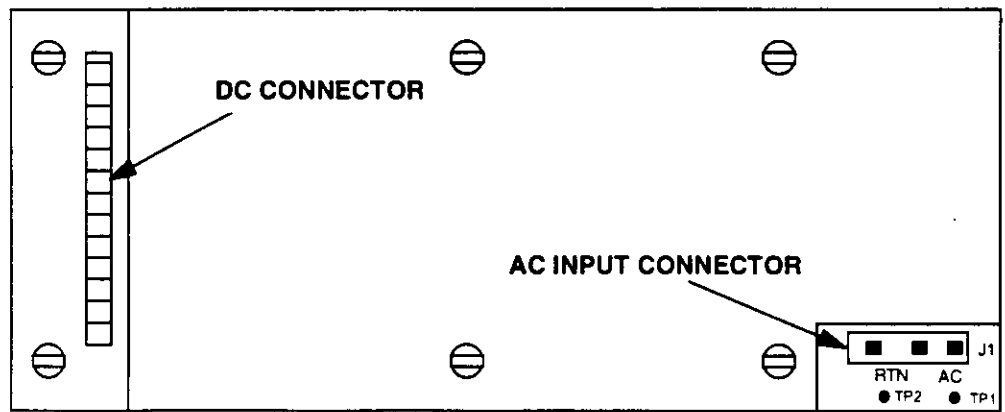


Figure 3-7. Power Supply AC Input Connector

### 3.3.4 CMI Configuration Setup

The CMI has been designed to accommodate a variety of site configurations. Paragraphs 3.3.4.1 through 3.3.4.4 describe four possible CMI installation configurations.

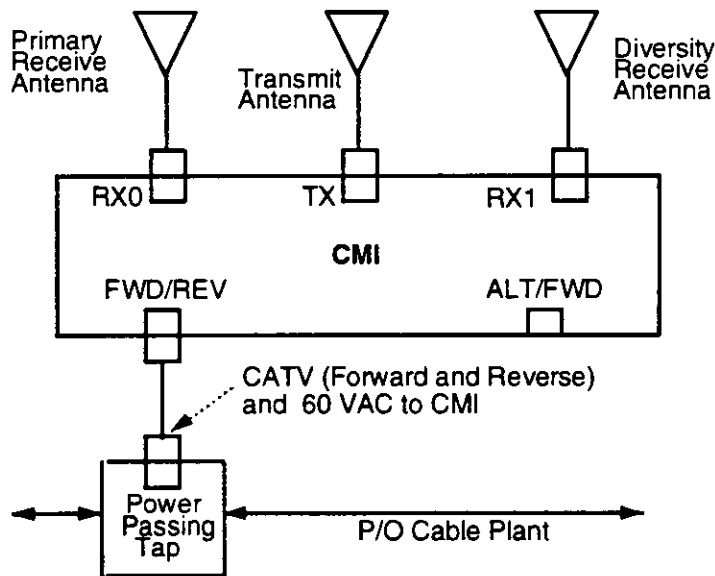
- Single Power Passing Tap
- Signal Tap and Power Inserter
- Power Passing Forward link Tap and a Separate Reverse link Tap
- Power Passing Reverse link Tap and a Separate Forward link Tap

#### 3.3.4.1 Single Power Passing Tap

Figure 3-8 shows the installation site prepared with a single Power Passing Tap to provide AC power to the CMI and to provide a connection to both the reverse link and forward link CATV signals. This tap is then connected to the FWD/REV port of the CMI. This connection can be made by installing 5/8 x 24 housing-to-F female adapters into both the Power Passing Tap output port and the CMI FWD/REV port. The two adapters can then be connected using a type F cable. The switch on the Single-Mode Power Extractor is set to FWD/REV UP/DOWN.

**NOTE**

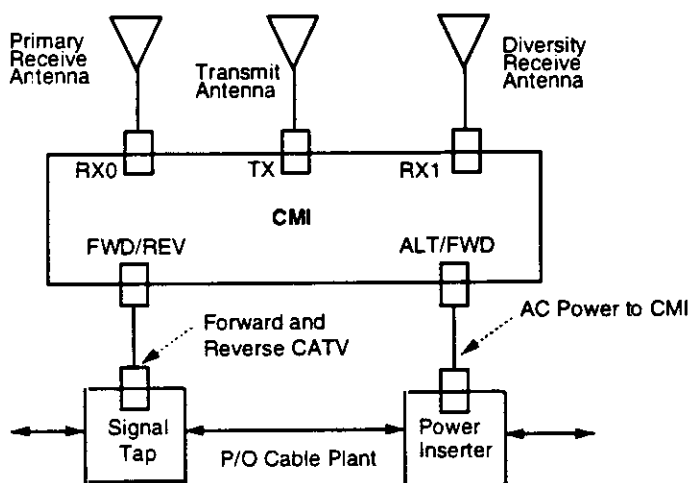
This same setup could also be implemented using a housing-to-hardline cable connector instead of the F adapters, then connecting the Power Passing Tap to the CMI using hardline.



**Figure 3-8. Single Power Passing Tap**

**3.3.4.2 Signal Tap and Power Inserter**

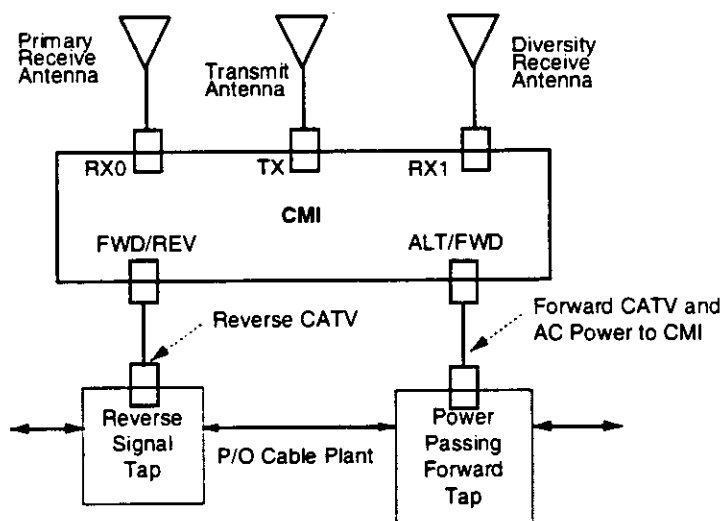
Figure 3-9 shows the installation site prepared with a Signal Tap to provide connection to both the reverse link and forward link CATV signals. This tap is then connected to the FWD/REV port of the CMI. Additionally, a Power Inserter is used on the cable plant to extract 60 Vac from the cable plant and route it to the CMI using the ALT/FWD port. The switch on the Single-Mode Power Extractor is set to ALT/FWD ALT/DOWN.



**Figure 3-9. Signal Tap and Power Inserter**

**3.3.4.3 Power Passing Forward Link Tap and a Separate Reverse Link Tap**

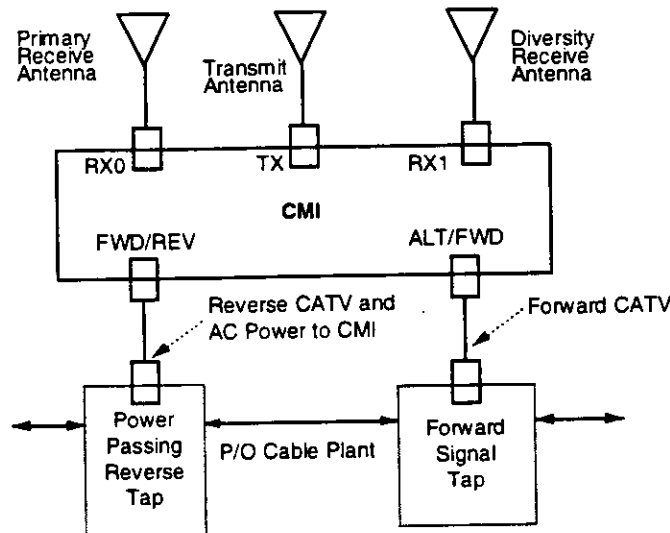
Figure 3-10 shows the installation site prepared with a Power Passing Tap to provide AC power to the CMI and to provide connection to the Forward link CATV signal. This tap is then connected to the ALT/FWD port of the CMI. A second Signal Tap is used on the cable plant to connect the CMI to the Reverse link side of the cable plant through the CMI FWD/REV port. The switch on the Dual-Mode Power Extractor is set to ALT/FWD ALT/DOWN.



**Figure 3-10. Power Passing Forward Link Tap and Separate Reverse Link Tap**

**3.3.4.4 Power Passing Reverse Link Tap and a Separate Forward Link Tap**

Figure 3-11 shows the installation site prepared with a Power Passing Tap to provide AC power to the CMI and to provide connection to the Reverse link CATV signal. This tap would then be connected to the FWD/REV port of the CMI. A second Signal Tap is used on the cable plant to connect the Forward link side of the cable plant to the CMI through the CMI ALT/FWD port. The switch on the Dual-Mode Power Extractor is set to FWD/REV UP/DOWN.



