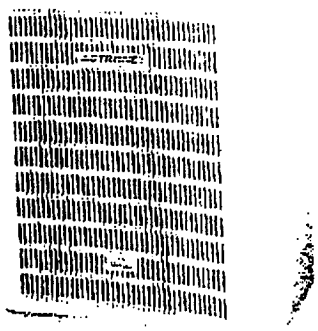
Micro-MDBS™



Micro-MDBS is a wireless data communications system that extends today's cellular digital packet data (CDPD) services to localized environments not covered by existing macrocellular networks. A go-anywhere RF-based data-delivery system, Micro-MDBS provides an economical, easy-to-install alternative to expensive and often confining wire-bound network installations.

Micro-MDBS can be installed either as a microcellular link to a public CDPD network or as the central component of a private or a semi-private wireless network. The system is ideally suited for large factories, hospitals, shopping malls, airports, office buildings, convention centers, campuses, and other centralized locations beyond the coverage of existing macrocellular services. The wireless mobility of a typical Micro-MDBS network allows users to address a wide variety of applications, including credit card verification, inventory management, database inquiry, short messaging, and hospital administration and patient management.

Because Micro-MDBS is wireless, users can move about freely, sending and receiving data from virtually any location, without the limitations of computer hookups or power outlets. Mobility is provided via portable "smart phones," mobile data terminals, or wireless palm-top computers. Micro-MDBS opens up the workplace as never before to a host of cellular data communications services both public and private.

Micro-MDBS consists of two main components: a multichannel controller (MCC) for network management, control, and diagnostics, along with up to 32 remote CDPD Molecules for data transmission and reception. During transmission, a cellular smart phone or terminal beams data to the nearest CDPD molecule. Each data molecule can support one or two RF channels that capture and route the information to the MCC, using the industry-standard Internet Protocol (IP). From the MCC, incoming data can be sent by frame relay to a mobile data intermediate station (MD-IS), which adds security encryption and forwards the information via a private or public network to a central computer site or other remote destinations. Micro-MDBS supports a large variety of MCC-to-CDPD Molecule connectivity options, including RS-232, RS-422, and Ethernet.

Micro-MDBS features an SNMP-based network management system for both local-console and remote administration, including configuration management, operations management, performance management, and fault management.

ASTRONET® Mitsubishi Electric

TAKING WIRELESS ANYWHERE

Key Benefits

Single controller — Unlike "fixed-radio" CDPD systems, which require a *separate* controller for each transceiver, Micro-MDBS features a distributed architecture that can link up to 32 CDPD-Molecule transceivers to a ***single*** MCC, saving tens of thousands of dollars on hardware and costs, especially for larger networks.

Lower installation costs — Micro-MDBS is designed to take advantage of commercially available off-the-shelf components and operating systems. In addition, the system can make use of existing Ethernet or twisted pair cabling, reducing hardware and labor costs. The net result: lower capital outlays and the assurance that industry-standard software and hardware will keep pace with advances in technology.

Extended range — With the addition of repeaters or modems, microcells can be distributed miles apart, while still using a single link to an MD-IS.

Simplified management and control — The entire Micro-MDBS network is monitored, controlled, and maintained from the system's central MCC with the help of an SNMP-based network management system. Information can be accessed at the MCC console itself or from a remote location. Besides managing channel assignments and power levels for CDPD molecules, the MCC provides configuration, operations, performance, and fault management.

Specifications

Multichannel Controller

Maximum RF channels	32
Connectivity options	Ethernet IP Serial Link IP (RS-232, RS-422)
Software/operating system	SCO UNIX release 4.20
Hardware platform	
CPU	80486-class
RAM	16 Mb
Hard drive	540 Mb
Network management	Local console administration SNMP remote support
Management functions	Configuration management Operations management Performance management Fault management

CDPD Molecules

Transceiver architecture	1 or 2 Mitsubishi CDPD RF units ASTRONET Transceiver interface unit
Transceiver output	800 mW
RF coverage	¼ mile radius in open space 1 or 2 floors in typical office building
Power supply	External 24 VDC from AC outlet
Housing	Wall-mount enclosure (optional outdoor enclosure available)

37 Skyline Drive, Suite 4100
Lake Mary, FL 32746-6214 407/333-4900
800/338-8251
e-mail: cdpd@astronet.mea.com

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TAKING WIRELESS ANYWHERE

Micro-MDBS

System Description

July 1996

Issue 1.0

ASTRONET Proprietary

Table Of Contents

1.0 General

This document describes ASTRONET's Micro-MD-BS, a Cellular Digital Packet Data (CDPD) Mobile Data Base Station (MD-BS). The Micro-MD-BS provides microcell coverage as augmentation to an existing CDPD macrocell network or as a base station in a private CDPD adjunct to a Local Area Network (LAN). With appropriate amplification equipment, the Micro-MD-BS can also serve as a CDPD macrocell base station.

2.0 System Design and Application

This section discusses the Micro-MD-BS' design parameters and its potential application in both public and private CDPD networks.

2.1 System Overview

ASTRONET's Micro-MD-BS is compliant with CDPD System Specification Revision 1.1. In order to facilitate the transition from earlier revisions of the CDPD System Specification the Micro-MD-BS is simultaneously compatible with Revision 1.0 of the CDPD System Specification as well.

The Micro-MD-BS is designed to take advantage of commercially available "off-the-shelf" components and operating systems to every extent possible. This ensures a high-quality, low cost product that is easily maintained and has the ability to "keep pace" with advances in technology.

2.2 Purpose and Use

The Micro-MD-BS will perform in a variety of applications in which conventional macrocell coverage is either not adequate or is prohibited by cost or scalability. Such applications are easily split between the domains of the Public CDPD Network and the Private or Semi-Private CDPD Network.

2.2.1 Public CDPD Network

In public CDPD networks the Micro-MD-BS will "fit into" the microcell "holes" in existing macrocell coverage. These holes occur in places such as Shopping Malls, Convention Centers, Airports, and other large structures, as well as outdoor areas like Campuses and Business Centers. This additional coverage will facilitate use of CDPD based Point-of-sale, Short messaging, and Database inquiry services in places with high concentrations of users.

