Private DataTAC™

800 MHz RD-LAP

Private DataTAC 2.0

System Planner

R4-11-4G

March 2001

MOTOROLA

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Acronyms

AAD	Accessories and Aftermarket Division
AC	Alternating Current
ALB	Automatic List Builder
ANSI	American National Standards Institute
API	Application Programming Interface
APT	Advanced Products Team.
AT®	Advanced Technology
ATP	Acceptance Test Plan
AUI	Attachment Unit Interface
AVL	Automatic Vehicle Location
BNC	Bayonet Neill Concelman
BTU	British Thermal Unit
CAD	Computer Aided Dispatch
CAP	Customer Acquisition Process
CCITT	Consultative Committee for International Telephony and Telegraphy
CD-ROM	Compact Disk-Read Only Memory
CMOS	Complementary Metal-Oxide Semiconductor
COF	Customer Order Fulfillment
COM	COMmunication (port)
CPU	Central Processing Unit
DAT	Digital Audio Tape
dB	Decibel
dBm	deciBel milliwatt
DBS	Data Base Station
DC	Direct Current
DCE	Data Communications Equipment
DOS	Disk Operating System

DTE	Data Terminal Equipment
EIA	Electronics Industries Association
FLM	Formatted Logical Messaging
FNE	Fixed Network Equipment
FRU	Field Replacement Unit
FTR	Formal Technical Review
FullVision® INM	FullVision Integrated Network Manager
GPS	Global Positioning System
GUI	Graphical User Interface
HDA	High Density Adapter
HP®	Hewlett Packard®
I/O	Input/Output
IB	Inbound
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISA	Industry Standard Architecture
ISG	Integrated System Group
ISO	International Standards Organization
ITU	International Telecommunications Union
ITU-T	International Telecommunications Union-Telecommunications standardization sector
kbps or kb/s	kilobits per second
kVA	kiloVolt Ampere
LAN	Local Area Network
laser	Light Amplification by Stimulated Emission of Radiation.
LATA	Local Access and Transport Area.
LCD	Liquid Crystal Display

LDC	Literature Distribution Center
LED	Light Emitting Diode
LID	Logical Identifier
LLC	Logical Link Control
Mb/s or Mbps	Megabits per second
MDCSE	Mobile Data Customer Solutions Engineering
MDT	Mobile Data Terminal
MHz	MegaHertz
MIB	Management Information Base
modem	modulator-demodulator
mph	messages per hour
MW-520	Mobile Workstation 520™
MWCS II	Motorola Wireless Communication Software II
NCL	Native Command Language
NDIS	Network Device Interface Specification
NiCd	Nickel Cadmium
NiMh	Nickel-Metal Hydride
OB	Outbound
OSI	Open Systems Interconnect
PA	Power Amplifier
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PRM	Portable Radio Modem
RAM	Random Access Memory
RAPI	Radio Application Programming Interface
RD-LAP	Radio Data-Link Access Procedure
RF	Radio Frequency
RFIO	Radio Frequency Input/Output
RFP	Request For Proposal
RFQ	Request For Quote
RIB	Radio Interface Box

RMON	Remote MONitoring
RNC3000 or RNC	Radio Network Controller (3000)
ROM	Read-Only Memory
RPM	Radio Packet Modem
RSS	Radio Service Software
SCSI	Small Computer Systems Interface
SDK	Software Development Kit
SI	Systems Integration
SIT	System Integration Test
SNMP	Simple Network Management Protocol
SOW	Statement Of Work
SRAM	Static Random Access Memory
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TNC	Threaded BNC Connector
TTO	Transmit Turn On
UDP	User Data Protocol
UHF	Ultra High Frequency
UPS	Uninterruptible Power Supply
VAC	Volts Alternating Current
VDC	Volts Direct Current
VGA	Video Graphics Array
VME	VersaModule, European
VRM	Vehicular Radio Modem
WAN	Wide Area Network
WinSock	Windows® Sockets
WNG	Wireless Network Gateway™

References

The documents referenced in this manual can be obtained from the following sources:

Accessories and Aftermarket Division Motorola Centralized Customer Service 1313 E. Algonquin Road Schaumburg, IL 60196 1-800-422-4210 FAX 1-847-538-8198	Literature Distribution Center (LDC)* Motorola, Inc. 2290 Hammond Drive Schaumburg, IL 60173 1-847-576-2828 FAX 1-847-576-5891 ***Available to Motorola employees only**

All R4 documents are available from LDC. The 68P documents are available from the Accessories and Aftermarket Division (AAD). Documents that initially start with a 98P numbering are available as a compact disk and ordered through AAD.

System Documents

Document	Document Number
Private DataTAC™ Network Capabilities Specification	R4-11-6
Private DataTAC™ UHF System Planner	R4-11-1006
Private DataTAC™ Application Design Guide	R4-11-1037
Private DataTAC™ 1.0/2.0.3 Migration Planner	R4-11-1034
Network Configuration and Optimization Guide	68P81099E55
System Manager's Guide	68P80800C25

Data Terminal Equipment (DTE)

Document	Document Number
Mobile Application Interface Guide (Native Mode Reference Guide)	98P08901C25

Radio Network Controller 3000 (RNC3000)

Document	Equipment Model Number	Document Number
Radio Network Controller 3000 Installation Manual	L1960/T5732	68P81098E75
Radio Network Controller 3000 Operations Manual	L1960/T5732	68P81098E70
Radio Network Controller 3000 Product Specification	L1960/T5732	68P81098E95
Formatted Logical Messsaging (FLM) Host Application Programmer's Manual	L1960/T5732	68P80800C85

Wireless Network Gateway™ (WNG)

Document	Equipment Model Number	Document Number
Wireless Network Gateway™ Installation and Operations Reference	T6517/T5814 T5901	68P81129E82
Wireless Network Gateway™ Product Specification	T6517/T5814 T5901	68P81129E84
Formatted Logical Messsaging (FLM) Host Application Programmer's Manual	T6517/T5814 T5901	68P80800C85

Motorola Wireless Communication Software (MWCS II)

Document	Equipment Model Number	Document Number
Motorola Wireless Communication Software (MWCS II) Administrator's Manual. This manual includes: MWCS II Administrator's Guide MWCS II Quick Reference Card	T5915 License Required	68P80800E40
Motorola Wireless Communication Software (MWCS II) Software Developer's Manual. This includes: MWCS II Administrator's Guide MWCS II Programmer's Guide and Reference MWCS II SDK Installation Guide MWCS II Quick Reference Card	T5916	68P80800E35
MWCS II Quick Reference Card NOTE: The Quick Reference Card is included in both of the above manuals and can also be obtained through AAD as a standalone reference.	T5915 License Required	68P80800D90

FullVision® Integrated Network Manager (FullVision INM)

Document	Equipment Model Number	Document Number
FullVision Integrated Network Manager Installation and User's Manual, Version 3.0	SQM01SUM0072/ SQM01SUM0065*	68P80800H20
FullVision Integrated Network Manager Functional Specification	SQM01SUM0072/ SQM01SUM0065*	68P80800D45
*Contact your local Business Manager for further information on the FullVision INM models.		

QUANTAR® Data Base Station (DBS)

Document	Equipment Model Number	Document Number
QUANTAR and QUANTRO Stations Radio Service Software User's Guide	C99ED-001D	68P81085E35
QUANTAR® Digital-Capable Station Instruction Manual	C99ED-001D	68P81094E20
QUANTAR Data Base Station Instruction Manual	C99ED-001C	68P81096E05

Vehicular Radio Modem 500 (VRM-500)

Document	Equipment Model Number	Document Number
VRM 500 Vehicular Radio Modem Owner's & Installation Manual	F2054	68P02943C70
Vehicular Radio Modem 500 and VRM 600 GPS Support	F2054	68P02945C10
Mobile Application Interface Guide	F2054	98P08901C25
VRM 500/600/650 Vehicular Radio Modem Radio Service Software User's Guide	F2054	68P02946C95

MCS 2000®

Document	Equipment Model Number	Document Number
MCS 2000 Mobile Radio Service Instructions, 800-MHz Frequency Range Specific Information	F2054 F3454 F3455	68P81080C42

Vehicular Radio Modem 650 (VRM 650)

Document	Equipment Model Number	Document Number
VRM 650 Vehicular Radio Modem for Private DataTAC™ Networks Owner's and Installation Manual	F3454 F3455	68P02952C90
VRM 500/600/**650** Vehicular Radio Modem Radio Service Software User's Guide	F3454 F3455	68P02946C95
Mobile Application Interface Guide	F3454 F3455	98P08901C25
VRM 500 and VRM 600 GPS Support Programming Guide	F3454 F3455	68P02945C10

Vehicular Radio Modem 660 (VRM 660)

Document	Equipment Model Number	Document Number
VRM 660 Vehicular Radio Modem for Private DataTAC Networks Owner's and Installation Manual	F2168	68P02950C75
Mobile Application Interface Guide	F2168	98P08901C25
VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2168	68P02945C40

Mobile Workstation 300/Mobile Workstation 350 (MW 300 and MW 350)

Document	Equipment Model Number	Document Number
Mobile Workstation 300/350 Owner's Manual	F5030/F5032	68P02959C05

Mobile Workstation 520™ (MW-520)

Document	Equipment Model Number	Document Number
MW-520 Mobile Workstation Application Developer's Kit	F5201/F5200	68P02950C70
Mobile Workstation 520 Owner's Manual	F5201/F5200	68P02950C60
Mobile Workstation 520 Quick Reference Card	F5201/F5200	68P02950C99
Mobile Workstation 520™ Vehicle Installation Guide	F5201/F5200	68P02951C30
Mobile Workstation 520™ Installation Manual	F5201/F5200	68P02950C65
800 MHz RF Power Amplifier Owner's and Installation Guide	F5201/F5200	68P02949C50
VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, **Mobile Workstation 520**, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F5201/F5200	68P02945C40

Portable Radio Modem 660 (PRM 660)

Document	Equipment Model Number	Document Number
PRM 660 Quick Reference	F2274	68P02948C26
PRM 660 Portable Radio Modem for Private DataTAC Networks Owner's and Installation Manual	F2274	68P02948C25
~~FORTÉ Wireless CommPad~~, VRM 660 Vehicular Radio Modem, **PRM 660 Portable Radio Modem**, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2274	68P02945C40
Mobile Application Interface Guide	F2274	98P08901C25

Global Positioning System (GPS) Receiver

Document	Equipment Model Number	Document Number
Private DataTAC 1.0 GPS Install Supplement	L3027 L3028	68P81129E91
Placer™ GPS 400 Manual	L3027 L3028	CDN6279
Placer™ GPS 450 Installation and Operator's Manual	L3073	CDN1540

Service Documents are also listed in Chapter 6.

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Using This Manual

This section describes this document's intended audience, explains the Private DataTAC™ network features, and tells whom to contact if the customer's system requirements exceed the standard specifications.

For a general overview of Private DataTAC features, refer to the "*Private DataTAC™ Network Capabilities Specification*." For more detailed information regarding Private DataTAC network features not covered in this document, refer to the documents listed in "*References*" on page xix.

Intended Audience

This document's intended audience is sales personnel and field engineers (also referred to as system engineers). This document helps them with the planning and ordering of a Private DataTAC network for a customer.