**Figure 3-11. Power Passing Reverse Link Tap and Separate Forward Link Tap**

**3.3.5 Power Extractor Reverse Link/Forward Link RF Attenuation**

**WARNING**

AC voltage may be present on the CATV coax during installation or maintenance. Ensure that switch on Power Extractor is set to OFF whenever power to CMI is not needed. Use extreme caution in order to prevent injury to personnel and avoid hardware damage.

The Power Extractor plugs into the CMI chassis and Connector Plate. It is secured by one captive screw. As shown in Figure 3-6, the Power Extractor contains two plug-in attenuator pad receptacles, one for adding reverse link attenuation and one for adding forward link attenuation. It also includes a plug-in equalizer receptacle for forward path equalization.

The Power Extractor is shipped with no pads or equalizer installed. It is recommended that both attenuation and equalization values be initially set to 0 dB. The pad receptacles will accept Scientific Atlanta model number PP-0 to PP-10 attenuator pads or equivalent. The equalizer receptacle will accept Scientific Atlanta model number EQ750 equalizers or equivalent.

### 3.3.6 Installing the CMI

#### 3.3.6.1 Attaching CMI to Messenger Strand

##### **WARNING**

Potentially dangerous High Voltage exists on the AC power cable to the CMI Assembly that could cause bodily injury or even death. Ensure that switch on Power Extractor is set to OFF whenever power to CMI is not needed. Use extreme care and required safety precautions while working on the CMI installation and handling the AC power cable.

The CMI Assembly weighs approximately 40 pounds. Provide adequate support when lifting and handling to avoid personal injury and/or equipment damage.

##### **NOTE**

To facilitate installation and maintenance, the CMI has been designed to be mounted to the messenger strand in such a way that when the hinged cover is opened, access to the internal components is made from the road side. See Figure 3-1 and Figure 3-2.

CMI Bracket Kit, part number 8333623G1, is provided with the CMI. These brackets secure the CMI Assembly approximately three inches below the messenger strand. It is recommended that the brackets be secured to the CMI before ascending to the cable strand. The washer, lockwasher and bolt supplied with the bracket are assembled in the order shown in Figure 3-12. Recommended torque range is 75 to 90 in-lb.

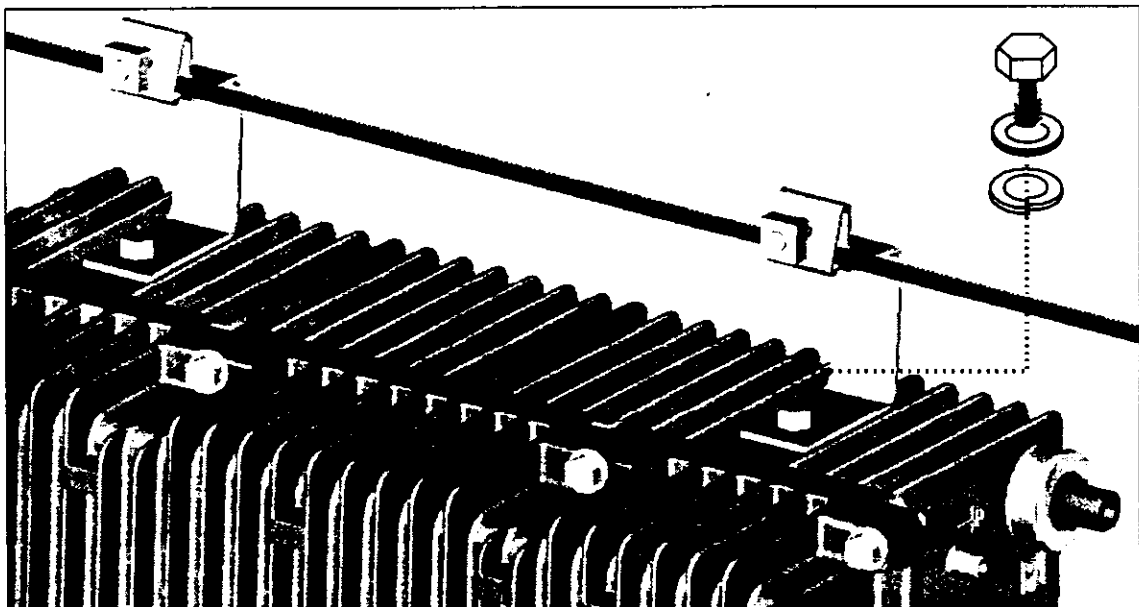


Figure 3-12. CMI Bracket Installation

### 3.3.6.2 Attaching Antennas to Messenger Strand

This procedure is provided for general guidance when installing the transmit and receive antennas for the CMI Assembly. The installer should follow the specific installation procedure provided by the antenna vendor with the antenna equipment.

- a. Prior to installing, assemble the antenna mounting element (bracket) provided by the antenna vendor with the antenna.

#### **WARNING**

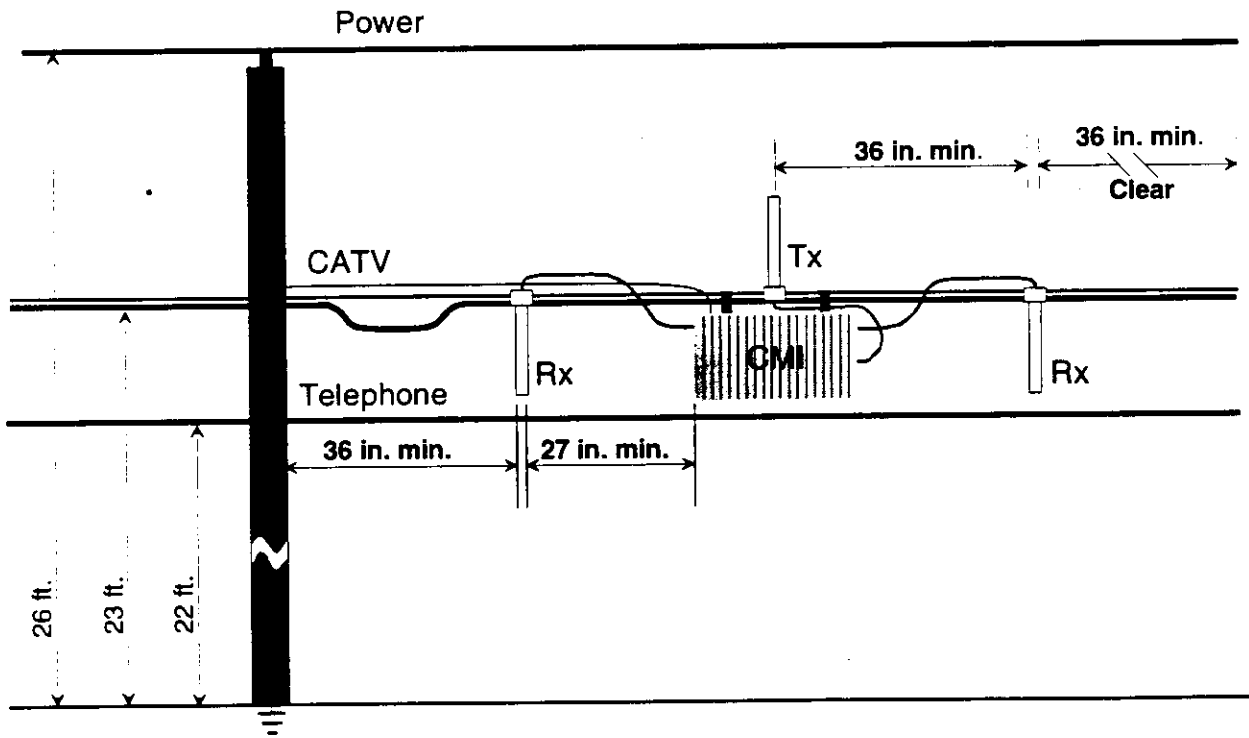
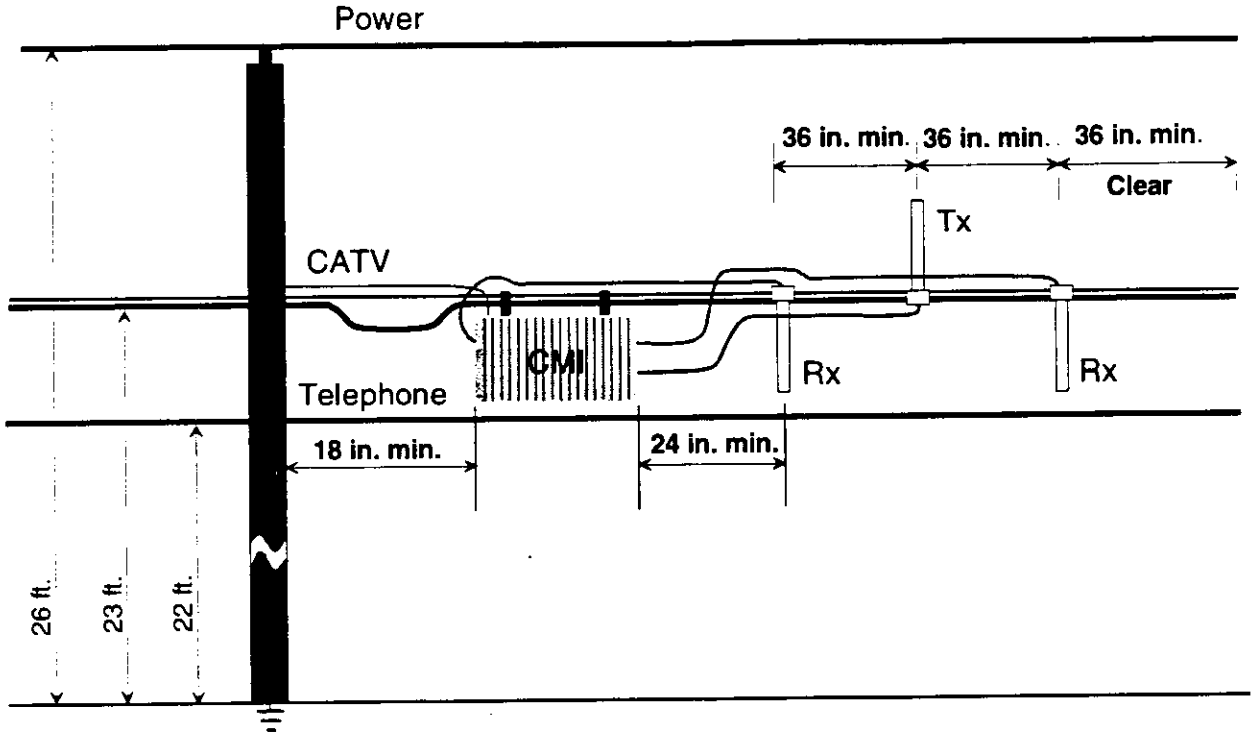
Potentially dangerous High Voltage exists on the AC power cable to the CMI Assembly that could cause bodily injury or even death. During a line surge or fault condition, High Voltage also could be present on the antenna connectors. Use extreme care and required safety precautions while working on the CMI installation and handling the AC power cable.