In such applications, the Micro-MD-BS would be connected directly to a serving Mobile Data Intermediate Station (MD-IS) in the public CDPD network.

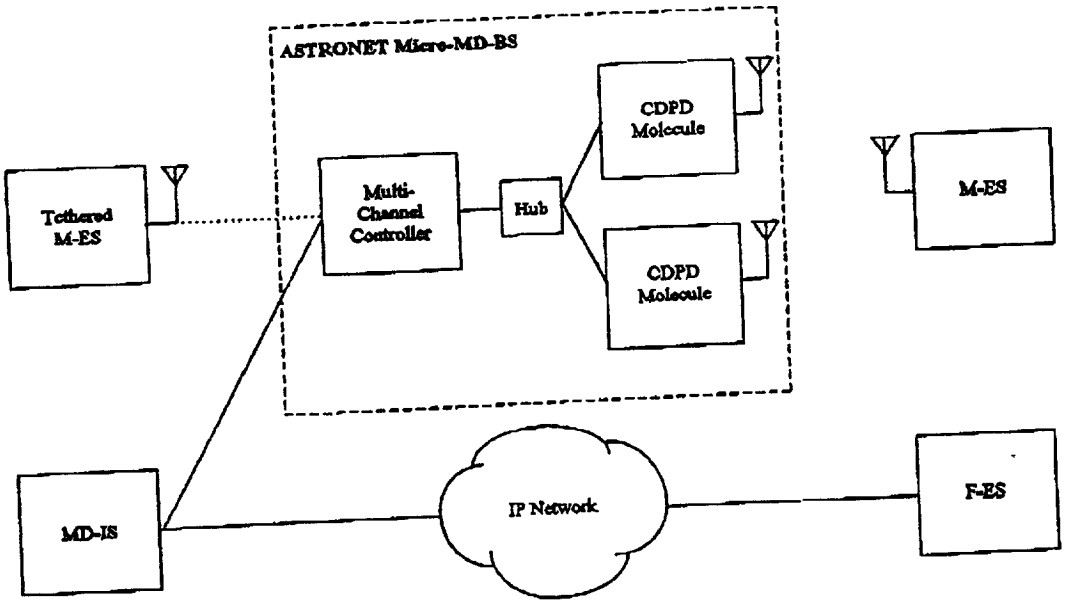
2.2.2 Private CDPD Network

ASTRONET's Micro-MD-BS also provides a feasible means of establishing a private wireless network based on CDPD. This is particularly useful in cases in which data need not be sent across the public network or in which large data transfers occur that would consume unnecessary and costly bandwidth on the public network. Examples of such private CDPD applications are inventory and materiel management in large warehouses and factories. Semi-private CDPD network applications are those in which the primary access to data would be routed through the private CDPD network while access is still available through the public CDPD network. Examples of such applications are database inquiry of patient information in hospitals, and initial transfer of route information for dispatched repair and delivery services.

In private and semi-private installations, the Micro-MD-BS could be connected directly to a dedicated serving MD-IS. In the case of a semi-private installation, the dedicated MD-IS would also be connected to the public CDPD network, serving as the home MD-IS for a given Mobile End Station (M-ES).

3.0 System Architecture

This section describes the basic architecture of the ASTRONET Micro-MD-BS. The block diagram is a representation of a simplified CDPD network and shows the fundamental hardware elements of ASTRONET's system.



ASTRONET's Micro-MD-BS in a Representative CDPD Network

3.1 General

The Micro-MD-BS is the data complement to OffiCell®, ASTRONET's microcell voice product introduced in 1993. The Micro-MD-BS is based upon a modified version of the Mitsubishi transceiver used in OffiCell with similar design and technical characteristics. With a maximum power output of 800 mW (unaided) the Mitsubishi CDPD transceiver is ideally suited for microcell applications.

The Micro-MD-BS is implemented with one or more CDPD Molecules which are managed by a centralized unit called a Multi-Channel Controller (MCC). Additionally, the MCC can control Tethered M-ESs used to perform RF channel quality monitoring and interference detection functions. (see block diagram)

3.2 Distributed Cell Concept

Each CDPD Molecule can support 1 or 2 channels of RF coverage. The Multi-Channel Controller's ability to accommodate up to 32 RF channels means that a fully loaded Micro-MD-BS can service from 16 to 32 separate CDPD Molecules.

The CDPD Molecules connected to a Multi-Channel Controller are not required to be co-located. ASTRONET decided to use the Internet Protocol (IP) as the data transport layer in communication between the Multi-Channel Controller and CDPD Molecule. These elements can, therefore, be distributed across large areas using standard network technology. Readily available devices such as repeaters and modems allow the microcells of a Micro-MD-BS to literally be separated by distances measured in miles, yet still be served by a single link to a serving MD-IS.

3.3 Connectivity Options

ASTRONET's choice of IP as a communication layer between the elements of a Micro-MD-BS provides many options in the area of connectivity. The most obvious would be the use of ethernet IP connections. Limitations on the separation distance between active elements on ethernet segments led to ASTRONET's implementation of Serial Link IP (SLIP)

communications over both RS-232 and RS-422. ASTRONET has successfully used 10Base-T ethernet IP, RS-232 SLIP direct-connect and over leased-line modem, and RS-422 SLIP.

4.0 Multi-Channel Controller

This section describes the functionality and hardware configuration of the Multi-Channel Controller element of the Micro-MD-BS.

4.1 Multi-Channel Controller Functionality

The Multi-Channel Controller (MCC) serves as the Micro-MD-BS' master device, managing channel assignments and power levels for each of the CDPD Molecules or microcells attached to it. The MCC provides the following functions for control of the CDPD Molecules:

- CDPD Molecule Configuration
- CDPD Molecule Operations control and status monitoring
- CDPD Molecule Performance Metrics collection
- CDPD Molecule Fault Notification collection

The MCC is also responsible for supplying information to the Mobile End Stations (M-ESs) concerning the CDPD network and directing the M-ESs to change channels as need. In this capacity the MCC handles the following aspects of Radio Resource Management:

- Broadcast of network identification, usage, and configuration for CDPD R1.1 and CDPD R1.0
- Channel Stream Management
- Planned Channel Hops
- Forced Channel Hops
- Congestion Control

The Multi-Channel Controller also acts as a logical channel or conduit between a CDPD Molecule and a serving MD-IS, It accepts CDPD traffic (MDLP frames) from one of its microcells and forwards it to the MD-IS. Return traffic from the MD-IS is routed to the appropriate microcell for delivery to the destination device.