What this System Planner Covers

This document describes planning requirements for a Private DataTAC network that uses radio channels in the 800 MHz band with the radio data-link access protocol (RD-LAP) radio protocol. This document helps the field engineer and sales person to:

- Determine customer requirements
- Analyze network capabilities
- Determine required hardware, software, options, and accessories
- Create an equipment list
- Create a statement of work (SOW)

The basic network ordering information is contained in the decision charts. These charts are supported by various diagrams and text that help you make informed choices. The purpose of the decision charts is to help in the planning of a core functional network that works the first time, every time, right out of the box. A complete data network also requires configuration and application software specific to the customer's business information and operational needs.

Decision charts explain the various components of the Private DataTAC network and how they interconnect. Products, options and accessories, documentation, site planning, and service information are also explained.

Customer requirements dictate which of several available topologies is best for their network application. For information on other features and current

and future topologies, consult the *Private DataTAC Network Capabilities Specification* and the *Network Configuration and Optimization Guide* documents, refer to the documents listed in "*References*" on page xix.

Other System Documents

Several documents are available that have pertinent information regarding the Private DataTAC 2.0.3. Their titles and brief descriptions follow.

Private DataTAC Network Capabilities Specification

This document describes the capabilities and limitations of a Private DataTAC network. Included are descriptions of computers and application programs that provide functions and present information in a form that benefits individuals who use the system.

Private DataTAC 2.0.3 Migration Planner

This document describes the various paths that can be taken from pre-Private DataTAC design, including basic software and hardware components. It also covers upgrading earlier releases of Private DataTAC to the current Private DataTAC 2.0.3.

Private DataTAC Network Configuration and Optimization Guide

This document specifies default configuration parameters. It also describes how to optimize and implement a Private DataTAC wireless data communications network.

Private DataTAC Application Design Guide

This guide provides field engineering, the Mobile Data Customer Solutions Engineering (MDCSE) team and third party application developers with descriptions of Private DataTAC system interfaces and recommended system integration and configuration parameters. Interfacing applications to both formatted logical messaging (FLM) and Internet Protocol (IP) based system configurations, and application and system performance and optimization are described.

Private DataTAC System Manager's Guide

This guide is written as an aid to those who manage data systems that include a Motorola Private DataTAC Network. System managers can be technicians, computer operators, engineers, and programmers with training or experience in operating a wide area network computer system.

The system documents described above are listed in "*References*" on page xix.

Technical Support

Contact the MDCSE group when technical support is required. Any non-standard system requirement must be defined in detail and submitted to MDCSE.

Mobile Data Customer Solutions Engineering
Commercial, Government and Industrial Solutions Sector
1301 E. Algonquin Road
Schaumburg, IL 60196
Phone: (847) 576-5193
Fax: (847) 576-0543

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Chapter 1
Wireless Data Communications Network

This chapter describes the Private DataTAC™ wireless data® communications network. The sections in this chapter are:

- What is Private DataTAC?
- Basic System Topology
- Private DataTAC System Features
- Fixed-End Equipment
- Wireless Computers
- External Radio Modems
- Private DataTAC System Performance

1.1 What is Private DataTAC?

Private DataTAC is a wireless data communication network that provides host computer system access from vehicle-mounted (mobile) or handheld (portable) wireless computers. The network extends normal wireline computer functions, such as logging into a computer and accessing application services, to field users. The Private DataTAC network supports field users who move throughout a predefined geographic area, or coverage area, determined by radio channel coverage design.

The Private DataTAC network provides the communications path between the field user and a host computer network. Application programs residing in the host computer and in the wireless computer perform operator functions. These application programs use Private DataTAC network services to communicate with each other. Field users can take advantage of Private DataTAC mobility services to conduct their duties wherever they go within the coverage area.

The Private DataTAC network and applications can complement or replace functions provided by a dispatcher communicating with field personnel through mobile or portable voice radios. A dispatcher obtains information from a wireline terminal. This information can be communicated to the field user verbally over voice radio, but the information becomes available directly to the field user with a wireless computer via a Private DataTAC network. This ability increases the efficiency of a customer operation.

The Private DataTAC network enables other functions not traditionally implemented using wireline computers. These functions include Automatic

Vehicle Location (AVL), automated dispatching, and real-time database update.

1.2 Basic System Topology

Figure 1-1 shows the basic Private DataTAC network with multiple base stations and multiple radio-linked remote mobile computers. These computers must be within the radio coverage area. The required coverage area can have up to 64 data base stations, strategically located throughout the area.

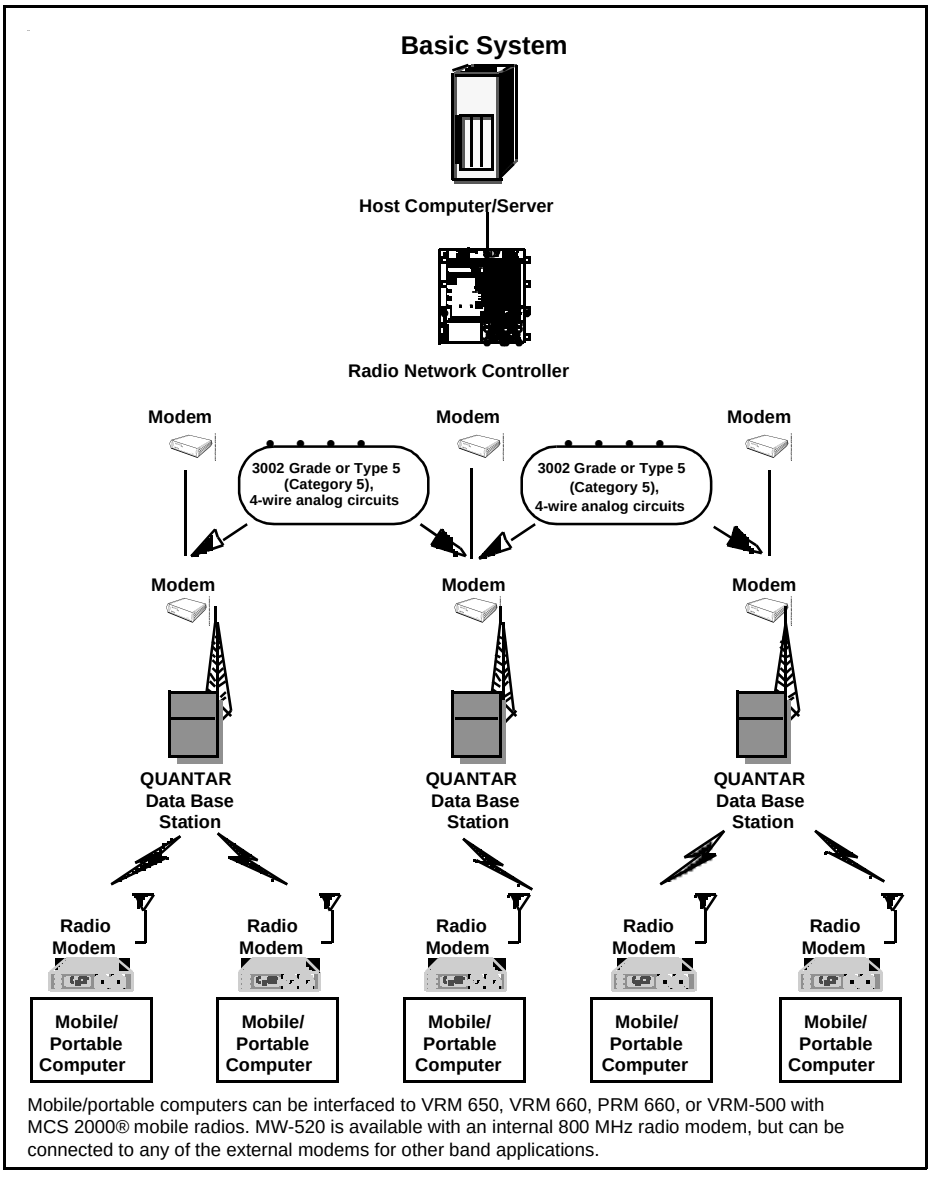

Figure 1-1. Basic Topology of a Private DataTAC System

1.3 Private DataTAC System Features

The Private DataTAC network features provide or enhance wireless computer access to host computer networks. This section covers the following:

- Data Messaging Services
  - — Bearer Services
  - — Host Connectivity
- Network Management
  - — RD-LAP Protocol Rate Agility
- Large System Support
  - — Controller Redundancy
  - — Fault Tolerant Wireless Network Gateway
  - — Mobility Management
- Security Services
  - — User Authentication
  - — Data Encryption
  - — Encryption Key Management

1.3.1 Data Messaging Services

Private DataTAC 2.0.3 provides data communication services by using land mobile radio frequency pairs called radio channels. These radio channels operate in duplex mode. One frequency transmits and the other receives at a given radio end point. Radio channels provide the wireless link over which user information is passed. Data messaging services include the following:

- Bearer Services
- Host Connectivity

1.3.1.1 Bearer Services

Private DataTAC networks enable wireless computers to use both Formatted Logical Messaging (FLM) and Internet Protocol (IP) bearer service communication sessions operating on the same computing device. The network does so by using both the WNG and MWCS II.

1.3.1.1.1 FLM Bearer Service

FLM bearer service is the message transport associated with a Motorola proprietary FLM host connection protocol for wireline, fixed-end host applications to communicate through the Private DataTAC network. It also defines the various methods for field applications to communicate through a Private DataTAC network.

FLM bearer services allow:

- Host-controlled mobile device registration
- Confirmed and unconfirmed messaging
- Multiple logically addressed host sessions with message routing
- User data compression

Private DataTAC establishes data compression services when the connection is initialized between the required Motorola Wireless Communication Software II (MWCS II) and the Wireless Network Gateway™ (WNG). The effectiveness of compression varies depending on the content and profile of user messages. Data compression reduces the time required for wireless computers and the Private DataTAC network to exchange data.

FLM Bearer Services are available with systems using one RNC controller or a WNG for connecting to the customer host.

1.3.1.1.2 IP Bearer Service

IP messaging standardizes RF subsystem interfaces so that IP is the common bearer service which transports user data and control information between LAN-based host computers and mobile host computers operating on the Private DataTAC network. End-to-end IP messaging requires a WNG to provide connectivity to the host and MWCS II to provide connectivity to the devices.

The WNG provides industry standard Internet Protocol (IP) routing with IP header and data compression serving as the registered host for both IP and FLM-based traffic. Along with the support of IP services, the WNG provides support for the FLM protocol allowing ease of migration for existing Private DataTAC networks to a standard IP architecture.

MWCS II supports both IP and legacy applications. The respective message types will be detected within the MWCS II and directed to the appropriate host. MWCS II supports a WinSock interface for incorporating IP messaging into the mobile computer.

IP Bearer Services allow the following:

- IP group / broadcast messaging
- Unit-to-unit messaging
- User data / header compression

IP group / broadcast messaging permits users to send and receive unconfirmed, from one-to-several data transmissions. An individual mobile host is capable of configuring up to nine group / broadcast addresses where eight addresses are user definable and one is reserved for *All Call*.