To avoid any possibility of overexposure to RF emissions when working near a CMI, maintain a minimum distance of eight inches from the transmitting antenna.

#### **NOTE**

Ensure that Transmit Antenna element is installed pointing upward and extending above the messenger strand; ensure that the receive antennas are pointing downward.

- b. Locate and position the Transmit Antenna with mounting element (bracket) pointed *upward*, using the typical setups shown in Figure 3-13 for guidance.
- c. Locate and position the two Receive Antennas with mounting elements (brackets) with elements pointed *downward*, using the typical setups shown in Figure 3-13 for guidance.



ANTINST1.DS4

Figure 3-13. Typical Antenna Installations

### **3.3.6.3 Installing and Routing Cables**

Cable installation and routing includes securing cables to the messenger strand/CATV cable and interconnecting the various hardware assemblies using Figure 3-8 through Figure 3-11.

#### **3.3.6.3.1 Protective Earth Grounding**

The following guidance is provided for routing the Protective Earth Grounding wire/cable. (Refer to Figure 3-1 for CMI threaded grounding connection point.) The recommended grounding hardware is a No. 6 stranded ground wire attached to a No. 6 crimped ground lug with a No. 10 screw.

#### **3.3.6.3.2 Antenna Cables**

This procedure is provided for guidance for routing the antenna cables. This installation procedure routes the signal cables between the CMI and the three antenna elements. Refer to Figure 3-14 for CMI connector location.

#### **NOTE**

This procedure is intended only as a general guide. The instructions provided with the Antenna Mounting Kits take precedence over this guide.

- a. Temporarily secure each cable with approximately eight-inch service/drip loop to messenger strand/CATV cable using tie wrap.
- b. Route and connect cables to CMI as follows:
  - Transmit Antenna element connector to CMI TX antenna connector.
  - Receive (Primary) Antenna element connector to RX0 connector.
  - Receive (Diversity) Antenna element connector to RX1 connector.
- c. Coil cables to remove excess slack.
- d. Secure cables, maintaining eight-inch service/drip loop to messenger strand/CATV cable using tie wrap.
- e. Apply waterproofing tape to all of the connections on the CMI Assembly.



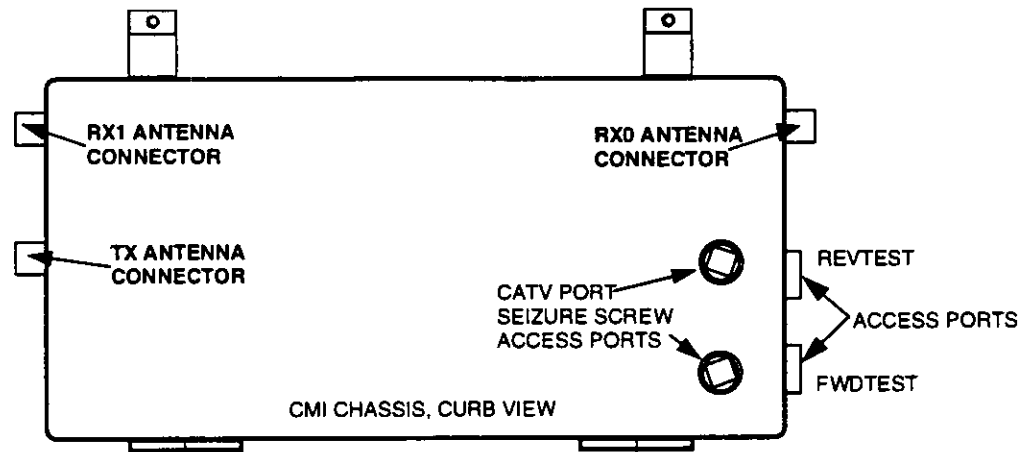


Figure 3-14. CMI Assembly Rear View

### 3.3.6.3.3 Power and CATV Cables

This procedure is provided for guidance for routing the Power and CATV cables. Refer to Figure 3-8 through Figure 3-11 for typical tap configurations and Figure 3-2 for CMI connector location.

- Ensure CMI is mechanically configured to accept cables as applicable per paragraph 3.3.2.
- Before connecting AC power cable to CMI, verify that source is 45 – 90 Vac.
- Connect cables, as applicable, per Figure 3-8 through Figure 3-11.
- Temporarily secure each cable with approximately eight-inch service/drip loop to messenger strand/CATV cable using tie wrap.
- Route and connect cables to CMI.
- Coil cables to remove excess slack.
- Secure cables, maintaining eight-inch service/drip loop to messenger strand/CATV cable using tie wrap.
- Apply waterproofing seal to all of the connections on the CMI Assembly.

### 3.3.7 CMI Power Check

After the CMI is mounted on the cable strand and all cables are installed, do the following:

- Open CMI per paragraph 3.3.2.
- If not already done, install FWD ATTN pad, REV ATTN pad and EQUALIZER pad in the power extractor module. Use 0 dB or other appropriate estimated value (refer to paragraph 3.3.5).
- Set Power Extractor power switch to either FWD/REV UPDOWN or ALT/FWD ALT/DOWN, as required by the CATV power configuration.
- Observe that green LED power indicator on Transceiver and on Power Supply are both lit. If one or both are not lit, refer to PCS-Over-Cable CMI/HIC System Version 1.85 Operation and Maintenance Manual, Document No. 8337148 for fault isolation and maintenance procedures.
- Close CMI per paragraph 3.3.2.

### 3.4 MEASUREMENT TEST POINTS

The CMI contains two CATV-Plug access ports for reverse link and forward link RF measurements. These RF test points provide isolation between the test measurement equipment and CMI AC power. The test point access ports are on the left side of the CMI when viewed from road. The access ports connect internally to the power extractor, as shown in Figure 3-15.

#### NOTE

The FWDTEST and REVTEST measurements can be performed using a Wavetech Stealth meter or similar device for single tone measurements only. The Stealth meter is not recommended for measuring wideband signals such as CDMA.