Finally, the MCC serves as a centralized repository of information concerning the operating states of the physical and logical elements that make up the Micro-MD-BS. The information is accessable at the MCC's console device through the proprietary user interface or from a remote location via the MCC's Simple Network Management Protocol (SNMP) agent. The Micro-MD-BS management functions provided by the MCC include:

- Configuration Management
- Operations Management
- Performance Management
- Fault Management

4.2 Hardware Platform

The Multi-Channel Controller functionality is carried out by software hosted on a 80486 class computer. The standard configuration of the MCC includes a 3.5 inch floppy drive, 16 Mb of RAM, and at least a 540Mb IDE hard drive.

While not required, an optional VGA monitor and keyboard can be included which will allow the Micro-MD-BS to be locally configured and maintained.

Off-the-shelf components such as ethernet, multi-port serial and frame relay cards are included in the Multi-Channel Controller depending on the communications requirements between the MCC and CDPD Molecules and between the MCC and MD-IS.

4.3 Software and Operating System

The MCC software is implemented as a set of cooperative processes running on Santa Cruz Operation's SCO UNIX Release 4.2.0 with networking extensions. The UNIX operating system offers a stable, industry accepted platform for the Multi-Channel Controller with multitasking capabilities that allow for engineering of individual processes at a functional level. This provides for a more optimal implementation of the multi-threaded tasks performed by the MCC.

5.0 CDPD Molecule

This section describes the functionality and hardware configuration of the CDPD Molecule element of the Micro-MD-BS.

5.1 CDPD Molecule Functionality

The CDPD Molecule's main function is the transmission and reception of CDPD data over the air as directed by the Multi-Channel Controller. It also provides several support functions to aid the MCC in its collection of performance metrics and fault notifications. Console based functions are available on the CDPD Molecule to allow for initial configuration, status and event monitoring, as well as off-line diagnostics for troubleshooting.

5.2 Hardware Platform

The CDPD Molecule is housed in a custom wall mount enclosure. It contains one or two Mitsubishi CDPD transceivers and an associated ASTRONET CDPD Transceiver Interface Unit. Commercially available off-the-shelf components make up the rest of the CDPD Molecule.

The CDPD Molecule contains a 80386 class Single Board Computer (SBC) which provides basic processing for the unit. The SBC is equipped with 1 Mb of RAM and 1536K of Flash ROM used as a solid state hard drive.

A Digital Signal Processor (DSP) card is required for each transceiver in the CDPD Molecule. The Single Board Computer controls the DSP in its task of transforming the waveform received by the transceiver to digital data appropriate for the network and vice-versa. A serial I/O card is used by the SBC to support communications with the DSPs and transceivers.

The CDPD Molecule uses an external power supply to provide 24 VDC from a commerical AC source. The power supply can be located near any convenient AC power outlet while allowing the CDPD Molecule to be installed in a position appropriate to provide optimal RF coverage. The 24VDC supply eliminates the requirement for wiring to be performed by a licensed electrician.

An optional ethernet card may be included in the hardware configuration depending on communications requirements between the CDPD Molecule and the Multi-Channel Controller.

The standard configuration of the CDPD Molecule is appropriate for installation indoors, in office buildings or warehouses. An optional environmental enclosure is available to accommodate installations under extreme environmental conditions.

5.3 Software and Operating System

The CDPD Molecule software operates as several single tasking process running on a version of DOS 6.0 on the SBC's boot ROM. These processes are supplemented by imbedded code written for the Digital Signal Processor. The CDPD Molecule boots automatically from the internal ROM.

Version upgrades for the CDPD Molecule software are handled through communication with the associated Multi-Channel Controller. New versions of the CDPD Molecule software are installed on the controlling MCC and logged into the MCC's configuration database. The CDPD Molecule then automatically downloads the new version of the software.

6.0 Mitsubishi CDPD Transceiver Characteristics

The Mitsubishi transceiver used in the Micro-MD-BS is designed for compatibility with Release 1.1 of the CDPD System Specification. It contains dual receivers to allow for diversity reception and the receivers are designed for a sensitivity of -113 dBM. An unaided maximum output of 800 milliwatts is sufficient to provide RF coverage to an area of approximately one quarter mile radius in open space or to one or two floors of a common office building. This makes the Micro-MD-BS especially suited to microcell situations. The addition of appropriate power amplifiers and antennas

enable the Micro-MD-BS to perform as a macrocell Base Station.

7.0 Tethered M-ES

The Tethered M-ES is an additional unit designed to monitor the Micro-MD-BS' RF functionality. The Tethered M-ES performs closed loop testing of both the forward and reverse RF paths on a given channel. It is connected to the Multi-Channel Controller using an RS-232 link (hence, the term "tethered").

Tests can be invoked manually from the Multi-Channel Controller or can be configured to run periodically. The results of the tests are logged on the MCC and can be reported to the Network Management System as an event.

8.0 Multi-Channel Controller - CDPD Molecule Connectivity

This section describes the options available for connecting a CDPD Molecule to a Multi-Channel Controller. Such options include ethernet connections and connections over serial line interfaces such as RS-232 and RS-422. It is important to note that the connectivity options described here are not mutually exclusive. That is, more than one method of connecting CDPD Molecules to a single Multi-Channel Controller may be employed simultaneously.

8.1 General

ASTRONET deliberately chose IP as the communications layer between elements of the Micro-MD-BS because of its widespread acceptance in the networking field. The relatively inexpensive components and software required to construct an IP network as well as the availability of utilities for management of such a network make IP an attractive choice for implementation of a distributed system such as the Micro-MD-BS.

8.2 Ethernet Connections

At the Local Area Network level, IP is generally associated with ethernet technology. Since the Micro-MD-BS can be easily thought of as a special purpose LAN consisting of one MCC and one or more CDPD Molecules the use of ethernet hardware to support the communications between the Micro-MD-BS elements was the first and logical choice for implementation.