Unit-to-unit addressing allows a mobile user to address and send a message to another mobile user on the RF network. Messages sent from a mobile computer travel inbound to the WNG where they are redirected outbound to

the destination mobile computer. This feature can be administratively denied if a customer requires host logging of RF message traffic.

Data compression services are established when the connection is utilized between the required MWCS II and the WNG. The effectiveness of compression varies depending on the content and profile of user messages. Compression reduces the time required for wireless computers and the Private DataTAC network to exchange data.

IP header compression services and data compression enhance IP messaging. IP header compression reduces overhead from 28 to 40 bytes to an average of eight or fewer bytes.

Data and header compression effectively increase channel capacity by reducing message transmission time. This compression allows the channel to support more users and messages or improve response time.

For more information, see *Private DataTAC 2.0 Network Capability Specifications*. For specific information relating to application and system design, see the *System Design Guide* and the *Application Design Guide*.

1.3.1.2 Host Connectivity

Private DataTAC 2.0.3 offers both proprietary and industry-standard network connection protocols. A customer host network can use a single computer and application program or several computers and applications.

Table 1-1 shows the availability of the protocols and host network connectivities.

Table 1-1. Host Link Protocols and Host Network Connectivities

Protocol	Host to RNC	Host to WNG	Host to RNC or WNG and FullVision INM	FLM Bearer Services	IP Bearer Services
Ethernet	Yes	Yes	Yes	Yes	Yes
ASYNC	Yes	No	No	Yes	No

If the customer uses a WNG or FullVision® INM in their system, then ethernet must be used.

Private DataTAC provides a way to pass data between field user applications and host network applications through supported host network connection protocols. FLM and IP host interfaces are available as options.

1.3.2 Network Management

Network management allows a system manager the ability to monitor network operation. A set of basic reports provide the system manager with an indication of how the components in the system are performing. Over time, the system manager can use this information to predict usage trends that can identify the need for network reconfiguration or future expansion.

The performance management reports provide hourly and daily information, as information is kept in the data warehouse.

FullVision INM is a network management tool that manages, configures and monitors Private DataTAC network elements from a single user interface point. This capability is support with a proprietary SNMP implementation on the WNG and RNC. Remote network management is also available from Motorola network management services.

1.3.2.1 RD-LAP Protocol Rate Agility

RD-LAP rate agility is designed for the public safety customers who, with a mix of 806 MHz and 821 MHz channels, need all channels to be available to all users across the network.

Private DataTAC supports network designs that use 9.6 kbps and 19.2 kbps RD-LAP protocols in the same network with support for mobility of a radio modem between these two channel types. A radio modem can operate only in RD-LAP mode when configured to do so.

Mobile and portable wireless computers support different customer needs without defining the specific application functions to be implemented.

RD-LAP rate agile modems allow seamless roaming between the 806 MHz and 821 MHz layers of the network. RD-LAP rate agility is implemented as a configuration option for 800 MHz modems; such as, VRM-500 w / MCS 2000 and the PRM 660, VRM 650, VRM 660 and MW-520.

This feature is field programmable in the modem using the new Windows® based Radio Service Software (RSS) package.

1.3.3 Large System Support

The Private DataTAC is a scaleable network supporting the needs of a single site to the more complex system configurations. Some of the additional features and functionality available for Private DataTAC would include support for up to 256 base stations, mobility management for Inter-RNC controller roaming, controller redundancy and a fault tolerant gateway platform.

1.3.3.1 Controller Redundancy

Controller redundancy allows high levels of system availability. Private DataTAC networks can be configured for message path redundancy to serve mission critical communication needs. There are three methods for controlling RNC redundancy. They are:

- FullVision INM Controlled Redundancy
- WNG Controlled Redundancy
- Host Controlled Redundancy

1.3.3.1.1 FullVision INM Controlled Redundancy

If the customer's Private DataTAC network does not require a WNG, the customer can use FullVision INM-controlled Radio Network Controller (RNC) redundancy. The FullVision INM monitors two RNCs. One RNC is active and handles messaging to and from the wireline host and mobile computers. The other RNC is in a warm standby state, ready for the FullVision INM to activate it if the primary RNC fails. This configuration is a method of ensuring the data communications messaging path from the customer wireline network to the wireless data computer.

This configuration supports only a single redundant pair of RNCs. This configuration introduces the use of an SNMP-controlled A / B switch, which controls the communications path between the RNCs and the associated base stations.

1.3.3.1.2 WNG Controlled Redundancy

A Private DataTAC network using a WNG, provides for controller redundancy for up to four pairs of RNCs in a redundant configuration. One RNC is active and handles messaging to and from the wireline host and mobile computers. The other RNC is in a warm standby state, ready for the WNG to activate it if the primary RNC fails. This configuration introduces the use of a Simple Network Management Protocol (SNMP) controlled A / B switch, which controls the communications path between the RNCs and the associated base stations.

1.3.3.1.3 Host Controlled Redundancy

If the Private DataTAC network does not contain a WNG or FullVision INM, the customer's host can control the RNC redundancy. The host monitors the state of the active RNC and decides when to switch to a standby RNC. This configuration supports FLM bearer services only and requires an A / B switch at the RNC.

For more information on redundancy control, see to the *Private DataTAC 1.0/ 2.0 Application Design Guide*, *FullVision Integrated Network Manager Functional Specification* and the *Wireless Network Gateway™ Product Specification*.

1.3.3.2 Fault Tolerant Wireless Network Gateway

The WNG fault tolerant hardware platform combines automatic fault recovery and intelligent configuration management to assure high availability and data integrity in UNIX® based applications environment providing a broad selection of reliability and configuration alternatives. The redundant component architecture within this gateway protects against a single point system failure providing for very reliable messaging.

For more information, see to the *Private DataTAC Network Capabilities Specification* and the *Wireless Network Gateway™ Product Specification*.

1.3.3.3 Mobility Management

Mobility management allows mobile devices to roam seamlessly throughout the coverage area within a Private DataTAC network without needing to select a different channel or have any specific knowledge of the RF network. The WNG manages these devices across up to four active RNC controllers and expands the coverage supporting up to 256 base stations.

1.3.4 Security Services

Private DataTAC 2.0.3 also offers data and network security services which include the following:

- User Authentication
- Data Encryption
- Encryption Key Management

Private DataTAC can optionally be ordered with user authentication and data encryption over-the-air services. These options require a WNG at the fixed-end, and MWCS II at the mobile computer.

These services aid in protecting the customer's network from unauthorized access through the Private DataTAC wireless network and protect the confidentiality of user information over-the-air.

1.3.4.1 User Authentication

User authentication is a feature that confirms end user identity to the network and enhances the system security by denying access to unauthorized and non-authenticated users. This feature limits an unauthorized user from cloning an authorized user's modem and middleware to gain access to the wired network and system resources.

User authentication is configured on a mobile-by-mobile basis. A portion of the mobile fleet can require its users to authenticate to the network whereas the remainder are not required to do this. This configuration allows for a flexible security policy.

NOTE

All over-the-air user authentication transactions are encrypted. User authentication can be disabled for a given user while still allowing that user to use data encryption.

For more information on data and network security, see *Private DataTAC 2.0 Network Capability Specifications.*

1.3.4.2 Data Encryption

Data encryption adds system-level user data encryption to provide a higher level of confidentiality to messages and to enhance the security of the Private DataTAC system overall. Data encryption is configured on a mobile-by-mobile basis. Data encryption can be figured in one of three ways:

- always in operation for a mobile
- never in operation for a mobile
- in operation for a mobile that is capable of encryption

All user data and the IP header are encrypted. Only the over-the-air RD-LAP packet header is not encrypted. Data encryption is transparent to end user applications. The existing user application is able to send an encrypted message without needing modification except as noted in the *Network Capabilities Specification* for MWCS II message size compatibility and encrypted unconfirmed outbound and broadcast message size reduction.

1.3.4.3 Encryption Key Management

The WNG automatically assigns and manages encryption keys. Each user device is assigned a unique key for individual messaging. All users share a common key for group call and all-call broadcast messaging. The WNG and MWCS II in the device use a two-party key exchange method to derive a root key that is used for the duration of the session. Keys are held in the device's volatile memory and are destroyed only when MWCS II or the device is turned off. Conversely, the keys are not volatile in the WNG. Normal inbound and outbound messaging resumes after the WNG restarts without renegotiating keys with those units that haven't changed or otherwise had their keys expire.

Encryption key length is 128-bits for U.S. customers. Due to export regulations, encryption key length is limited to 40-bits for customers outside of the U.S.

For more information on data and network security, see *Private DataTAC 2.0 Network Capability Specifications.*

1.4 Fixed-End Equipment

The Private DataTAC network's fixed-end components provide the network infrastructure that enables mobile computers to communicate with the customer host network. These products establish and control the radio subsystem that provides the coverage area for the network and are the source of most network management services.

This section describes the following network component products:

- Radio Network Controller 3000 (RNC3000)
- Wireless Network Gateway (WNG)
- FullVision INM
- QUANTAR Data Base Station

1.4.1 Radio Network Controller 3000 (RNC3000)

The Private DataTAC network uses the RNC3000. This important component provides the interface between the host computer network and the base sites that comprise the radio subsystem. It also controls and facilitates communication services with the network's wireless computers and supports their mobility. The RNC allows several Private DataTAC network management services.

The RNC is described in three categories as follows:

- RNC Hardware Configurations
- RNC Functions
- RNC-to-Transceiver Site Link

1.4.1.1 RNC Hardware Configurations

The RNC is based on a VersaModule European (VME) architecture with a Motorola 68030-based control processor, 1.4 MB floppy disk drive, hard disk drive, and a configurable number of 68030-based I/O processors. The modular design accommodates various radio site configurations.

An RNC can be factory-configured to accommodate up to 64 sites configuration by installing appropriate hardware. Host interface selection determines which network interface cards should be installed.

A redundant RNC configuration requires one or more A/B switch products to enable switching the base site links from one RNC to the other. An SNMP-managed A/B switch is required for WNG controlled or FullVision controlled redundancy.

The RNC hardware platform permits simple expansion of data base site interfaces. The unit is rack-mounted in its own cabinet with a power supply and base site link modem card cage. If a redundant RNC configuration is ordered, the site link switch also is mounted in one of the two cabinets. Hardware platform upgrades are ordered as required.

1.4.1.2 RNC Functions

The RNC manages the data messaging in a Private DataTAC system and provides the data communication interface between the RF networks and the host computer network. Within these networks, the RNC performs the following functions:

- Maps host interface protocol to RF protocol through the Registration/Authorization feature
- Manages the routing of messages from a host network to an RF network, and vice versa
- Provides message reliability by acknowledging the successful receipt of messages from the user devices, and reporting undeliverable messages to the user devices
- Supplies statistics and alarms to a host or FullVision INM to evaluate operating states and failure types in Private DataTAC systems
- Supports up to 64 base stations over leased-line modems.

While performing these functions, the RNC maintains a detailed database that includes the status of infrastructure components and user devices.

The above mentioned functions are described in more detail in the *Network Capabilities Specification*.