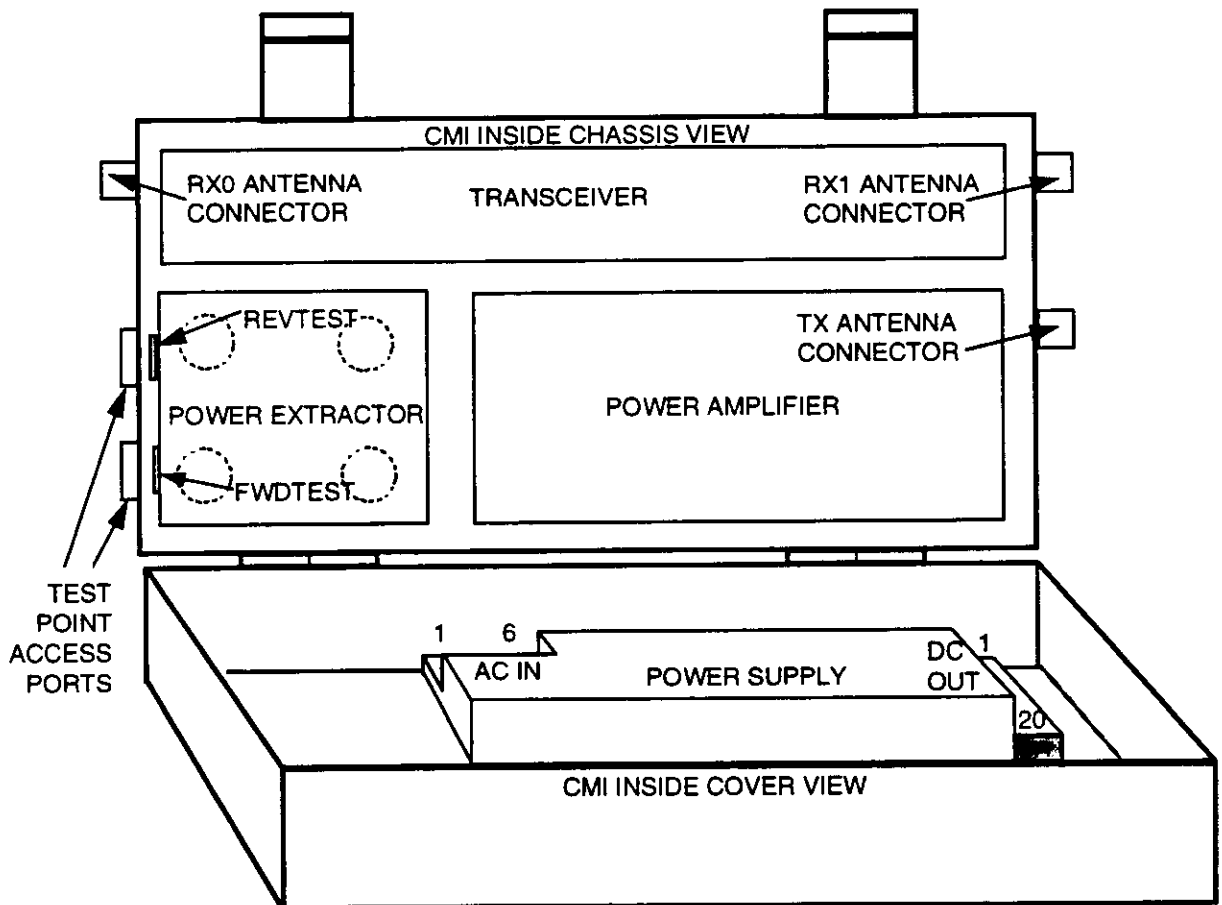


Figure 3-15. CMI Test Point Access and Subassembly Layout

**NOTE**

Ensure that CATV Cable Plant is operating before performing the following level checks.

Cross reference tables for PCS channel to frequency and CATV channel to frequency are provided in Appendix A and Appendix B, respectively.

The CMI data sheet at the end of this manual may be reproduced and used for recording the measured levels specified in the following procedures.

**3.5 FORWARD LINK CMI INSTALLATION MEASUREMENTS AND ADJUSTMENTS**

**WARNING**

Potentially dangerous High Voltage exists on the AC power cable to the CMI Assembly that could cause bodily injury or even death. Use extreme care and required safety precautions while working on the CMI installation and handling the AC power cable.

**3.5.1 CMI Forward Link CATV Tilt Adjustment**

This procedure checks the tilt of the cable plant at the CMI and adjusts the CMI equalizer accordingly to compensate for the transceiver Reference and Control tone and downstream CDMA input requirements.

- a. Open CMI per paragraph 3.3.2.
- b. If not already done, install FWD ATTEN pad, REV ATTEN pad and EQUALIZER pad in the power extractor module. Use 0 dB or other appropriate estimated value (refer to paragraph 3.3.5).
- c. Remove FWDTEST test point CATV plug from CMI. Insert a Long Reach Test Point Adapter through the access hole to mate with Power Extractor test point (20 dB down).
- d. Connect a *short* Type F test cable (less than six feet) between Long Reach Test Point Adapter and meter. (If a long cable is used, insertion loss of the cable at the frequency of interest should be determined and included in the calculations).
- e. At FWDTEST port, measure signal level of Channel 2 video carrier and record.
- f. At FWDTEST port, measure and record the signal level of Channel 76 video carrier (or closest adjacent video channel).
- g. Calculate the Cable Tilt by subtracting recorded value measured at Channel 2 from recorded value measured at Channel 76.

$$\text{Channel 76 Level} - \text{Channel 2 level} = \text{Cable Tilt}$$

- h. Install an equalizer in Power Extractor receptacle with a value corresponding to measured Cable Tilt.

**NOTE**

Only negative cable tilt can be compensated at the CMI. If a positive cable tilt greater than +5 is measured, the Cable Plant manager should be advised. Likewise, if the negative tilt is too great to be compensated within  $\pm 3$  dB, contact the Cable Plant manager for assistance.

- i. Repeat measurements, and change equalizer values if necessary, until Channel 2 video carrier and Channel 76 Video Carrier levels are within  $\pm 3$  dB.
- j. Replace FWDTEST test point CATV plug, and close CMI per paragraph 3.3.2.

**3.5.2 Forward Link CATV Video Reference Level Check**

This procedure checks the forward link CATV signal level at the CMI to ensure the level is within specifications.

- a. Open CMI per paragraph 3.3.2. Verify that both attenuator pads and equalizer pad, 0 dB or other calculated values, are installed in Power Extractor.
- b. Remove FWDTEST test point CATV plug from CMI. Insert a Long Reach Test Point Adapter through the access hole to mate with the Power Extractor test point (20 dB down).
- c. Connect a short Type F test cable (less than six feet) between Long Reach Test Point Adapter and meter.
- d. At FWDTEST test point, verify that video reference level Forward link tap is approximately  $-11$  dBmV  $\pm 5$  dB. Record this level.

**NOTE**

If the video reference level varies excessively from  $-11$  dBmV, the tap value should be changed. In addition, if a Video Reference Level of at least  $-16$  dBmV cannot be obtained, then the Cable Plant design needs to be evaluated to determine where there is excessive loss in the video level.

- e. Replace FWDTEST test point CATV plug, and close CMI per paragraph 3.3.2.

**3.5.3 CMI Forward Link Reference and Control Tone Input Level Check**

**NOTE**

The CATV cable plant and assigned HIC at the headend must be active for the following level checks. PCS Headend and Cable Plant technician on-site support is required to complete the CMI integration procedure.

This procedure checks the forward link (downstream) reference and control tone signal level at the CMI to ensure the level is within specification.

- a. Ensure that Headend primary rack is turned on and appropriate HIC is active.

- b. Open CMI per paragraph 3.3.2. Verify that both attenuator pads and equalizer pad, 0 dB or other calculated values, are installed in Power Extractor.
- c. Remove FWDTEST CATV plug from CMI.
- d. Insert a Long Reach Test Point Adapter through access hole to mate with Power Extractor test point. Connect a short Type F test cable between Long Reach Test Point Adapter and meter.
- e. At FWDTEST test point, measure level of HIC forward link Reference Tone at 52.5 MHz. Replace FWD ATTEN pad with a different value as needed (refer to paragraph 3.3.5) to obtain  $-26 \text{ dBmV} \pm 5 \text{ dB}$ .
- f. At FWDTEST test point, ensure that Reference Tone is 15 dB down ( $\pm 3 \text{ dB}$ ) from video reference level. If not, contact Cable Plant manager for assistance in adjusting CATV video reference level.
- g. At FWDTEST test point, verify that HIC forward link Reference Tone level is approximately  $-26 \text{ dBmV} \pm 5 \text{ dB}$ . Record this level and pad value.
- h. Replace FWDTEST test point CATV plug, and close CMI per paragraph 3.3.2.

### **3.6 REVERSE LINK CMI INSTALLATION MEASUREMENTS AND ADJUSTMENTS**

#### **3.6.1 Upstream Gain Adjustment**

This procedure determines the upstream pad value in the CMI power extractor module in order to set up a consistent upstream gain between the CMI and its corresponding cable plant fiber node with respect to all other CMIs on the CATV network. Therefore, when all CMIs are set to the operating upstream setpoint level, they will operate at roughly the same upstream output power level.

#### **NOTE**

The Upstream Gain Adjustment procedure assumes that all fiber nodes on the reverse link of the CATV Plant have been adjusted for a consistent gain between Fiber Node and HIC, in preparation for CMI deployment.