Standard ethernet 10Base- (10 million bits per second) hardware is inexpensive and software drivers are readily available for ASTRONET's chosen operating systems. The ethernet connection can be established with the addition of appropriate network interface cards to both the MCC, the CDPD Molecule and a hub (if required by the interface).

The common 10Base- ethernet wiretypes and the maximum distances between active elements are:

Common Name	Wire Type	Distance
10Base-T	Twisted Pair	100 Meters
10Base-2	Thin Coax	185 Meters
10Base-5	Thick Coax	500 Meters

Readily available repeaters or extenders can be used to increase separation distances between the MCC and the CDPD Molecules.

8.2.1 Installation in Existing Networks

Because of its reliance on common networking technology, the Micro-MD-BS can use the cabling and supplementary devices (hubs, routers, etc.) in a facility that already has a data network installed. The requirements for this type of installation are the availability of a network access port near the planned position of each CDPD Molecule and one for the Multi-Channel Controller. IP addresses must also be assigned for each of the devices.

The advantage of this type of install action is that the current network infrastructure is used, thus reducing the total cost of implementation of the CDPD network.

8.2.2 Installation As a Standalone Network

A simple installation of a Micro-MD-BS would most likely consist of a small number of CDPD Molecules communicating with their Multi-

Channel Controller over dedicated wiring. In this case, the installation is simply a standalone network and will require installation of cables as well as hubs and repeaters necessary to position the CDPD Molecules in such a way as to optimize coverage.

The advantage to the standalone network installation of a Micro-MD-BS is that the added bandwidth used by the communication between the MCC and the CDPD Molecules does not impact any currently existing network activity.

8.3 RS-232 Connections

The distance between active elements on an ethernet network may make installation of the Micro-MD-BS infeasible in large structures that do not already have an extensive data network. For this reason ASTRONET designed the Micro-MD-BS to be capable of using Serial Link IP as an alternate means of communication between the Multi-Channel Controller and the CDPD Molecules. RS-232 ports are available on the MCC and CDPD Molecule which can be used for this type of connection.

8.3.1 Direct Connections

A direct connection between the elements of the Micro-MD-BS is appropriate when short distances are involved. This situation would exist when the Multi-Channel Controller and the CDPD Molecule are located in the same room. The connection between the two elements is established through the use of a null-modem serial cable of the appropriate length. The maximum distance of a direct connect RS-232 link is approximately 50 feet. This is the simplest installation of the Micro-MD-BS.

8.3.2 Connections Using Modems

It is possible to use line drivers such as leased-line modems to extend the effective distance between the CDPD Molecule and its Multi-Channel Controller. With adequate equipment, separation distances on the order of miles can be easily achieved. The use of modems allows for installation of the Micro-MD-BS in a large facility by utilizing the facilities existing telephone wiring. This eliminates the need to install an extensive data network cable to support the Micro-MD-BS. These connections require adequate phone wire pairs and appropriate modems or line drivers for each CDPD Molecule.

8.4 RS-422 Connections

An alternative to the RS-232 communication is ASTRONET's use of SLIP over RS-422. RS-422 provides for a greater distance between the Multi-Channel Controller and the CDPD Molecule without using additional equipment. RS-422 can be implemented over twisted-pair cables such as phone wire. The maximum separation distance between elements using RS-422 for communication is 4000 feet. Connections of this type require availability of adequate cabling between the MCC and the CDPD Molecule.

9.0 Micro-MD-BS - MD-IS Connectivity

ASTRONET's Micro-MD-BS is primarily intended to augment the public CDPD network. As such, it must be able to interface with as many Mobile Data Intermediate Stations as available.

To date the Micro-MD-BS has been tested with products from the following MD-IS manufacturers:

- Retix
- Lucent Technologies (Frame Relay- UDP and Frame Relay -Native Mode Point-to-point)

Communication with each tested MD-IS has been proven over a V.35 DS0 link into a T1 channel. A PVC-Frame Relay protocol is established over the physical link.

The development of an interface compliant with the Hughes' MD-IS is in progress.

10.0 M-ES Support

The ASTRONET Micro-MD-BS has been tested for compatibility with many common Mobile End Stations and CDPD modems. To date, ASTRONET has tested the Micro-MD-BS with

products from the following CDPD modem manufacturers:

- Mitsubishi
- Sierra Wireless
- PCSI
- Cincinnati Microwave
- Motorola
- Novatel

The list of CDPD modems is continuously changing and testing with new modems is performed as they become available.

11.0 Micro-MD-BS Administration

This section discusses the facilities available for Configuration and Operations Management of the Micro-MD-BS

11.1 General

The Multi-Channel Controller serves as the central point of administration for the Micro-MD-BS. Whether administered locally, at the MCC's console, remotely via a login session or through the Network Management System interface the MCC provides the following capabilities to the user:

- Configuration Management
- Operations Management
- Performance Management
- Fault Management

The Configuration Management functions supported by the Micro-MD-BS allow setting the number of CDPD Molecules serviced by the system channel stream assignments and power levels for each CDPD Molecules. Parameters regarding communication with the serving MD-IS are also specified through the Configuration Management functions of the Micro-MD-BS. Configuration information for the Micro-MD-BS is stored in a binary file on the MCC. It is possible to change the configuration of the Micro-MD-BS while the system is in service.

Fault Management functions will automatically format and log or display administrative and alarm state information related to the physical (MCC, CDPD Molecule) and logical (software processes) elements of the Micro-MD-BS.

Performance metrics, such as the number of data frames received by the Micro-MD-BS and those that are forwarded to the MD-IS or rejected, are collected by the Micro-MD-BS. Functions are provided to format and display these metrics.

Operations Management functions are those that start up or shut down the Micro-MD-BS and its components. Additional functions can force a channel hop on a particular channel stream.

11.2 Console Administration

The MCC User Interface is a proprietary program that modifies the configuration database of the Micro-MD-BS. The interface is text based and is ideally suited for use from the MCC's console or a remote terminal session. Once modification of the database is made, the MCC User Interface informs the appropriate processes and the changes take effect.

11.3 Remote Administration Using SNMP

To facilitate remote administration of the Micro-MD-BS, a SNMP agent and SNMP v1 Management Information Base (MIB) are available on the Multi-Channel Controller. The MIB is designed to map closely to the OSI management definitions listed in the CDPD System Specification R1.1. The MIB objects also correspond to objects defined in the MCC User Interface described above.