1.4.1.3 RNC-to-Transceiver Site Link

The products used to establish the link between the network controller and a base station site are the COMSPHERE® modems (see Chapter 3, “Decision Charts,” section 3.3.1 and 3.3.2). One modem is co-located with the RNC and one is at the base station site for each site connection. These modems support the High-level Data Link Control (HDLC) used to transport message packets and other information between the network controller and the base site.

The Private DataTAC network requires one four-wire circuit for each site link. This link operates at 7.2 or 14.4 kbps using the modem’s wireline modulation technique, depending on the radio protocol speed.

1.4.2 Wireless Network Gateway (WNG)

The WNG is a software platform that links wireline data networks to Motorola RF networks. This software platform manages message traffic to and from the wireless network. The wireless network includes the RNC and QUANTAR DBS.

WNG is described in two categories as follows:

- WNG Hardware Configurations
- WNG Functions
- Motorola Wireless Communication Software (MWCS II)

1.4.2.1 WNG Hardware Configurations

The WNG uses the IBM® AIX® operating system running on a Motorola VME hardware platform, which allows for easy expansion and maintenance. Two WNG options are available, including the XR Series and the Fault Tolerant FX Series.

The WNG hardware platform consists of the following:

- PowerPC® based processor
- Hard drive
- Floppy drive
- CD-drive
- Power supply
- Tape drive
- Two I/O ethernet adapters in a 19-inch rack mountable VME-based chassis

1.4.2.2 WNG Functions

The major functions of the WNG include:

- IP routing / messaging services
- FLM host connectivity
- Five FLM host support with or without IP
- IP / Header and Data Compression
- Mobility Management - up to 4 RNC controllers
- Mobile user registration / authorization
- Alarms, statistics, and message tracing
- SNMP-based management support
- Fault Tolerant hardware option
- RNC3000 redundancy
- Security services
  - — User authentication
  - — Data encryption
  - — Encryption key management

The functions listed above are described in more detail in the *Network Capabilities Specification* and *Wireless Network Gateway™ Installation and Operations Reference*.

Security services requires a WNG and MWCS II at the mobile computer. These services aid in protecting the customer's network from access of unauthorized users of the Private DataTAC wireless network as well as protecting the confidentiality of user information over-the-air. For more information on security services, consult the *Private DataTAC 2.0 Network Capabilities Specification* or the *WNG Operations Manual*.

1.4.2.3 Motorola Wireless Communication Software (MWCS II)

MWCS II software, often referred to as middleware, is the communication device driver for compliant wireless computers. MWCS II is used with Microsoft® Windows® 95 or Windows 98 operating systems. MWCS II provides the mobile application with access to the Private DataTAC network through a variety of programming interfaces and allows application developers to write their software to an industry standard applications interface, e.g., WinSock (Windows Sockets). By interfacing through WinSock, developers and customers have the flexibility to use the application software on other IP-based systems should the need arise.

MWCS II is capable of handling all modem and over-the-air communication, eliminating the applications' need to interface with Native Mode.

MWCS II works in conjunction with WNG and is required to enable the Private DataTAC 2.0.3 services of IP, compression, and security. Support for Windows NT® and Windows CE are planned for future release. For the Private DataTAC 2.0.3 network, MWCS II has added a stealth mode feature that allows application developers and system administrators to determine whether communications errors will be communicated to the application for handling or whether these errors will be displayed to the end user in a dialog box.

The MWCS II Software Developer's Kit (SDK) provides two APIs for developing 32-bit applications. They are radio application programming interface (RAPI) for radio modem control and RF Input/Output (RFIO) for simple messaging. RAPI and RFIO are described in the following two subsections. See the *Wireless Communication Software Administrator's Manual* for more information.

1.4.2.3.1 Radio Application Programming Interface (RAPI)

RAPI is designed for applications that require maximum modem control and is used in conjunction with WinSock. RAPI is also for developers who require MDC™-compatibility services and network-level acknowledgments.

For more information, consult the *Motorola Wireless Communication Software Developer's Manual* and *Network Capabilities Specification*.

1.4.2.3.2 Radio Frequency Input/Output (RFIO)

RFIO is designed for non-communications fluent programmers who don't need significant modem interface. RFIO hides the technical details of the radio and WinSock APIs.

For more information, consult the *Motorola Wireless Communication Software Developer's Manual* and *Network Capabilities Specification*.

1.4.3 FullVision INM

FullVision INM is a Motorola network management tool that allows customers to monitor the status of the communications system.

A network management tool is a software application that aids in managing a complex radio communications system and its component parts, including radio modems, computers, and Internet-working devices. This tool helps to maximize available resources and minimize the Private DataTAC network downtime and maintenance costs. The network management tool communicates with managed components using Simple Network Management Protocol (SNMP).

FullVision INM is integrated with Hewlett-Packard® OpenView® and allows for greater control over the operation of the communication system. FullVision INM integrates the fault management of Motorola and approved third-party devices.

FullVision INM offers the following features:

- System administration
- Topology maps
- Fault management
- Configuration management
- Performance management
- Performance monitoring and analysis
- Enhanced alarms and statistics
- Configurable polling
- Hewlett-Packard® hardware platform evolution
- HP® NetView software platform evolution
- Device test status and management

For more detailed information of the above features, see the *Network Capabilities Specification* and *FullVision Integrated Network Manager Installation and User's Manual.*

1.4.4 QUANTAR Data Base Station

The base site product used at all Private DataTAC base station site is the QUANTAR DBS. This product is based on the Motorola QUANTAR platform and has additional embedded software that provides the functions required by the Private DataTAC network. QUANTAR is described in two categories as follows:

- QUANTAR Configurations
- QUANTAR Functions

1.4.4.1 QUANTAR Configurations

The DBS consists of a 30-inch cabinet with a power supply and ventilation equipment. The DBS requires 12-rack units allowing for two-rack units above and below the lease-line modem.

The QUANTAR platform is a microprocessor-controlled, single channel, full-duplex base station package. The QUANTAR design includes an extremely sensitive receiver to maximize radio coverage. The DBS is available in the 800 MHz band with radio power options of 20 and 100 watts. The DBS supports both RD-LAP 9.6 (821-824 MHz) and RD-LAP 19.2 (806-821 MHz) radio protocols.

The DBS is available in a variety of input power configurations including 110 and 220V AC and 12, 24, 48, and 60V DC, and a combination whereby 12V DC is used as a backup to failure of the 110V or 220V AC supply.

1.4.4.2 QUANTAR Functions

The DBS consists of integrated radio and controller logic by means of embedded software. The major functions of this logic are:

- Radio protocol encoding and decoding
- Transceiver radio modulation and demodulation
- Radio protocol channel contention control
- Received signal strength determination
- Communication with the RNC
- Network management support
- Self-diagnostics and alarm forwarding

More detailed information of the functions can be found in *Network Capabilities Specification*.

1.5 Wireless Computers

The Private DataTAC network offers Motorola manufactured and certified wireless data computers for mobile and portable use, the MW 300/MW 350 and Mobile Workstation 520™ (MW-520). This section discusses the following wireless computers:

- Mobile Workstation 300 and Mobile Workstation 350
- Mobile Workstation 520 (MW-520)

1.5.1 Mobile Workstation 300 and Mobile Workstation 350

The Mobile Workstation 300 and the MW 350 are mid-tier mobile workstations designed to support a variety of Windows CE-based applications. The MW 300 and MW 350 feature a PowerPC processor running Windows CE, an integrated smart card reader/writer, backlit display and keypad, and small form factor allowing for easier mounting.

1.5.2 Mobile Workstation 520 (MW-520)

The MW-520 mobile data computer is designed specifically for computing and communications in a mobile environment while offering the power of a desktop computer. It is tested to strict Motorola and military standards for rain, shock, vibration, temperature and dust.

An internal or external radio modem provides communication services while a separate application processor environment supports local computing. The MW-520 mobile computer has the capability of using Windows 98, Windows 2000 or Windows ME. MWCS II can operate on Windows 95 or Windows 98 only. The MW-520 mobile computer features an optional integral radio modem and radio. This integrated packaging

simplifies unit installation and saves space. Modular construction allows quick separation for servicing.

The internal radio configuration supports both RD-LAP 9.6 kbps and RD-LAP 19.2 kbps on the F5203 model.

1.6 External Radio Modems

External radio modems allow mobile computers to communicate in a Private DataTAC 2.0.3 network. The power supply for the VRM-500, VRM 650, and the VRM 660 is the vehicle's battery. The PRM 660 uses either its internal battery or external vehicle power.

A Global Positioning System (GPS) Trimble® Placer™ 450 receiver can be connected to the VRM-500 or the VRM 650 auxiliary (AUX) interface port as part of an AVL application. The VRM and Private DataTAC network serve as a transparent communications pipe between the AVL application running in the host and the GPS receivers in the vehicles.

NOTE

AUX port cannot be used for GPS when DTE runs MWCS II and enables complementary services.

These subsections describe the following Private DataTAC radio modems:

- VRM-500
- VRM 650
- VRM 660
- PRM 660

1.6.1 VRM-500

The VRM-500 is an external radio modem and is paired with a data-capable Motorola MCS 2000® mobile radio option for RD-LAP data service.

1.6.2 VRM 650

The VRM 650 is an integrated radio modem based on the Motorola MCS 2000 mobile radio in a compact, self-contained unit built in a die-cast aluminum chassis. The VRM 650 is designed for dedicated, data-only applications. These models are available in the 800 MHz, 900 MHz, and UHF bands. The VRM 650 is dash or remote-mounted.

1.6.3 VRM 660

The VRM 660 is a compact, integrated radio modem in a self-contained unit built in an aluminum chassis. The VRM 660 is designed for dedicated, data-only applications. This modem has features and functions similar to the VRM 650, but with reduced power and no AUX port.

1.6.4 PRM 660

The PRM 660 is an integrated radio modem based on the Motorola INFOTAC® portable radio modem in a compact, self-contained unit built in a rugged housing. The PRM 660 is designed for dedicated, data-only applications.

Wireless access is possible through an internal 3-watt transceiver and flip-up antenna. An LCD and function keys are built into the unit to provide an easy-to-use interface for modem set up and operation. Labels on the LCD identify the function keys. Plain text help information can be reviewed on the 4-line by 20-character display, as needed.

1.7 Private DataTAC System Performance

Radio coverage reliability and availability have a large effect on system response time and capacity. The field engineer must accurately model the future customer operations and conditions to design a network that meets the customer's requirements. Motorola System Engineering can predict capacity and response times using the Private DataTAC network performance simulator. This simulation provides estimates and statistics of network capacity and end-to-end message delivery and acknowledgment delay.

This simulation, when used with specific customer requirements and data from the system analysis, produces accurate results upon which to base design decisions. This procedure permits analysis of the effects of application efficiency and radio coverage design alternatives before actual implementation. The result of this simulation helps the system engineer decide the suitable topology and equipment the customer needs.

1.7.1 Capacity Issues

System capacity depends on the individual capacities of key products and links including:

- Host Capacity
- Host Link Capacity
- WNG Capacity
- RNC Capacity
- Radio Channel Capacity
- Mobile Computer Messaging Capacity
- System Response Time

This system planner refers to a standard message profile for illustrative purposes to define the network and device capabilities. This profile does not represent the customer's network operations. For the customer's particular

operation, systems engineering develops the message profile as part of the solution design.