##### **3.6.1.1 *Adjusting Upstream Gain at the CMI Site***

- a. Open CMI per paragraph 3.3.2. Verify that both attenuator pads and equalizer pad, 0 dB or other calculated values, are installed in Power Extractor.
- b. Remove the REVTEST CATV plug from CMI.
- c. Insert a Long Reach Test Point Adapter through access hole to mate with Power Extractor test point.
- d. Connect a Type F test cable between Long Reach Test Point Adapter and test signal generator 75-ohm output.
- e. Inject a CW signal into the CMI REVTEST port at the assigned upstream CATV frequency for the CMI, using a power level of  $+40 \text{ dBmV}$ .

- f. After the measurements and calculations are made at the headend, insert attenuator pad of calculated value into REV/UP ATTEN receptacle of Power Extractor.
- g. Replace REVTEST test point CATV plug, and close CMI per paragraph 3.3.2.

### 3.6.1.2 **Adjusting Upstream Gain at the HIC**

- a. Connect a Type F test cable to a spectrum analyzer (75  $\Omega$  input).
- b. Connect a Type F test cable to the HIC UPSTREAM TEST POINT of appropriate sector for CMI being measured.
- c. Set up spectrum analyzer to upstream frequency for CMI being adjusted and measure injected CW signal.
- d. Perform a peak search or set marker to CW signal to be measured. Record the power level (in dBmV).

#### NOTE

Given the injected level at the CMI of +40 dBmV, the nominal level of the CW signal expected at the HIC test port is -35 dBmV. This value assumes 35 dB of cable plant loss between the upstream fiber node and the HIC input and 40 dB of combined loss for the CMI and HIC test ports: +40 dBmV injected power level at the CMI Test Port minus 75 dBmV of total loss = -35 dBmV.

- e. Determine attenuator pad necessary to adjust the upstream gain between the CMI and fiber node using the following equation:  
(Measured CW Level) - (-35 dBmV nominal level at HIC Test Port) = UP pad value
- f. Have CMI technician install an attenuator pad with the calculated value in REV/UP ATTEN receptacle of Power Extractor.

### 3.6.2 **Activate CMI**

This procedure, also referred to as *CMI acquisition*, adds the selected CMI to the database for monitoring and control by the HECU via the assigned HIC. The procedure also shows that the HIC and CMI are communicating and that all cable interconnections appear to be satisfactory.

- a. Ensure that Headend primary rack is turned on and appropriate HIC is active.
- b. At HEADEND CONTROL PANEL dialog, select **Alarms**, then **CMI Out Of Service Control**.
- c. At CMI OUT OF SERVICE dialog, select Out Of Service Indicator OFF to disable all Out Of Service alarms, then select OK.
- d. At the HECU CONTROL PANEL dialog (Figure 3-16), double-click on appropriate HIC.

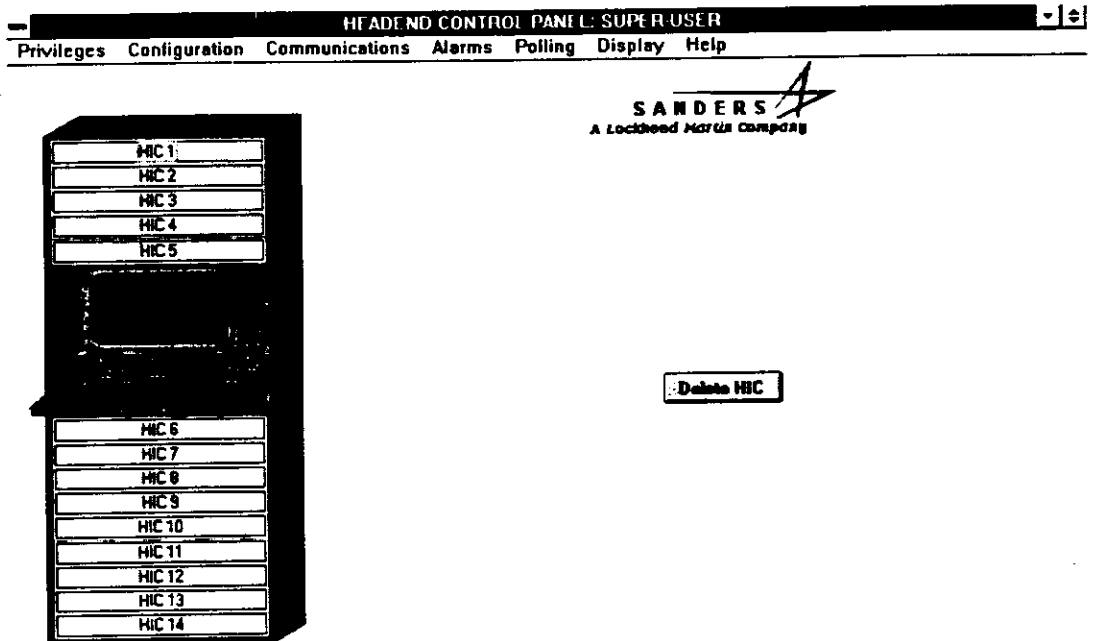


Figure 3-16. Typical HECU CONTROL PANEL Dialog

- e. Set the HIC CONTROL PANEL dialog (Figure 3-17) controls as follows:
  - Select appropriate Sector (Alpha, Beta, Gamma)
  - *Upstream Frequencies* are set as needed by the user.
  - *PCS Frequency* is set as needed by the user.
- f. At HIC CONTROL PANEL dialog, verify that *Upstream Power* field for selected sector indicates +10 dBmV  $\pm$  3 dB. Select associated Control button to adjust attenuation as required.

**NOTE**

For additional HECU procedures, instructions, and associated dialogs, refer to PCS-Over-Cable Version 1.85 Operation and Maintenance Manual for Headend Equipment and Cable Microcell Integrator, Document No. 8337148.

- e. At HIC CONTROL PANEL dialog (Figure 3-17), double-click on appropriate CMI (CMI 1 through CMI 24).
- f. Observe that the ADD CMI dialog (Figure 3-18) appears.
- g. Enter the following:
  - CMI Neuron Chip ID using 12 Hexadecimal characters (This is required).
  - CMI Serial Number (This field is optional and is used for reference only).
  - CMI Location Number (This field is optional and is used for reference only).

- h. Select OK to add the new CMI to the selected HIC/sector (Alpha/Beta/Gamma).
- i. At HIC CONTROL PANEL dialog, confirm icon of added CMI is green. If alarms occur and CATV Plant/BTS signal are connected and correct, the CMI being activated is the suspected failure. Table 2-6 lists the alarms recognized by the HECU software and the probable equipment failure for each alarm.

**NOTE**

For further alarm information, refer to the PCS-Over-Cable Version 1.85 Operation and Maintenance Manual for Headend Equipment and Cable Microcell Integrator Document No. 8337148.

- j. At HEADEND CONTROL PANEL dialog, select Alarms, then CMI Out Of Service Control.
- k. At the CMI OUT OF SERVICE dialog, select Out Of Service Indicator ON and select all desired alarms, then select OK.

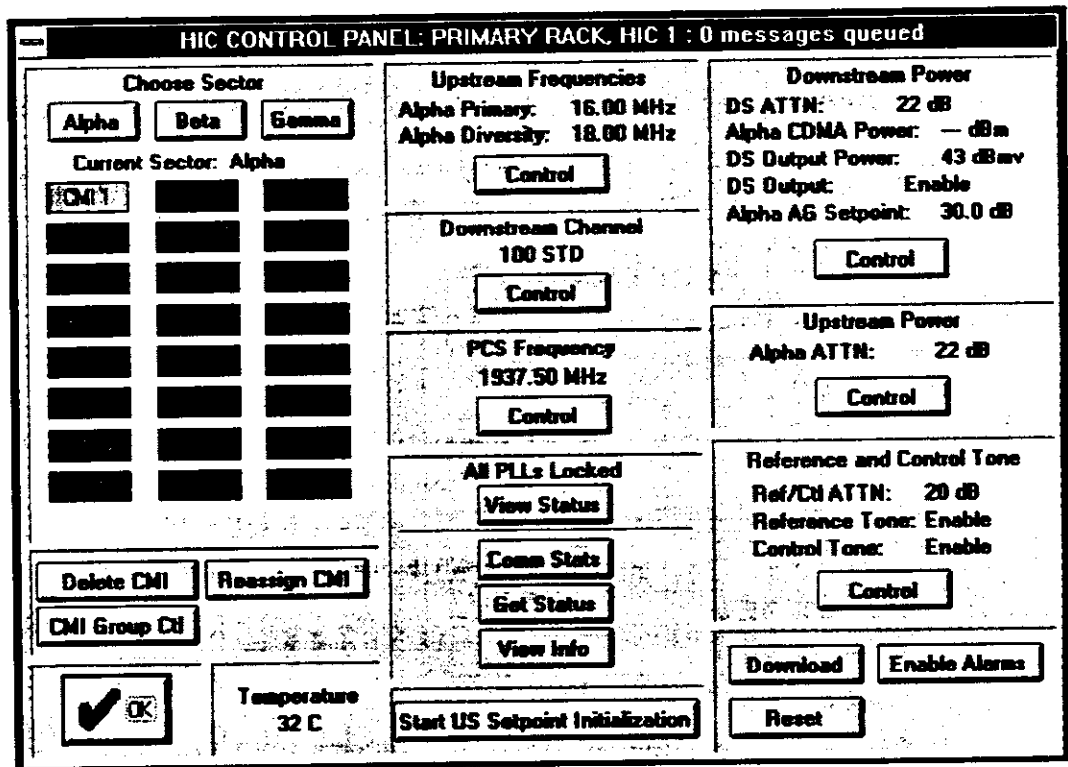


Figure 3-17. Typical HIC CONTROL PANEL Dialog



Figure 3-18. Typical ADD CMI Dialog

### 3.6.3 Measure Reverse Link Control Tone at CMI

This procedure, together with the next one, checks the Reverse link CATV Control Tone signal level from the CMI to the Cable Plant Headend to ensure the level is within specifications.