11.4 Remote Administration Using CMIP

An interface to the Common Management Interface Protocol (CMIP) network management systems is currently in progress.

12.0 Interference Detection and Avoidance

The CDPD System Specification requires that an MD-BS be able to detect possible interference with the voice cellular system and channel hop, as required, to minimize such interference.

Issue 1
July 24, 1996

ASTRONET's Micro-MD-BS supports an AMPS gateway that provide an interface to an external interference detection device.

There are two interference detection functions that are inherent to the Micro-MD-BS. These utilize the CDPD Molecule's transceiver and the Tethered M-ES.

12.1 Reverse Channel Interference Detection Using the CDPD Molecule Transceiver

ASTRONET's implementation of interference detection using the CDPD Molecule's transceiver takes advantage of the fact that the transmissions received by the CDPD Molecule from an M-ES (reverse channel) are non-continuous or bursty. In the idle time between bursts from the M-ES, the CDPD Molecule monitors the reverse channel. Any non-CDPD signal above a specified strength threshold is interpreted as interference and a new channel is requested from the Multi-Channel Controller. Channel lists that are appropriate for individual CDPD Molecules are stored in the MCC's configuration database.

12.2 Forward Channel Interference Detection Using the Tethered M-ES

While interference detection on the reverse channel is possible through the use of the CDPD Molecule's receiver, it is not possible to tune the receiver to the forward channel (signal transmitted by a CDPD Base Station). To implement interference detection on the forward channel, ASTRONET designed a Tethered M-ES.

The Tethered M-ES is designed to monitor the quality of the RF channel in use by a given CDPD Molecule or Macro-MD-BS. The tests performed by the Tethered M-ES are done on a periodic basis. In the idle time between tests the Tethered M-ES can be commanded to switch to the next available channel in the CDPD Molecule's channel list and monitor the forward channel for interference. If interference is detected, the channel will be removed from the candidate list of available channels for the CDPD Molecule.

13.0 Availability

The Micro-MD-BS, ASTRONET's microcell CDPD Mobile Data Base Station, will be available in the third quarter of 1996. For more information please direct inquiries to:

Marketing Department
ASTRONET Corporation
37 Skyline Drive Suite 4100
Lake Mary, FL 32746
Attn.: CDPD Information

E-mail:
cdpd@astronet.mea.com

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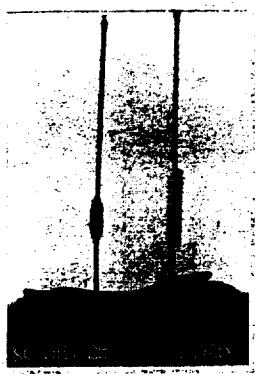

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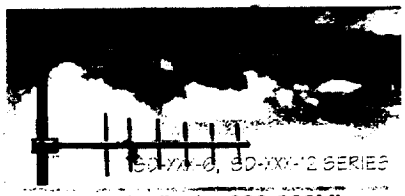

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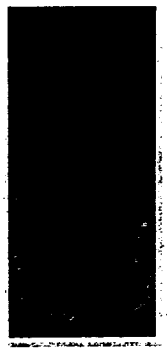

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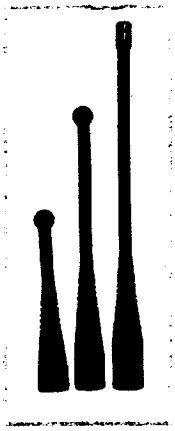

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Enclosed array, 824-894MHz directional with field adjustable reflector panels that provide horizontal beamwidths between 60 and 160 degrees. "N" female termination, 500W power rating.....$848.00

SRL-411C9R

Enclosed array, 824-896MHz adjustable. "N" female termination, 500W power rating.....$1,234.00

SRL-307

Yagi antenna, 406-512MHz, 7 element, 10dB rugged construction "N" male termination, 250W power rating.....$134.00

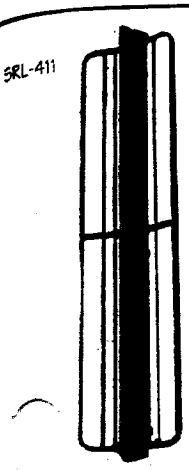
SRL-406

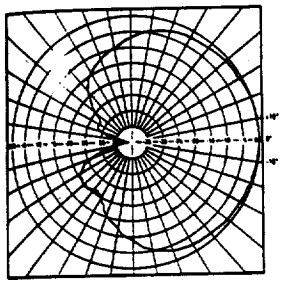
Yagi antenna, 806-960MHz, 10dB "N" male termination, 125W power rating.....$146.00

SRL-480

Omnidirectional antenna, 806-960MHz, 10dB designed for cellular systems. "N" female termination, 500W power rating.....$818.00