Capacity is rated using a standard message profile consisting of a 50-character (user data) inbound (IB) message, 100-character (user data) outbound (OB) message, and equal IB and OB rates. Network capacity is the sum of IB and OB messages (table 1-2).

Capacity and performance are determined by modeling and simulation only. The benchmark capacities are useful when providing the customer with estimates.

Table 1-2. Standard Message Profile

Message Service	User Data Length	Delivery Service	Direction	Quantity
Variable Length	50 Characters*	Individual Confirmed	Inbound	50% of total capacity
Variable Length	100 Characters*	Individual Confirmed	Outbound	50% of total capacity
* Character = one byte; one byte = 8 bits				

Capacity specifications consider the radio protocol link-level acknowledgments. If the host or mobile computer applications call for manual acknowledgments as the standard for public safety emergency dispatches, manual acknowledgments must be treated as user messages.

1.7.1.1 Host Capacity

When the user messaging requirements are determined, the effect on the host computer must be assessed by systems engineering. This decides if the host processor can support the additional load that the Private DataTAC network will introduce. The customer's systems analyst or host applications vendor provides this analysis, with input and assistance from the Motorola systems analyst.

1.7.1.2 Host Link Capacity

The RNC3000 and WNG capacities using a dedicated TCP/IP ethernet host link is non-blocking to the Private DataTAC network. Non-blocking is a term that signifies the message capacity specified is higher than the total capacity that a network configuration can attain.

1.7.1.3 WNG Capacity

WNG capacity, using the standard message profile, is 400K messages per hour (mph), which equates to approximately four fully-loaded RNC3000s. In a high availability system design that incorporates a fault tolerant WNG, the capacity is 250K mph.

1.7.1.4 RNC Capacity

RNC capacity, using the standard message profile, is 100K mph. This capacity equates to approximately five fully-loaded RD-LAP 19.2 kbps radio channels, or approximately nine fully-loaded RD-LAP 9.6 kbps radio channels using radio modems with 5 ms transmitter turn-on (TTO) time.

1.7.1.5 Radio Channel Capacity

The radio channel capacity study for the standard message profile shows that the IB radio channel is the limiting factor. The efficiency of the IB channel contention method directly relates to the key parameters of message length and radio TTO time.

1.7.1.6 Mobile Computer Messaging Capacity

The mobile computer message capacity consists of the radio modem capacity and the mobile computer application's ability to process messages.

The capacity of a radio modem is the number of messages it can send and receive within an hour, which is 1,000 mph, using the standard message profile. A Private DataTAC radio modem can send or receive data messages, but not simultaneously.

The radio modem prioritizes outbound messages over inbound message if both are encountered simultaneously. Radio modems cannot send outbound messages if they are receiving an inbound message. The radio modems are designed to wait until a message is successfully sent or retries (up to four) are exhausted. Radio coverage reliability can have an impact on modem message capacity.

1.7.1.7 System Response Time

System response time during typical and peak system use is the most apparent user concern. A transaction is a user-initiated message and the subsequent response(s). The time it takes to complete a transaction is a combination of mobile computer and host processing delays and radio system delays. Excessive delays can reduce operation efficiency and effectiveness which can be frustrating to the user.

The major areas that impact system response times are:

- Application hosts
- Host systems
- Private DataTAC network(s)
- Mobile computer and its application(s)
- Number of mobile computers using the channel

Message delivery delay and response delay specifications are expressed statistically. Two common statistical methods are average and 90th percentile

delay. The Motorola simulator yields these metrics for the customer's peak message profile. Delays usually are less during off-peak periods.

The 90th percentile delay metric represents that 90 percent of all delays that are less than or equal to the indicated delay. The following delay specification provides figures for average and 90th percentile delays for Private DataTAC networks operating at 90 percent of radio channel and RNC message capacity. The specifications are rated using the standard message profile (table 1-3).

Table 1-3. Message Delivery and Response Delay Specification

Delay Type	Radio Channel Reliability	Maximum Average Delay	Maximum 90 Percent Delay	Special Conditions
Delivery	90 percent	4 seconds	8 seconds	90 percent radio channel and RNC message capacity
Response	90 percent	5 seconds	10 seconds	90 percent radio channel and RNC loading

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Chapter 2
System Planning Process

This chapter covers the system planning preparatory process. Adding a Private DataTAC™ network to an existing computer system requires more than new hardware. Mobile computer and host application software issues must be considered.

2.1 Scope

This chapter discusses high-level issues that must be addressed before designing a Private DataTAC network. This manual does not cover all issues relevant to a business case, an application analysis, or a formal SOW. Other documents, both at the procedural level and product specific, address these details. (For other documents that address these details, see "*References*" on page xix.)

Managing the solution requires the skills and talents of several individuals working as a team. This group is the solution team. The team approach is used because of the large volume of detailed information to be determined, shared, and commonly understood. The solution team for this phase includes:

- Sales and the Advanced Products Team (APT)
- Systems Engineering
- Project Management
- Application Software Engineering
- Systems Technologists
- Business Development

2.2 System Planning Process Overview

The system planning process starts with the business case. The business case could be the result of a Request for Proposal (RFP) or a Request for Quote (RFQ). The business case contains the basic elements of customer qualification, budget availability, time tables, and basic technical requirements. At this level, the account manager creates a needs analysis based on a series of questions to the potential customer, what the customer requires, and any relevant information in the RFP or RFQ. The needs analysis helps management decide if this is a feasible project. If the project is feasible, the group advances to the system analysis and application analysis phases.

System analysis begins with the business case information. Future scenarios are developed to help determine whether Motorola can provide the products, network, or system to meet customer expectations.

Application analysis starts simultaneously with the system analysis and provides information for the product functions within the confines of future operational scenarios. The two analyses use the results to confirm that a Private DataTAC network is a viable customer solution. These results are then used to create an outline and specifications to help the system engineer with the technical system requirements that guide the system design. The complete design effort guides the system engineer to create detailed equipment lists that lead to the proposal and SOW.

The following subsections describe the planning process in more detail. This process follows the Motorola Customer Acquisition Process (CAP) and System Integration (SI) standards. They are:

- Business Case
- System Analysis
- Application Analysis
- Technical System Requirements
- System Design
- Equipment List, Proposal, and Statement of Work

2.3 Business Case

The account manager must create a business case for the customer before the system engineer designs the system. Motorola management uses the business case to determine resource needs and develop the sales potential, based on the customer's qualifications, specifications, budget, time tables, and technical requirements.

A Private DataTAC network provides specific competitive advantages. In businesses such as delivery couriers, a wireless data network extension of the information system can provide the customer's business with a distinct advantage over their competition by providing real-time package tracking.

For a service business, the wireless data network can provide quicker customer response times and lower operating costs by reducing or eliminating multiple trips to correct a single problem.

For public safety, the network can increase safety for the field officer, yield quicker response times to emergencies, and provide greater control of assets. For utility companies, a wireless data network can reduce service interruptions by quicker responses to outages and better control of assets.

The radio data network and application software allow the customer to use mobile computers in the field. To stimulate the thought process and ideas, some application scenarios include the following:

- Yard master coordinating the assembly of a train of railroad cars for delivery to customer sidings
- Factory floor manager ordering materials for the production line
- Dock master requesting the removal of a trailer from a loading dock
- Dispatcher sending address and route information to a courier
- Utility meter reader entering customer meter readings
- Cable company installer enabling services
- Firefighter reviewing the floor plans of a burning building
- Fork lift operator guided from one material move to the next without stopping at the office to pick up the next assignment
- Fuel oil delivery truck operator directed on a computer-optimized delivery route
- Tank and vehicle sensors connected to the mobile computer relay product disbursements for immediate billing
- Service technician ordering repair parts for immediate delivery to the job site
- Patrol officer checking for warrants before approaching a vehicle
- Load master coordinating dock workers and crane operators in loading a container ship

Mobilizing the remote computer from the wireline network requires special consideration to optimize operation and response times. Eliminating the wire between the host computer and the remote computer and replacing it with two-way radios, injects noise and delays not normally encountered in wireline systems. Figure 2-1 illustrates the mobile computer connected directly to the host. See the *Private DataTAC™ Application Design Guide* for more information.

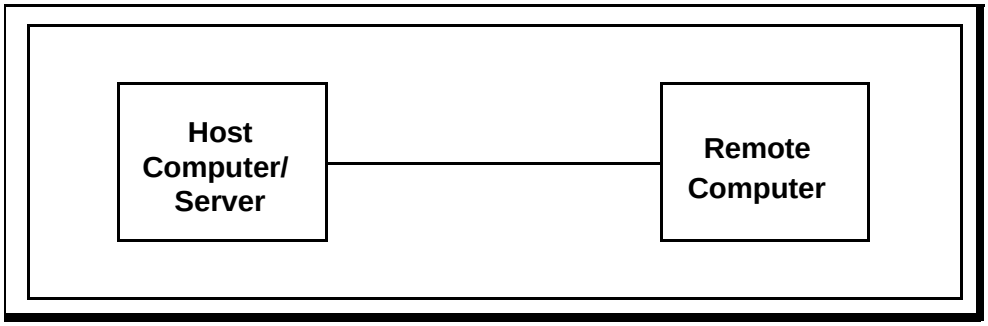


Figure 2-1. Wireline Network Computer Link to Host

This scenario causes the response times to be longer and message capacity smaller than wire connected systems. Figure 2-2 illustrates the replacement of the wire with radio to connect the remote computer to the host. See the *Private DataTAC™ Application Design Guide* for more information.

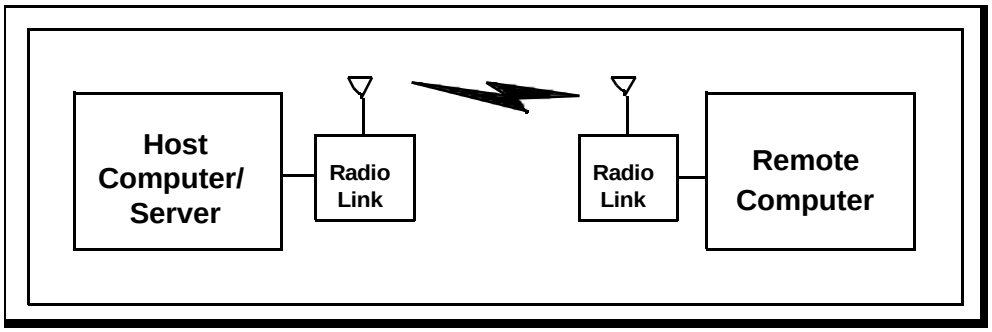


Figure 2-2. Radio Data Network Computer Link to Host

The customer's problem must be clearly understood by the solution team and the problem can be stated several different ways. In a public safety application, the problem presents itself from the perspective of different participants.

A few examples of these problems are shown as follows:

- Police officers need to know who is likely to be in a vehicle before they approach it during a traffic stop. Knowing whether an individual has outstanding arrest warrants or if the vehicle is stolen will prepare the officer.
- Citizens might complain to village officials if a traffic stop takes too long or if the officer treats them like criminals.

- The police chief complains to the watch commanders that the citation rates are lower than those of neighboring municipalities. Funding and staffing are based partly on citation activities, officers must be more efficient.