#### NOTE

This procedure requires the use of a spectrum analyzer at the CMI.

- a. Open CMI per paragraph 3.3.2. Verify that both attenuator pads and equalizer pad, 0 dB or other calculated values, are installed in Power Extractor.
- b. Remove REVTEST test point CATV-plug from CMI.
- c. Insert a Long Reach Test Point Adapter through the access hole to mate with Power Extractor test point. Connect a short Type F test cable between the Long Reach Test Point Adapter and meter.
- d. At REVTEST Test Point, verify that Reverse link Control Tone level is between +8 dBmV and +18 dBmV. If level is too high, insert a fixed attenuator of larger value in REV ATTEN pad location of the Power Extractor (refer to paragraph 3.3.5). Record this level and fixed attenuator value.
- e. Replace REVTEST test point CATV plug, and close CMI per paragraph 3.3.2.

3.6.4 **Measure CMI Reverse Link Control Tone at HIC**

- a. At HIC CONTROL PANEL dialog (Figure 3-17), verify that icon of CMI to be measured is green (active, normal operation).
- b. At CMI GROUP CONTROL dialog, disable *Autostats* for all CMIs on sector of CMI to be measured.
- c. At HIC CONTROL PANEL dialog, double-click on icon of CMI to be measured; CMI CONTROL PANEL dialog appears (Figure 3-19).
- d. Select Control button for *Transceiver Parameters*; TRANSCEIVER CONTROL dialog appears showing *Autostats* disabled. At TRANSCEIVER CONTROL dialog, enable all functions and click OK.
- e. Using a spectrum analyzer (75-ohm input), observe the designated alpha, beta, or gamma sector UPSTREAM TEST POINT (CATV Control Tone) signal at HIC front panel. Verify that Control Tone amplitude is approximately 15 dB below the Video Reference level, approximately -22 dBmV.
- f. If necessary, use CMI UPSTREAM POWER dialog to adjust *Control Tone ATTN* until Control Tone amplitude is 15 dB below Video Reference level. Select Save To EEPROM to save the new settings.
- g. Record CMI UPSTREAM POWER dialog *Control Tone ATTN* setting.
- h. For the CMI being measured, at CMI CONTROL PANEL dialog, select *Transceiver Parameters Control*. At TRANSCEIVER CONTROL dialog, ensure that all parameters are disabled.

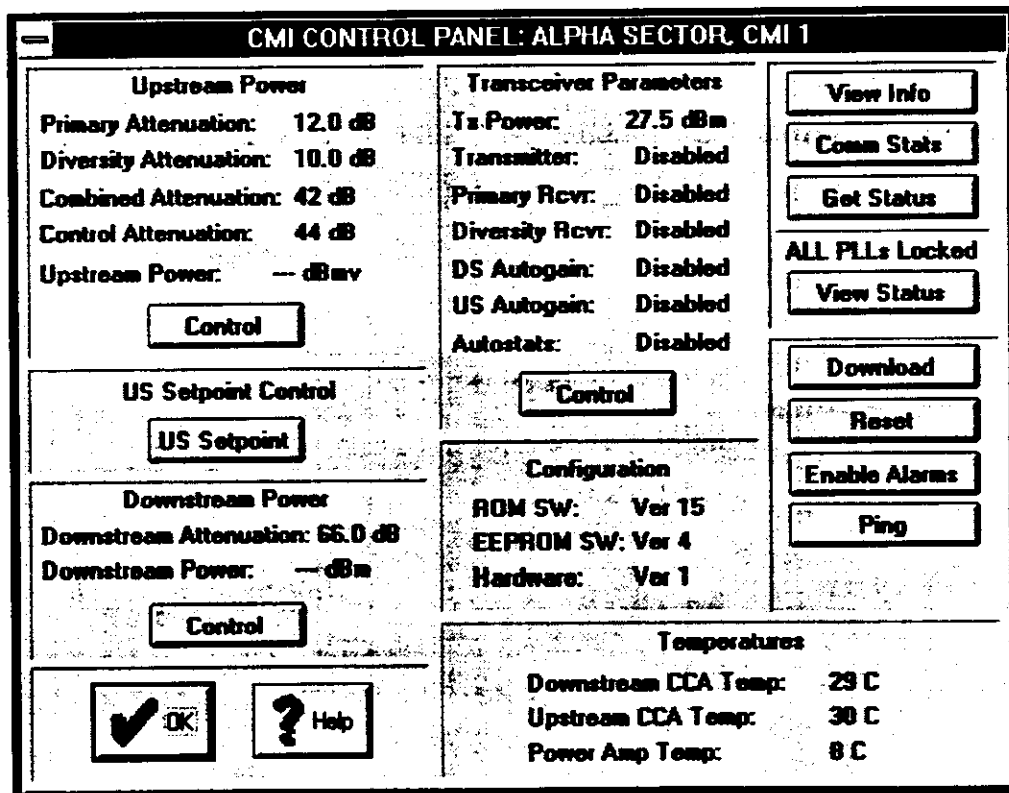


Figure 3-19. Typical CMI CONTROL PANEL Dialog

**NOTE**

After all CMIs installed for a given sector or node have been checked and adjusted individually per the procedures above, perform the following procedures for all CMIs assigned to a given HIC.

**3.6.5 Setting CMI Reverse Link Signal Level Setpoint at HIC**

This procedure, or the alternate procedure in paragraph 3.6.7, is used to determine the target reverse link (upstream) output level for all the CMIs assigned to a given HIC in a given sector. This target level is otherwise known as the upstream autogain setpoint. The ideal target level for a single CMI in a simulcast will depend on the number of CMIs in the simulcast.

- a. Measure the reverse link video reference at HIC UPSTREAM TEST POINT for sector of interest (Alpha, Beta, Gamma). Record this value.
- b. At HEADEND CONTROL PANEL dialog, select **Alarms**, then **CMI Out Of Service Control**.
- c. At CMI OUT OF SERVICE dialog, select Out Of Service Indicator OFF to disable all Out Of Service alarms, then select OK.
- d. At HEADEND CONTROL PANEL dialog, select the first HIC to be worked on.
- e. At HIC CONTROL PANEL dialog, select CMI Group Ctl and disable all functions except *Alarms* for all sectors that have CMIs attached, then select OK.
- f. At the HIC CONTROL PANEL dialog, select Start US Setpoint Initialization.
- g. With all CMIs disabled, at appropriate HIC UPSTREAM TEST POINT, measure reverse link CATV noise floor over intended frequency range. (The noise floor at this point will represent the combined noise effects of each fiber node in the sector.)
- h. Calculate the Rough Target for a single CMI by the following formula:  
$$\text{Rough Target} = \text{Video Reference} - 31 - 10 \log(n)$$
where  $n$  is the number of CMIs in the sector. Record this value.
- e. If Rough Target is less than 5 dB above CATV noise floor, then alternate balancing method must be used (paragraph 3.6.7).
- f. If Rough Target is greater than or equal to 5 dB above the noise floor, proceed to the Upstream Setpoint Initialization procedure, paragraph 3.6.6.