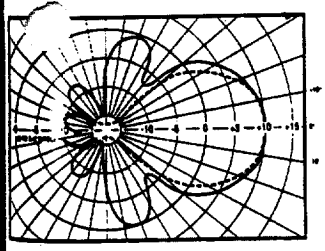
SRL-411





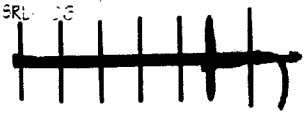
— Horizontal Radiation Pattern/130°

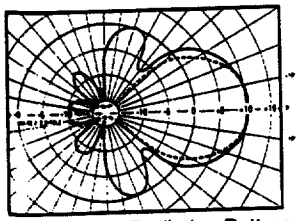
SRL-307



— Horizontal Radiation Pattern

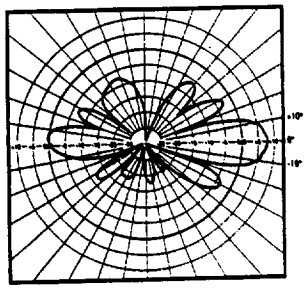
SRL-406





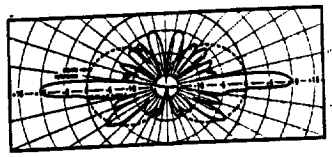
— Horizontal Radiation Pattern

SRL-410C4



— Vertical Radiation Pattern

SRL-480



— Vertical Radiation Pattern

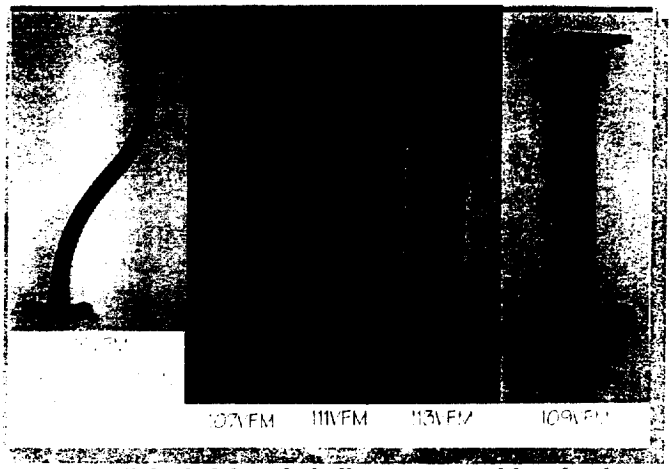
MOUNTS

Now install your mobile radio equipment or cellular equipment professionally.
SMC mounting hardware is assembled from machined **steel and aluminum components.** Manufacturing tolerance are maintained to insure **superior fit and finish. SMC** uses **high quality fasteners, including Teflon coated allen screws with nylon patches.** These patches ensure the allen screws stay securely tightened under vibration. The hardware is finished with a durable, **polyurethane enamel.** This low gloss, textured finish blends with virtually any setting and offers excellent resistance to nicks and scratches.

Operator will be fully satisfied due to easy access on his equipment.
Use SMC pedestal mount for the placement and installation of radio equipment, siren controls, light bars, control heads, scanners, cellular phones, portable radios, speakers, compact disks, stereos, faxes, laptops, etc.
Now, there is no limitation.
Pedestal Mounts ready to be installed regardless of space.
SMC Mounts meet all security norms including airbags on brand-new automobiles.
Call now for the most suitable mount to your needs.

SMC ELECTRO-MOUNT

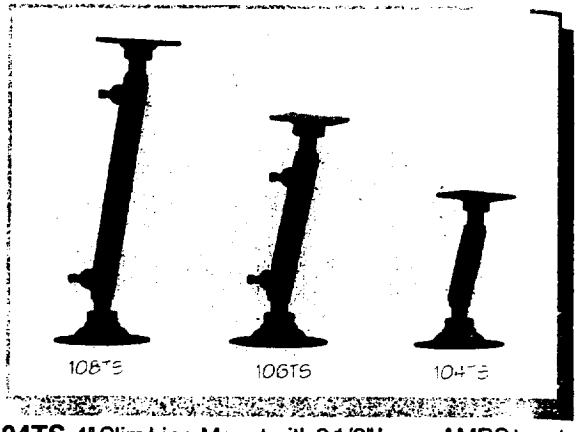
Vinyl Clad Flex Mounts



- **Flexible tubing totally encased in vinyl.**
- **Multi positionable base.**
- **Positions easily.**
- **Various lengths.**

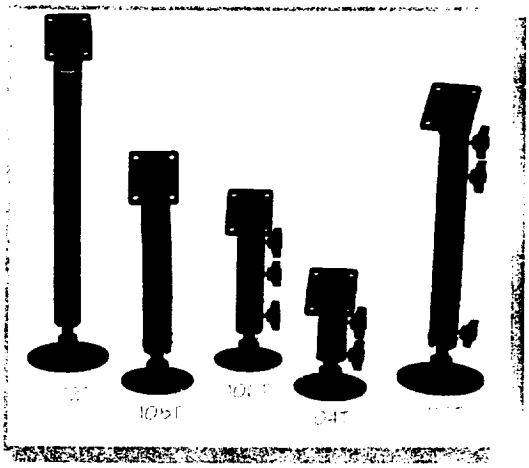
107VFM. 7 inch.....$11.00
109VFM. 9 inch.....$11.40
111VFM. 11 inch.....$12.00
113VFM. 13 inch.....$12.00
115VFM. 15 inch.....$13.00

Slim Line Mounts. Use them for Cellular, Portable and lightweight radios. 3 Lbs (1.5Kg)