A wireless network solves the problems by giving the officers in the field the same access to local, state, and federal criminal databases that they have in the office, which reduces the incident time. Shortened incident times reduce time complaints from citizens and enables the officers to make more stops per shift. Officers knowing whom to expect in the stopped vehicle can treat those with warrants and arrest records with full formality.

In a commercial application, the problem presents itself in the following examples:

- A fuel oil delivery truck operator stops at the office to pick up a list of deliveries for that day. The driver then drives to the locations in order shown on the list which typically is in the same order that the request was received.
- Customers complain they have to take time off work to be available to give the driver access to fill ports on the oil tanks.
- Managers complain to the drivers that they need to plan their routes to minimize mileage and increase deliveries per day.
- Sales and marketing complain that the company is losing customers to competition because of poor service.
- The accounts receivable department complains that the drivers make mistakes on recording meter readings on the tanks and that they do not turn in the log sheets on time.

A wireless data network solves these problems by providing drivers with the next stop information and has the host computer determine the next stop from all available jobs. This reduces transit time between deliveries and provides statistics for estimating customer delivery times. Monitoring the sensors on the dispensing equipment on the vehicle enables a customer to do immediate billing for services rendered.

2.4 System Analysis

This section describes how system analysis leads to the system requirements. System analysis compiles and organizes the information required to create the technical requirements for the customer. The analysis activities are based on business case and management's decision to pursue the opportunity.

The solution team usually decides on an approach and meets early in the problem definition and the information gathering phases.

System analysis covers the following:

- Information gathering and operational objectives
- Availability expectations
- Constraints

System analysis is the basis for determining whether a wireless computer system is the correct solution for the customer. The system analysis focuses on how the customer plans to use the system which leads to the technical requirements. A system analyst should:

- Obtain an end-to-end functional description of how the system should operate based on the customer's needs. This includes identifying all the Motorola or third-party hardware and software needed for the system.
- Evaluate the customer's connectivity requirements and assist in evaluating the existing hardware platforms and applications.
- Identify the message flow and routing requirements through the communication network and develops a system load profile for the system.
- Identify the customer's dependence on the network for business flow which leads to addressing the availability issues.

2.4.1 Information Gathering and Operational Objectives

Gathering information begins with assessing the problem. The following is an example of the type of question that probes for the problem. Following the question are several example responses that speak to the types of issues behind the customer's inquiries.

What are some of the reasons for adding mobile computers to an existing information system?

The example response might be:

- To provide the organization with a distinct competitive advantage
- To catch up with competition in providing goods and services
- To respond to citizens demanding significantly faster response from public safety organizations
- To be an industry innovator and early adopter of technology
- To provide wireless data service companies with the latest technology so they can then provide it to their customers

For public safety, utilities, and commercial clients, there are similar requirements. These requirements are described in the following sections which cover the gathering and organizing of information for technical requirements, software considerations, and issues that need to be addressed.

- Application software
- Two-way radio coverage
- System capacity
- Response time

2.4.1.1 Application Software

The Private DataTAC network is a data radio transport that needs customer specific application software. Integrating software applications across the Private DataTAC network and optimizing radio channel use can be complicated. Addressing application software at both ends of the network is covered in this section. On occasion, a third-party computer aided dispatch (CAD) vendor is subcontracted.

The information gathering process can be guided by questions such as those in the following subsections:

- Mobile applications software functionality
- Host/server software functionality

These two sections are not exhaustive or complete. Each question can have follow-up questions to help clarify or refine information. Each example has both similar and unique requirements.

2.4.1.1.1 Mobile Application Software Functionality

Questions addressing mobile application software functionality include:

- For the mobile computer, how much of the processor capacity is required for the application(s) that uses the network?
- What percentage of the mobile computer CPU resources does each of the applications use?
- What is the message profile for each mobile computer for sending and receiving messages via the Private DataTAC network?
- What mobile computer applications need to run to communicate with applications running on servers or host computers?
- Which mobile computer application does not use the network or system?

2.4.1.1.2 Host or Server Software Functionality

Questions addressing host or server computer application software functionality include:

- What server or host applications use the land-based network, but not the Private DataTAC network?
- How much of the host CPU capacity is required to support mobile computers?
- Which applications run on the customer's host or server that will be used by the mobiles via the Private DataTAC network?
- How much of the host CPU capacity is being used?
- Which local area network (LAN) or wide area network (WAN) protocol is used?
- Who manages the developing of a custom application to use with the Private DataTAC network, if required?

2.4.1.2 Two-Way Radio Coverage

Two-way radio coverage issues need to be defined up front. Coverage has a major effect on network performance and the equipment required.

Questions to answer include:

- What percentage of the operational area needs to be covered and at what level of reliability?
- What is the mix of portable and mobile computers?
- How many radio channels are available?
- How many radio channels can the system dedicate for data communications?
- What is the distribution profile of mobile computers in the coverage area?
- How many base station sites are available?
- Given the available base station sites, does the radio coverage match or exceed the customer's operational area?
- As the customer's operational area expands, how many additional base station sites will be required?
- What is the customer's operational area expansion rate and time table?
- What is the typical dispersion of customer's targeted mobile resources within the operational area?
- Are there requirements for in-building coverage and to what reliability level should the network cover them?
- Does the customer have multiple operational areas in different states, provinces, or countries?
- What are the environmental factors such as hills, vegetation, and water, within the operational area that might affect radio reliability?
- What is the availability or access to base station sites, such as mountain tops, water towers, radio towers, or building tops?

2.4.1.3 System Capacity

- Capacity covers issues that concern the maximum number of messages per hour that the system can handle.
- Capacity issues need to be addressed up front and determine part of the system design.
- What are the system capacity and response time expectations?
- How many mobile computer equipped resources will be deployed?
- What is the customer's LAN / WAN load profile?
- How many messages per hour should each mobile computer handle during peak periods and normal periods?
- What is the expected message profile per mobile computer in message lengths and frequency of each?
- What is the current loading and capacity on the existing system before Private DataTAC is added?

2.4.1.4 Response Time

Response time needs to be addressed up front and determines part of the system design.

Response time covers issues relative to the time it takes for a system to process a message. These issues are the center of the customer expectations. The following issues must be addressed:

- What is the response time expectation?
- What is the existing system's load and capacity without Private DataTAC?
- What is the current response time of desktop computers connected to the land-based network doing similar activities required of the mobile computers?

With answers to these and several follow-up questions, a system designer can create a network design that addresses many response time issues.

2.4.2 Availability Expectations

The customer's business operations dictate the availability expectations. Five-day / eight-hour operational demands, though different from seven-day / twenty four-hour operational demands, are just as critical. In both cases, availability during operating hours is a priority. Much of the expectations center on how closely coupled the wireless data network is to the customer's revenue stream.

Availability covers a variety of expectations such as the percentage of time that the network is available for service maintainability, remote monitoring, and management. Typical questions include:

- What level of network availability is required?
- For public safety and utility customers, what percentage of time must the network be available?
- For commercial customers, what percentage of the regular work day must the network be available?
- What level of remote monitoring or network management is required?
- What level of support does the customer expect to do internally?
- What level of support does the customer expect from the external provider?

On the maintainability side of the issue are the following questions:

- How much space is available for FNE installation?
- Are equipment installation sites accessible?
- What are the environmental factors of the installation spaces?
- What services are available to the installation spaces?
- What acceptance tests does the customer require for customer acceptance and benchmarking network performance?
- How much downtime can the customer tolerate?
- What level of interchangeability or network availability does the system require?

2.4.3 Constraints

Constraints are conditions and situations that the system designer must take into consideration during the design stage. Some constraints are as follows:

- Not enough base sites
- Too few RF channels
- Area not covered because of poor base site locations
- Insufficient budget / phased rollout

2.5 Application Analysis

Application analysis compiles and organizes the information required to create the technical software requirements for the customer. The application analysis activities are based on the business case and management's decision to pursue the opportunity. This phase describes the software functionality the customer needs.

The application designer needs specific information to make the best choices in approach. As a guide to organizing the data, create the following:

- A written current operational scenario
- A written future operational scenario
- List of differences

The application designer must understand the customer's problem before starting the analysis.

2.5.1 Current Operational Scenario

The first step of the current operational scenario is to map the process of the customer's targeted operations. The operational scenario is assembled to ensure that sufficient information is available and that the details are captured. This activity is a joint effort of the APT, sales account manager, and the customer. The output of this activity gives a detailed description of what is occurring in the customer's process. Sometimes, the best way is to observe and record what actually happens, what information is used, and who reviews it. Break down each transaction, command, and a response to words, numbers, or codes that clearly communicate instruction, information, or status. Items such as bills of lading, work orders, delivery logs, trip logs, etc., highlight the information the customer uses to run their business.

Every person or function that operates in or on a vehicle is a potential candidate for mobile computer use. Determine which functions have the most positive effect on profits and efficiency.

2.5.2 Future Operational Scenario

The future operational scenario invokes cost savings or additional revenue because of changing the process. The basis of value rests with the customer and the concept of sufficient benefit of additional revenue, timely and accurate data, or improved response time to emergencies, etc. Examples of a couple of questions to ask are:

- Does the increased citation rate of each police officer offset the cost of the system? Specifically, how long does it take to recover the system's cost?
- Does the increased volume of deliveries offset the cost of the system? This has two aspects: the first is deliveries to new customers and the second is frequency of service for each customer.

A customer's current operations, moving to a future scenario are based on the customer's perception. If the customer is not serving their customers in the most efficient manner, or serving a market or class of customers that provide growth and profitability, then using a Private DataTAC network to address the customer's need to change is weighed against the various possible solutions.

2.5.3 List of Differences

While comparing the two operational scenarios, create a list of the differences. Organize the list into what customers do that is different and what equipment, networks, or systems are required to help them to do it. Total customer satisfaction depends on the customer's confirmation of this list of processes and procedures.

2.6 Technical System Requirements

The system engineer, using the results of the application analysis and system analysis, specifies the customer's technical system requirements. This phase leads into the system design process.

There are three technical requirements: functional, architectural and performance. They are described in the following subsections.

2.6.1 Functional Requirements

Functional requirements describe the specific data transfer and processing required for information flow through the system. The requirements typically relate to the host and wireless computer applications or system routing requirements.

The system engineer must analyze the following system functional requirements for every Private DataTAC network design:

- Host application functions
- Wireless computer functions
- Network management functions
- Host and mobile computer connectivity
- Wireless computer mobility

2.6.2 Architectural Requirements

Architectural requirements describe the physical location, the connections between equipment, and the logical distribution of processing. The main areas of concern are radio site location, communications links, and radio frequency planning.

The system engineer must identify and analyze the following architectural requirements before proceeding to the system design phase:

- Computer site availability
- Base site availability
- Computer to base site communications links
- Radio channel availability
- Mobile computer geographic distribution

2.6.3 Performance Requirements

Performance requirements describe messaging capacity, response times, and data radio coverage in objective terms of numbers and time.

The systems engineer must identify and analyze the following performance requirements before proceeding to the system design phase:

- System capacity
- System response times
- Radio coverage area
- Availability

2.7 System Design

This system design section is the final phase leading to the equipment list, proposal, and SOW.