**3.6.6 Upstream Setpoint Initialization**

- a. At HIC CONTROL PANEL dialog, select Sector and CMI to be set.
- b. Connect Spectrum Analyzer to appropriate sector UPSTREAM TEST POINT on front panel of selected HIC.
- c. Set up Spectrum Analyzer as follows:

- Center Frequency at midpoint of chosen sector Primary and Diversity upstream frequencies.
  - Frequency Span - 4 MHz.
  - Resolution Bandwidth - 30 kHz
  - Input - 75 Ohms.
  - Amplitude Units to dBmV and scale to 1 dB per div.
  - Input Attenuator - 0 dB.
  - Enable the Display Line and place it at mid screen
  - Select BW and turn on Vid Avg, set for 100 samples average.
  - Adjust Reference Level until the Display Line readout indicates Rough Target value.
- d. At the CMI CONTROL PANEL dialog, select US Setpoint.
- e. Wait a few moments for Upstream Setpoint to take effect and pedestal levels to settle, then observe levels of Primary and Diversity pedestals on Spectrum Analyzer.
- f. Observe the average levels of Primary and Diversity pedestals. If one is below the Rough Target Display Line, increment UP the appropriate setpoint control in the US SETPOINT INITIALIZATION dialog to move Upstream pedestal near mid-screen. If one is above the Rough Target Display Line, increment DOWN the appropriate setpoint control. (Each increment of the Up/Down indicator is equal to approximately 0.5 dB).
- g. Select Update button.
- h. Observe Status indicator: It is red while updating is in progress and turns green when the update is complete. Wait a few moments for new Upstream Setpoint to take effect, then observe Spectrum Analyzer to determine if another adjustment is required. Continue this process until the final US Setpoint selected produces pedestal levels that average out to Rough Target value  $\pm 0.25$  dB.
- i. When satisfied that the setpoint is as close as possible, select Exit at the US SETPOINT INITIALIZATION dialog to save the last setpoint. Note that selecting Cancel will close dialog but will not save correct setpoint value.
- j. Select OK to close CMI CONTROL PANEL dialog.
- k. At HIC CONTROL PANEL dialog, select next CMI in present Sector to be set.
- l. Repeat steps d through k to complete all CMIs in present Sector.
- m. Repeat steps b through k to complete all the Sectors in the HIC.
- n. After all CMIs have been set, from HIC CONTROL PANEL dialog, select Stop US Setpoint Initialization.
- o. At HIC CONTROL PANEL dialog, select CMI Group Ctl and enable all functions for all Sectors that have CMIs attached, then select OK.

- p. If additional HICs are to be adjusted, repeat paragraph 3.6.5 for each HIC.
- q. At HEADEND CONTROL PANEL dialog, select **Alarms**, then **CMI Out Of Service Control**.
- r. At the CMI OUT OF SERVICE dialog, select Out Of Service Indicator ON and select all desired alarms, then select OK.

### 3.6.7 Alternate Balancing Method

In some cases the target level of a single CMI may be close to—or even beneath—the combined CATV noise floor. In these cases the pedestal cannot be used to balance the CMI. Instead a test signal is used.

- a. At HIC CONTROL PANEL dialog, select Stop US Setpoint Initialization.
- b. At CMI UPSTREAM POWER dialog, activate desired CMI by enabling receivers and setting combined reverse link attenuators to nominal values: Primary: 5; Diversity: 5; Combined: 44.
- c. With spectrum analyzer connected to the HIC upstream test point of interest, verify that pedestals are at least 10 dB above noise floor. If necessary, adjust attenuator settings at CMI UPSTREAM POWER dialog.
- d. At CMI CONTROL PANEL dialog, select Ping. At the resulting PING CMI dialog, enable test signals on desired CMI.
- e. Measure power levels of the two test signals and average power of pedestals. Record these values.
- f. Calculate power difference between the test signals and the pedestals., Record these values.
- g. Calculate final target levels for the two test signals of a single CMI by adding Rough Target level—measured in paragraph 3.6.5—to the difference between test signals and the pedestals. (In this way, the test signals are used to gauge when the pedestals are at the desired setpoint for the sector, since the appropriate level is too close to the noise floor to be accurately measured. Note that there will be a separate target level for each CMI signal, Primary and Diversity.) Record final target levels.
- h. With a single CMI enabled, enable test signal and adjust upstream attenuators at CMI UPSTREAM POWER dialog until both primary and diversity test signals are at desired target level. Save these attenuator settings to EEPROM, and record these values.
- i. At TRANSCEIVER CONTROL dialog, disable all functions for CMI just adjusted.
- j. Repeat this procedure for each CMI in sector.

**Appendix A. PCS Channel to Frequency Cross Reference**

PCS CDMA CHANNEL NUMBER	CMI PCS TRANSMIT FREQ (MHz)	CMI PCS RECEIVE FREQ (MHz)	PCS CDMA CHANNEL NUMBER	CMI PCS TRANSMIT FREQ (MHz)	CMI PCS RECEIVE FREQ (MHz)
1	1930.05	1850.05	48	1932.40	1852.40
2	1930.10	1850.10	49	1932.45	1852.45
3	1930.15	1850.15	50	1932.50	1852.50
4	1930.20	1850.20	51	1932.55	1852.55
5	1930.25	1850.25	52	1932.60	1852.60
6	1930.30	1850.30	53	1932.65	1852.65
7	1930.35	1850.35	54	1932.70	1852.70
8	1930.40	1850.40	55	1932.75	1852.75
9	1930.45	1850.45	56	1932.80	1852.80
10	1930.50	1850.50	57	1932.85	1852.85
11	1930.55	1850.55	58	1932.90	1852.90
12	1930.60	1850.60	59	1932.95	1852.95
13	1930.65	1850.65	60	1933.00	1853.00
14	1930.70	1850.70	61	1933.05	1853.05
15	1930.75	1850.75	62	1933.10	1853.10
16	1930.80	1850.80	63	1933.15	1853.15
17	1930.85	1850.85	64	1933.20	1853.20
18	1930.90	1850.90	65	1933.25	1853.25
19	1930.95	1850.95	66	1933.30	1853.30
20	1931.00	1851.00	67	1933.35	1853.35
21	1931.05	1851.05	68	1933.40	1853.40
22	1931.10	1851.10	69	1933.45	1853.45
23	1931.15	1851.15	70	1933.50	1853.50
24	1931.20	1851.20	71	1933.55	1853.55
25	1931.25	1851.25	72	1933.60	1853.60
26	1931.30	1851.30	73	1933.65	1853.65
27	1931.35	1851.35	74	1933.70	1853.70
28	1931.40	1851.40	75	1933.75	1853.75
29	1931.45	1851.45	76	1933.80	1853.80
30	1931.50	1851.50	77	1933.85	1853.85
31	1931.55	1851.55	78	1933.90	1853.90
32	1931.60	1851.60	79	1933.95	1853.95
33	1931.65	1851.65	80	1934.00	1854.00
34	1931.70	1851.70	81	1934.05	1854.05
35	1931.75	1851.75	82	1934.10	1854.10
36	1931.80	1851.80	83	1934.15	1854.15
37	1931.85	1851.85	84	1934.20	1854.20
38	1931.90	1851.90	85	1934.25	1854.25
39	1931.95	1851.95	86	1934.30	1854.30
40	1932.00	1852.00	87	1934.35	1854.35
41	1932.05	1852.05	88	1934.40	1854.40
42	1932.10	1852.10	89	1934.45	1854.45
43	1932.15	1852.15	90	1934.50	1854.50
44	1932.20	1852.20	91	1934.55	1854.55
45	1932.25	1852.25	92	1934.60	1854.60
46	1932.30	1852.30	93	1934.65	1854.65
47	1932.35	1852.35	94	1934.70	1854.70

**PCS Channel to Frequency Cross Reference (Continued)**

PCS CDMA CHANNEL NUMBER	CMI PCS TRANSMIT FREQ (MHz)	CMI PCS RECEIVE FREQ (MHz)	PCS CDMA CHANNEL NUMBER	CMI PCS TRANSMIT FREQ (MHz)	CMI PCS RECEIVE FREQ (MHz)
95	1934.75	1854.75	140	1937.00	1857.00
96	1934.80	1854.80	141	1937.05	1857.05
97	1934.85	1854.85	142	1937.10	1857.10
98	1934.90	1854.90	143	1937.15	1857.15
99	1934.95	1854.95	144	1937.20	1857.20
100	1935.00	1855.00	145	1937.25	1857.25
101	1935.05	1855.05	146	1937.30	1857.30
102	1935.10	1855.10	147	1937.35	1857.35
103	1935.15	1855.15	148	1937.40	1857.40
104	1935.20	1855.20	149	1937.45	1857.45
105	1935.25	1855.25	150	1937.50	1857.50
106	1935.30	1855.30	151	1937.55	1857.55
107	1935.35	1855.35	152	1937.60	1857.60
108	1935.40	1855.40	153	1937.65	1857.65
109	1935.45	1855.45	154	1937.70	1857.70
110	1935.50	1855.50	155	1937.75	1857.75
111	1935.55	1855.55	156	1937.80	1857.80
112	1935.60	1855.60	157	1937.85	1857.85
113	1935.65	1855.65	158	1937.90	1857.90
114	1935.70	1855.70	159	1937.95	1857.95
115	1935.75	1855.75	160	1938.00	1858.00
116	1935.80	1855.80	161	1938.05	1858.05
117	1935.85	1855.85	162	1938.10	1858.10
118	1935.90	1855.90	163	1938.15	1858.15
119	1935.95	1855.95	164	1938.20	1858.20
120	1936.00	1856.00	165	1938.25	1858.25
121	1936.05	1856.05	166	1938.30	1858.30
122	1936.10	1856.10	167	1938.35	1858.35
123	1936.15	1856.15	168	1938.40	1858.40
124	1936.20	1856.20	169	1938.45	1858.45
125	1936.25	1856.25	170	1938.50	1858.50
126	1936.30	1856.30	171	1938.55	1858.55
127	1936.35	1856.35	172	1938.60	1858.60
128	1936.40	1856.40	173	1938.65	1858.65
129	1936.45	1856.45	174	1938.70	1858.70
130	1936.50	1856.50	175	1938.75	1858.75
131	1936.55	1856.55	176	1938.80	1858.80
132	1936.60	1856.60	177	1938.85	1858.85
133	1936.65	1856.65	178	1938.90	1858.90
134	1936.70	1856.70	179	1938.95	1858.95
135	1936.75	1856.75	180	1939.00	1859.00
136	1936.80	1856.80	181	1939.05	1859.05
137	1936.85	1856.85	182	1939.10	1859.10
138	1936.90	1856.90	183	1939.15	1859.15
139	1936.95	1856.95	184	1939.20	1859.20