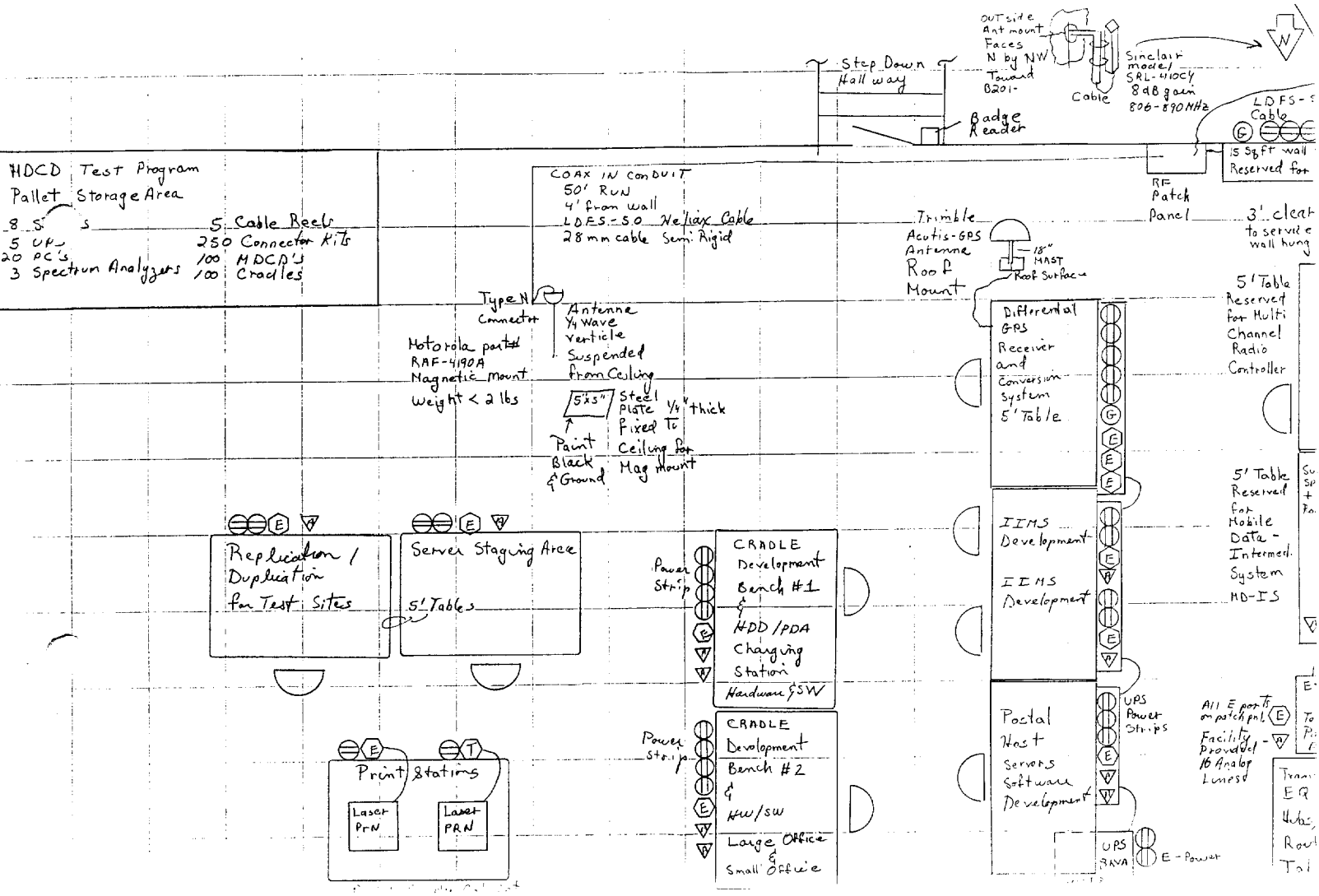


104TS. 4" Slim Line Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$7.00
106TS. 6" Slim Line Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$9.00
108TS. 8" Slim Line Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$10.00

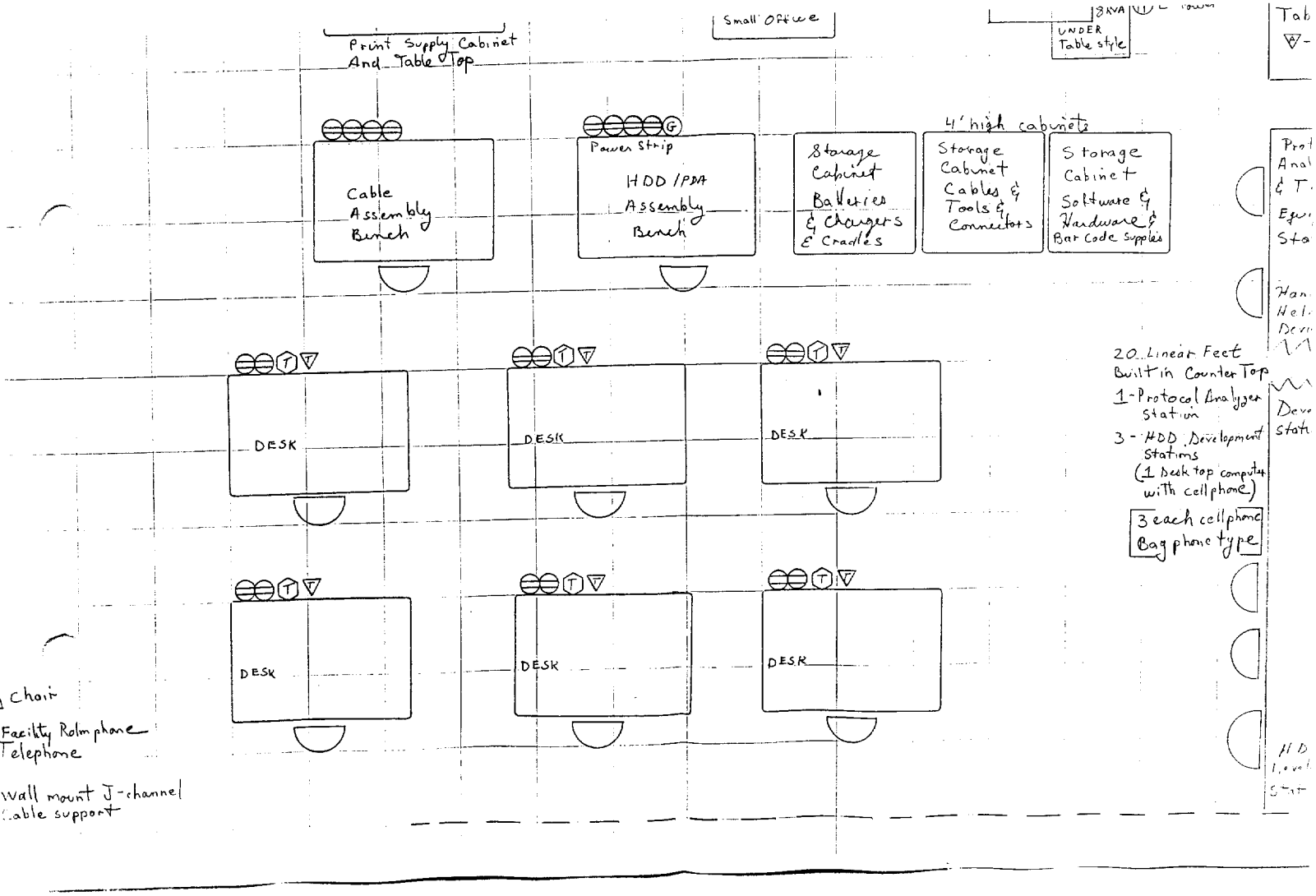
Pedestal Mounts (Up to 4.5 Lbs.)