After documenting the specific customer requirements, the systems engineer decides which standard Private DataTAC network topology can meet the customer's system-level requirements. The systems engineer decides which type of design fulfills the customer's requirements.

2.7.1 Functional Design

The Private DataTAC network uses the transport layer of the data radio communications interface for host and wireless computer applications. The *Private DataTAC Network Capabilities Specification* document describes the end-to-end functions of the Private DataTAC network.

The systems engineer must prepare a functional system design for a formal technical review (FTR). It minimally includes the following items:

- high-level system functional capabilities description
- Host and terminal connectivity description
- Private DataTAC network services utilization description
- Private DataTAC network functional ATP

If Motorola provides and integrates applications software, the system engineer must also provide the following:

- Detailed host application and connectivity description
- Detailed terminal application and connectivity description
- System level functional ATP
- System integration test (SIT) plan and procedures

2.7.2 Architectural Design

The system engineer must make architectural choices based on functional and performance trade-offs.

Figure 2-3 shows a general architectural design illustrating high-level FNE physical architecture and incorporating a customer's system and Private DataTAC. This diagram shows the host computer connecting to and controlling the WNG. The diagram also shows a message switch performing protocol conversation for linking the host to the RNC. The device shown in the diagram is a computer aided dispatch (CAD) system.

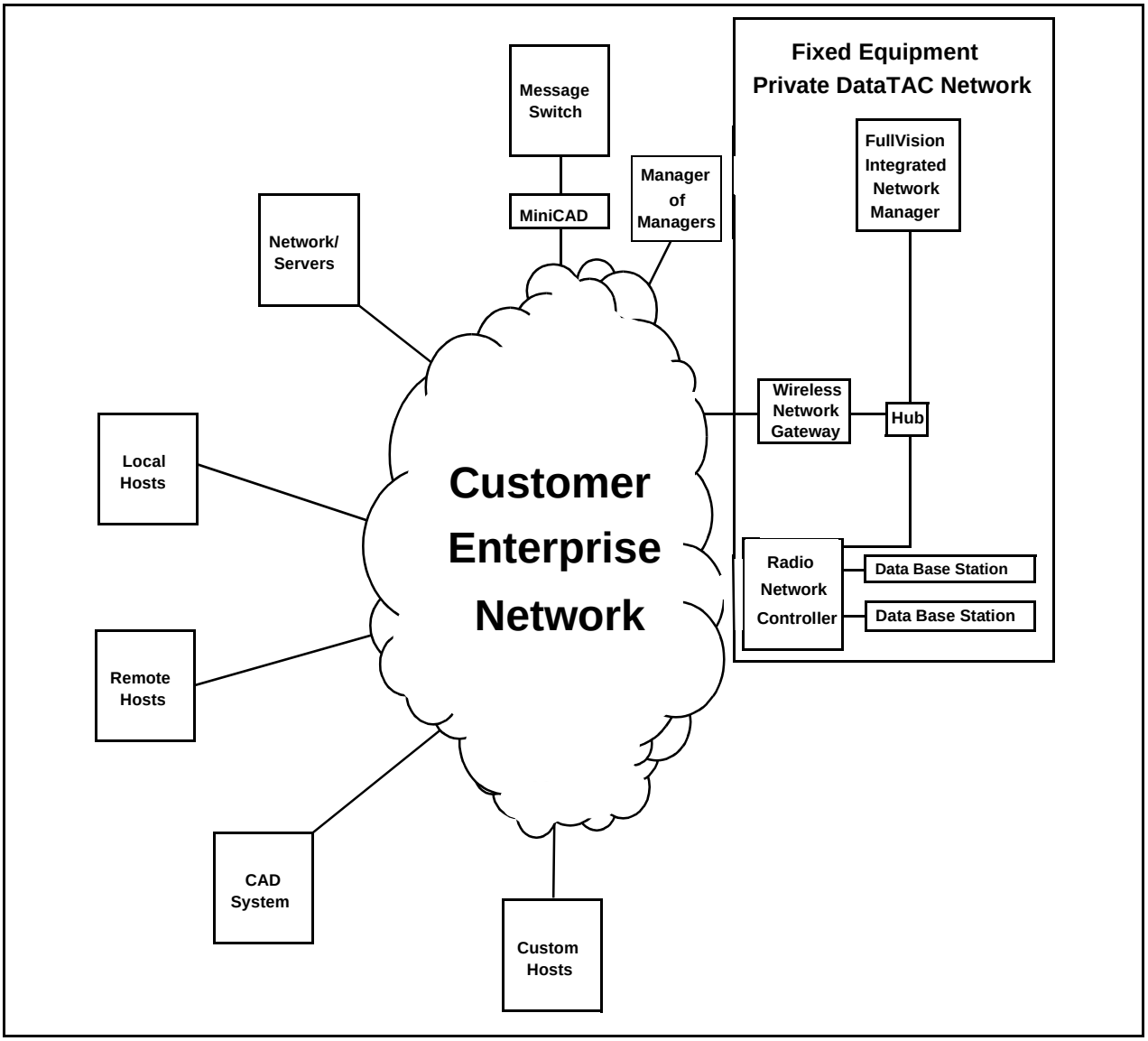


Figure 2-3. Fixed-End Customer System Diagram

The system architecture design must be documented for an FTR and should minimally include the following items:

- Detailed RNC and / or WNG connection diagram
- Detailed FullVision® INM connection diagram
- Detailed DBS and antenna system connection diagram
- Detailed radio channel architecture diagram
- Detailed mobile computer connection diagram

2.7.3 Performance Design

Private DataTAC network performance design is an integral part of the system design. All the system design choices interact with the specific customer application requirements to form a quantitative description which should agree with the customer's performance expectations.

The solutions team must document the performance design for an FTR and minimally include the following items:

- System and component capacity analysis
- System response time analysis
- Coverage map analysis
- Radio path equalization analysis
- Availability analysis
- Interference analysis (if applicable)
- Cascaded amplifier analysis (if applicable)

The term analysis means a combination of the actual prediction results, the methodology used to arrive at the prediction, and the justification of input parameters used in the design.

2.8 Equipment List, Proposal, and Statement of Work

Upon completion of the FTR for the components of the system design, the solution team creates the proposal and SOWs. The equipment list (also called a Bill Of Material) is part of these two documents. Typically, the SOW is created following the final negotiations activities and becomes part of the contract. These processes are described in the following subsections:

- Creating the equipment list
- Acceptance test plan
- Assembling the proposal
- Creating the statement of work

2.8.1 Creating the Equipment List

Systems engineering has access to various design guides to assist in selecting suitable equipment and creating coverage maps and support information. Early on, the equipment list is created by the system engineer when the requirements of the customer have been established. This list is forwarded to the project manager who estimates costs for service, installation, and any other outside costs. The equipment list is put through a technical scrub to confirm all technical aspects are covered, and the list is complete. Engineering charges, service, installation, and any travel expenses are put through the configurator application which compiles the general costs for the customer's system. When the costs are compiled, these costs are confirmed through a bid and quote scrub and the final dollar is set. The equipment list is then put into the COF system.

2.8.2 Acceptance Test Plan

The project manager, systems engineering, and systems integrator together create the acceptance test plan (ATP). The ATP can have variations in the test procedures, depending on the customer's preferences. The ATP should include the following:

- Cover letter
- Executive overview
- Detailed list of responsibilities
  - Motorola responsibilities
  - Customer responsibilities
  - Other
- System description in detail
- Expected system performance in detail
- Link verification test with field testing
- Procedures for testing in detailed steps
- Coverage test of the customer's area
- Guarantee coverage of fixed sites and mobiles
- Detailed maps, grids, and test points
- Testing at our site or customer's
- References, if required
- Literature from LDC (sales brochures)
- Capacity testing, confirming mph network capacity

When the ATP is completed, it is given to the contracts department as part of the SOW.

2.8.3 Assembling the Proposal

Sales and systems engineering working together create the proposal documents for presentation to the customer. Proposal text and support information are available in various Private DataTAC documents shown in the *References* section of this document.

Part of the proposal should include training for Motorola's portion of the solution. The customer needs to be trained on the process, as modified, using the equipment and software. This training should occur before and after equipment installation.

2.8.4 Creating the Statement of Work

The SOW is a compilation of the system description, responsibilities, an ATP, and other considerations as earlier discussed in this chapter. After completion of the equipment list, the SOW needs to be created. This document provides the customer with a clear description of the responsibilities and actions of the Motorola team. The SOW details those items provided by others, such as application software for the host or mobile computers.

The SOW should minimally contain the following:

- Radio frequency (RF) coverage maps using the mobile data parameters of the areas covered as they relate to the customer's operational area
- ATP to validate the RF coverage
- Acquisition and development plans for base station sites, if required
- A list of throughput assumptions based on business case analysis
- A frequency plan
- An equipment list (both fixed network equipment and subscriber units)
- System drawings
- Recommendations for client's future needs

Chapter 3
Decision Charts

The decision charts in this chapter help the system designer and engineering personnel select equipment to meet the specific customer needs. The charts also help the systems engineer select compatible equipment for new and existing systems. When you are selecting equipment from the decision charts, the compatibility charts, options, and accessories charts for the associated equipment are on the same page. Chapter 4, “Equipment Descriptions,” describes them in detail.

To use the charts, select one item in each column or block. Moving to the right, select one item in the next column or block. AND bars (vertical) separate major equipment sections, and denote required equipment on either side in configuring a complete system. OR bars (horizontal) separate alternate equipment within a section. Box extensions on the bottom of equipment boxes denote required options. The use of the vertical and horizontal bars is reflected in the Core System Configurations box (fig. 3-1). Box extensions on the left or right of an equipment box denote the most common choices in required interface options. Large gray boxes denote a major system component made up of several items. Specific notes define what is required for a complete item.

The decision charts show the core system set. With the use of simple AND and OR barriers, the layout shows the required items and those items that might be substituted. The core system has three possible configurations: ABE, ACE, and ADE (fig. 3-1). The choices of B, C, and D are the only variables in the system shown. The AND barriers show that you must choose from the alternatives of B, C, or D. Options and accessories to the units below expand the range of choices for additional feature sets, but not of the core unit set.

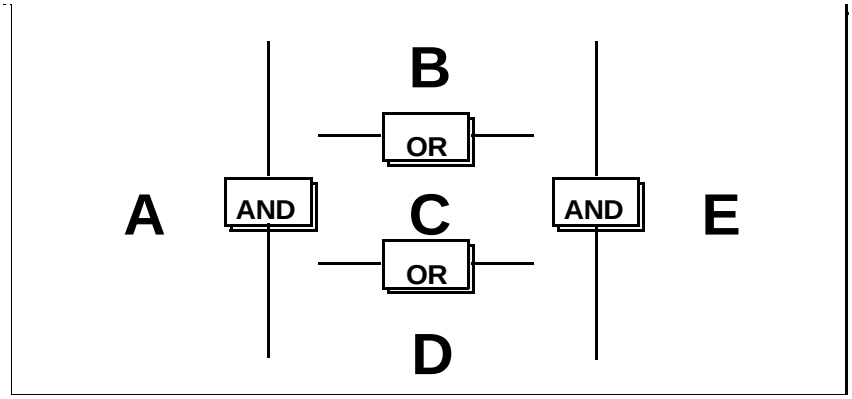


Figure 3-1. Core System Configurations

Four other features are used in the decision charts to help with understanding relationships between products:

- The use of gray **AND** bars (soft **AND**s) means that the items to the right of the bar are not needed for system operation. These items provide additional capability or functionality (fig. 3-2).
- The use of boxes with rounded corners means that the model number inside is control or application software. The model number inside is required for proper system operation (fig. 3-2).
- The use of open-ended overlap boxes to the right or left side of the larger boxes lists a cable or interface that might be required (fig. 3-3).
- The use of open-ended overlap boxes on the bottom of the larger boxes lists requirements for the model in the box being overlapped (fig. 3-3).