## Appendix B. CATV Channel to Frequency Cross Reference

EIA No.	STD	HRC	IRC
1	N/A	72.0036	73.2625
2	55.2500	54.0027	55.2625
3	61.2500	60.0030	61.2625
4	67.2500	66.0033	67.2625
5	77.2500	n/a	n/a
6	83.2500	n/a	n/a
5	N/A	78.0039	79.2625
6	N/A	84.0042	85.2625
7	175.2500	174.0087	175.2625
8	181.2500	180.0090	181.2625
9	187.2500	186.0093	187.2625
10	193.2500	192.0096	193.2625
11	199.2500	198.0099	199.2625
12	205.2500	204.0102	205.2625
13	211.2500	210.0105	211.2625
14	121.2625	120.0060	121.2625
15	127.2625	126.0063	127.2625
16	133.2625	132.0066	133.2625
17	139.2500	138.0069	139.2625
18	145.2500	144.0072	145.2625
19	151.2500	150.0075	151.2625
20	157.2500	156.0078	157.2625
21	163.2500	162.0081	163.2625
22	169.2500	168.0084	169.2625
23	217.2500	216.0108	217.2625
24	223.2500	222.0111	223.2625
25	229.2625	228.0114	229.2625
26	235.2625	234.0017	235.2625
27	241.2625	240.0120	241.2625
28	247.2625	246.0123	247.2625
29	253.2625	252.0126	253.2625
30	259.2625	258.0129	259.2625
31	265.2625	264.0132	265.2625
32	271.2625	270.0135	271.2625
33	277.2625	276.0138	277.2625
34	283.2625	282.0141	283.2625
35	289.2625	288.0144	289.2625
36	295.2625	294.0147	295.2625
37	301.2625	300.0150	301.2625
38	307.2625	306.0153	307.2625
39	313.2625	312.0156	313.2625
40	319.2625	318.0159	319.2625
41	325.2625	324.0162	325.2625
42	*331.2750	330.0165	*331.2750
43	337.2625	336.0168	337.2625
44	343.2625	342.0171	343.2625
45	349.2625	348.0174	349.2625
46	355.2625	354.0177	355.2625
47	361.2625	360.0180	361.2625
48	367.2625	366.0183	367.2625
49	373.2625	372.0186	373.2625
50	379.2625	378.0189	379.2625
51	385.2625	384.0192	385.2625
52	391.2625	390.0195	391.2625
53	397.2625	396.0198	397.2625
54	403.2500	402.0201	403.2625
55	409.2500	408.0204	409.2625
56	415.2500	414.0207	415.2625
57	421.2500	420.0210	421.2625
58	427.2500	426.0213	427.2625
59	433.2500	432.0216	433.2625
60	439.2500	438.0219	439.2625
61	445.2500	444.0222	445.2625
62	451.2500	450.0225	451.2625
63	457.2500	456.0228	457.2625
64	463.2500	426.0231	463.2625

EIA No.	STD	HRC	IRC
65	469.2500	468.0234	469.2625
66	475.2500	474.0237	475.2625
67	481.2500	480.0240	481.2625
68	487.2500	486.0243	487.2625
69	493.2500	492.0246	493.2625
70	499.2500	498.0249	499.2625
71	505.2500	504.0252	505.2625
72	511.2500	510.0255	511.2625
73	517.2500	516.0258	517.2625
74	523.2500	522.0261	523.2625
75	529.2500	528.0264	529.2625
76	535.2500	534.0267	535.2625
77	541.2500	540.0270	541.2625
78	547.2500	546.0273	547.2625
79	553.2500	552.0276	553.2625
80	559.2500	558.0279	559.2625
81	565.2500	564.0282	565.2625
82	571.2500	570.0285	571.2625
83	577.2500	576.0288	577.2625
84	583.2500	582.0291	583.2625
85	589.2500	588.0294	589.2625
86	595.2500	594.0297	595.2625
87	601.2500	600.0300	601.2625
88	607.2500	606.0303	607.2625
89	613.2500	612.0306	613.2625
90	619.2500	618.0309	619.2625
91	625.2500	624.0312	625.2625
92	631.2500	630.0315	631.2625
93	637.2500	636.0318	637.2625
94	643.2500	642.0321	643.2625
95	91.2500	90.0045	91.2625
96	97.2500	96.0048	97.2625
97	103.2500	102.0051	103.2625
98	*109.2750	108.025	*109.2750
99	*115.2750	114.025	115.2750
-	649.2500	648.0324	649.2625
-	655.2500	654.0327	655.2625
-	661.2500	660.0330	661.2625
-	667.2500	666.0333	667.2625
-	673.2500	672.0336	673.2625
-	679.2500	678.0339	679.2625
-	685.2500	684.0342	685.2625
-	691.2500	690.0345	691.2625
-	697.2500	696.0348	697.2625
-	703.2500	702.0351	703.2625
-	709.2500	708.0354	709.2625
-	715.2500	714.0357	715.2625
-	721.2500	720.0360	721.2625
-	727.2500	726.0363	727.2625
-	733.2500	732.0366	733.2625
-	739.2500	738.0369	739.2625
-	745.2500	744.0372	745.2625
-	751.2500	750.0375	751.2625

\* Special Assignment

EIA No. = EIA channel designation  
 Frequency values, in MHz, are picture carrier frequencies of the three EIA CATV channel allocation plans: STD = Standard, HRC = Harmonically Regulated Carriers, IRC = Incrementally Related Carriers



**RACK/HIC DATA SHEET**

HIC Serial Number \_\_\_\_\_

Neuron® Chip Number \_\_\_\_\_

Location/Cell ID \_\_\_\_\_

Para No.	Step No	Name	Value
2.6.1.5	h	Busbar voltage	_____ Vdc
2.7.1	d	15 MHz Reference	_____ dBm
2.8.3.1	d	CDMA Forward Link input power	_____ dBm
2.8.3.3	d	Reference and Tone Control attenuator	_____ dB
2.8.3.4	e	Forward Link Pilot Level at DS Test Point	_____ dBmV
2.8.3.4	e	DS Attenuator Setting	_____ dB
2.8.3.5	a.3)	Reference Tone Amplitude at Headend	_____ dBmV
2.8.3.5	a.3)	Reference and Control Tone Attenuator setting	_____ dB
2.8.3.5	a.3)	Video Reference Level at Headend	_____ dBmV
2.8.3.5	b.4)	Forward Link CDMA Pilot Level at Headend	_____ dBmV
2.8.3.5	b.5)	Final DS Attenuator setting	_____ dB
3.6.1.2	d	Reverse Link power level at HIC	_____ dBmV
3.6.5	a	Reverse Link Video Reference	_____ dBmV

**CMI DATA SHEET**

CMI Serial Number \_\_\_\_\_

Neuron® Chip Number \_\_\_\_\_

Location \_\_\_\_\_

Para No.	Step No	Name	Value
3.5.1	e	Channel 2 video carrier	_____ dBmV
3.5.1	f	Channel 76 video carrier	_____ dBmV
3.5.2	d	Video Reference level	_____ dBmV
3.5.3	g	Forward Link Reference Tone level	_____ dBmV
3.5.3	g	FWD ATTN pad value	_____ dB
3.6.3	d	Reverse link Control Tone level	_____ dBmV
3.6.3	d	REV ATTN pad value	_____ dB
3.6.4	g	Reverse link Control Tone ATTN setting	_____ dB
3.6.5	h	Rough Target value for Upstream Setpoint	_____ dBmV
3.6.7	e	Ping power level - Primary	_____ dBmV
3.6.7	e	Ping power level - Diversity	_____ dBmV
3.6.7	e	Pedestal Average power level - Primary	_____ dBmV
3.6.7	e	Pedestal Average power level - Diversity	_____ dBmV
3.6.7	f	Ping - Pedestal difference, Primary	_____ dBmV
3.6.7	f	Ping - Pedestal difference, Diversity	_____ dBmV
3.6.7	g	Final Target level - Primary	_____ dBmV
3.6.7	g	Final Target level - Diversity	_____ dBmV
3.6.7	h	Upstream Primary ATTN	_____ dB
3.6.7	h	Upstream Diversity ATTN	_____ dB