104T. 4" Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$7.00
106T. 6" Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$9.00
108T. 8" Mount with 2 1/2" base, AMPS top plate and T-Knob fasteners.....$1 00
110T. 10" Mount with 3" base, AMPS top plate and T-Knob fasteners.....$1 .00
112T. 12" Mount with 3" base, AMPS top plate and T-Knob fasteners.....$13.00

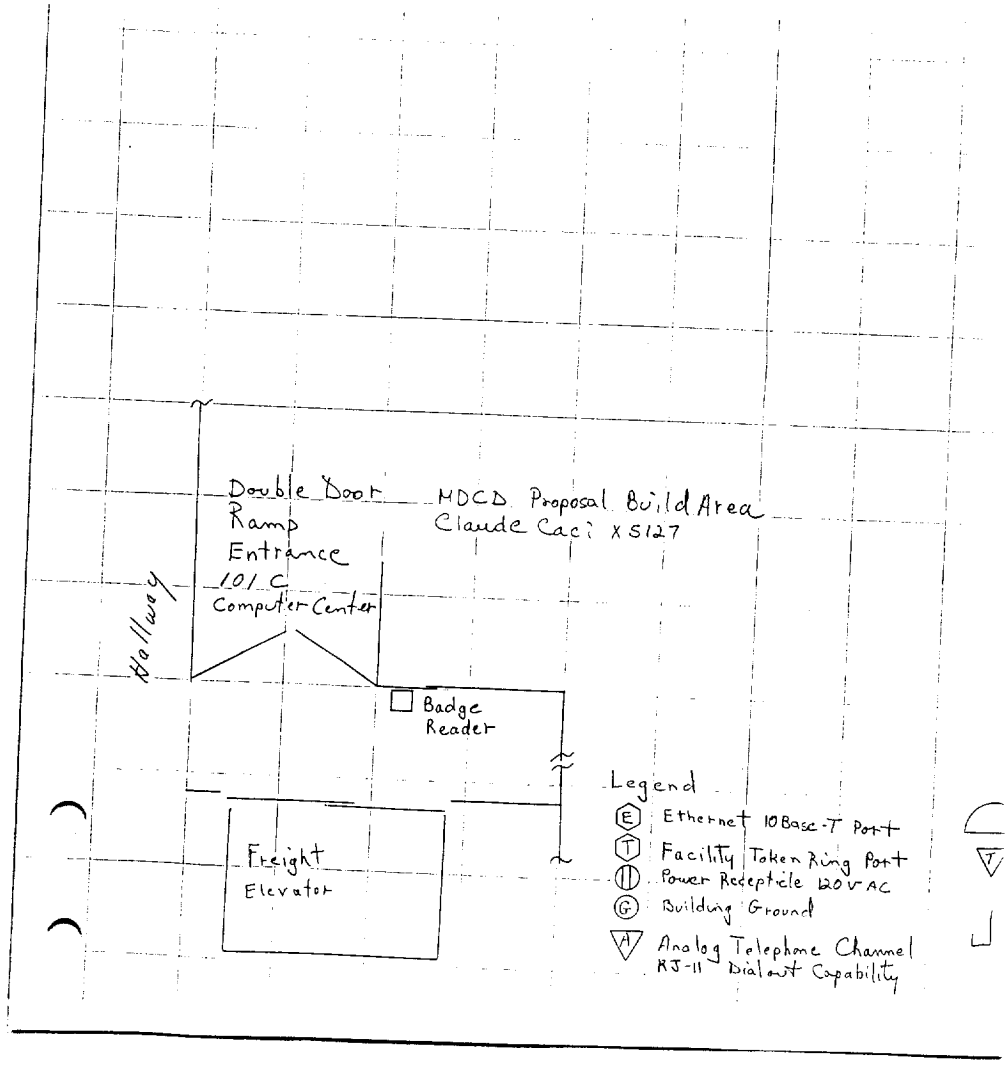

HDCD Test Program
Pallet Storage Area
8 Servers
5 UPS
20 PC's
3 Spectrum Analyzers
5 Cable Reels
250 Connector Kits
100 MDCD's
100 Cradles
COAX IN CONDUIT
50' RUN
4' from wall
LDFS-50 Heliax Cable
28 mm cable Semi Rigid
Type N Connector
Antenna
1/4 Wave
Verticle
Suspended from Ceiling
Motorola part#
RAF-4190A
Magnetic mount
Weight < 2 lbs
5"x5"
Steel Plate 1/4" thick
Fixed To Ceiling for Mag mount
Paint Black & Ground
Step Down
Hall way
Badge Reader
OUTside Ant mount Faces N by NW Toward B201-
Cable
Sinclair model SRL-4110CY
8dB gain
806-890MHz
LDFS-5 Cable
15 Sqft wall Reserved for
RF Patch Panel
3' clear to service wall hung
Trimble Acutis-GPS Antenna Roof Mount
18" MAST
Roof Surface
Differential GPS Receiver and Conversion System
5' Table
5' Table Reserved for Multi Channel Radio Controller
5' Table Reserved for Mobile Data - Intermed. System MD-IS
IIMS Development
IIMS Development
Postal Host Servers Software Development
UPS Power Strips
UPS 5kVA
E - Power
All E ports on patch pnl.
Facility Provided - 16 Analog Lines
Replication / Duplication for Test Sites
Server Staging Area
5' Tables
Power Strip
CRADLE Development Bench #1 & HDD/PDA Charging Station
Hardware & SW
CRADLE Development Bench #2 & HW/SW
Large Office & Small Office
Print Stations
Laser PRN
Laser PRN

#2


Print Supply Cabinet And Table Top
Small Office
UNDER Table style
Cable Assembly Bench
Power Strip
HDD/PDA Assembly Bench
Storage Cabinet Batteries & Chargers & Cradles
4' high cabinets
Storage Cabinet Cables & Tools & Connectors
Storage Cabinet Software & Hardware & Bar Code Supplies
DESK
DESK
DESK
DESK
DESK
DESK
20 Linear Feet Built in Counter Top
1 - Protocol Analyzer station
3 - HDD Development stations (1 desk top computer with cellphone)
3 each cellphone Bag phone type
Chair
Facility Rolmphone Telephone
Wall mount J-channel Cable support

3

H
8


Double Door
Ramp
Entrance
101 C
Computer Center
Hallway
MDCD Proposal Build Area
Claude Caci x5127
Badge
Reader
Freight
Elevator
Legend
E Ethernet 10Base-T Port
T Facility Token Ring Port
Power Receptacle 120V AC
G Building Ground
V Analog Telephone Channel
RJ-11 Dialout Capability