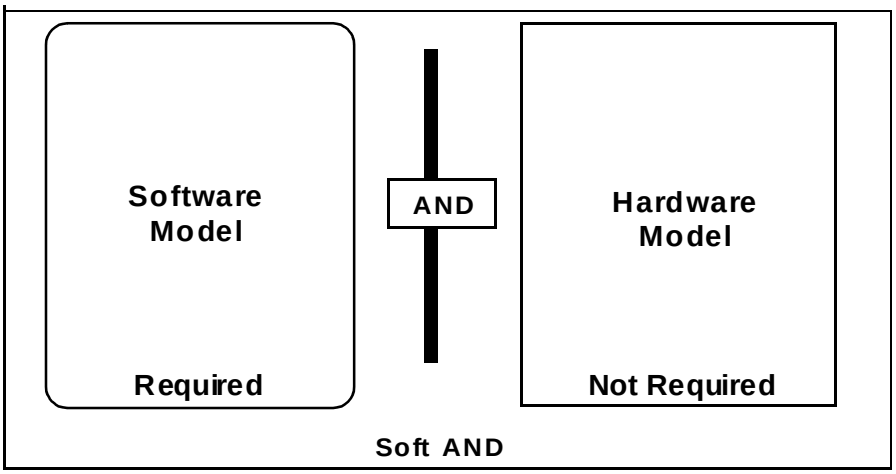


Figure 3-2. Gray AND Bar

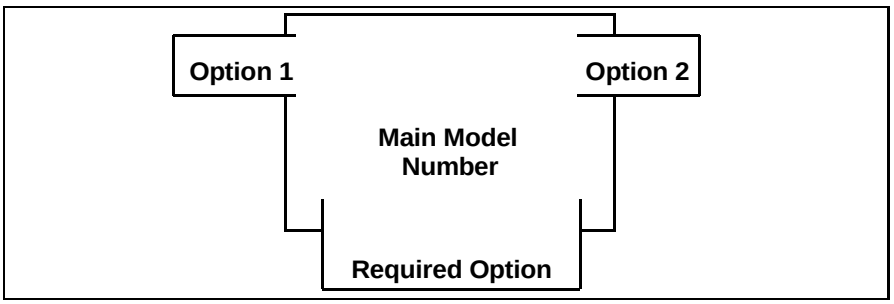


Figure 3-3. Overlays

3.1 Interconnect/Information Flow

Figure 3-4 is a site map that reflects how the basic interconnections and information flows through the devices and the data system. For example, the Global Positioning System (GPS) receiver can be connected directly to a VRM or a mobile computer. Locations for the devices are shown in the site map.

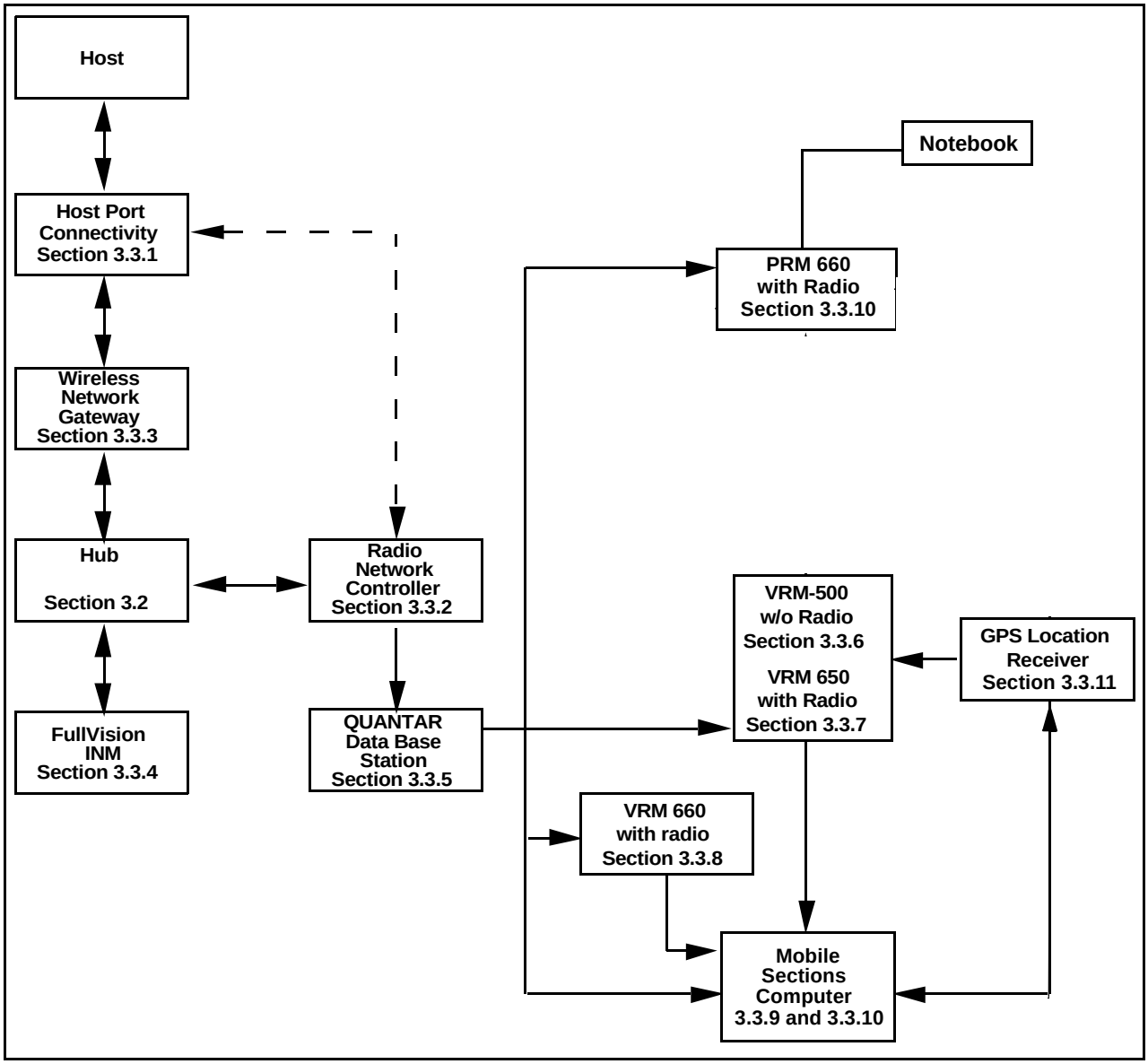


Figure 3-4. Interconnect/Information Flow

3.2 Ethernet Connectivity

Figure 3-5 shows the ethernet hubs and 10BaseT cables as they relate to SNMP with FullVision® INM and non-SNMP without FullVision INM.

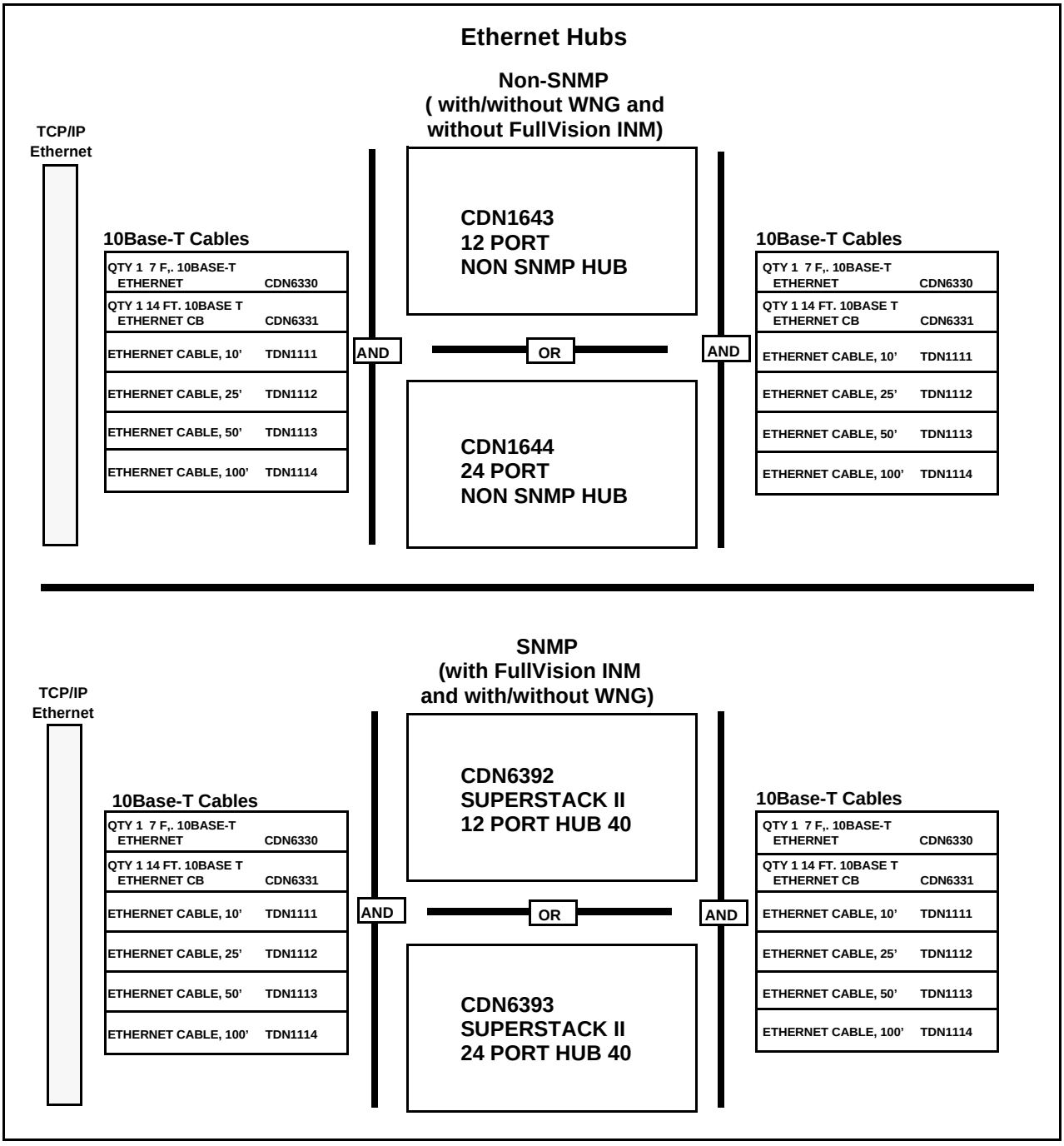


Figure 3-5. Ethernet Hub and Cable Connectivity

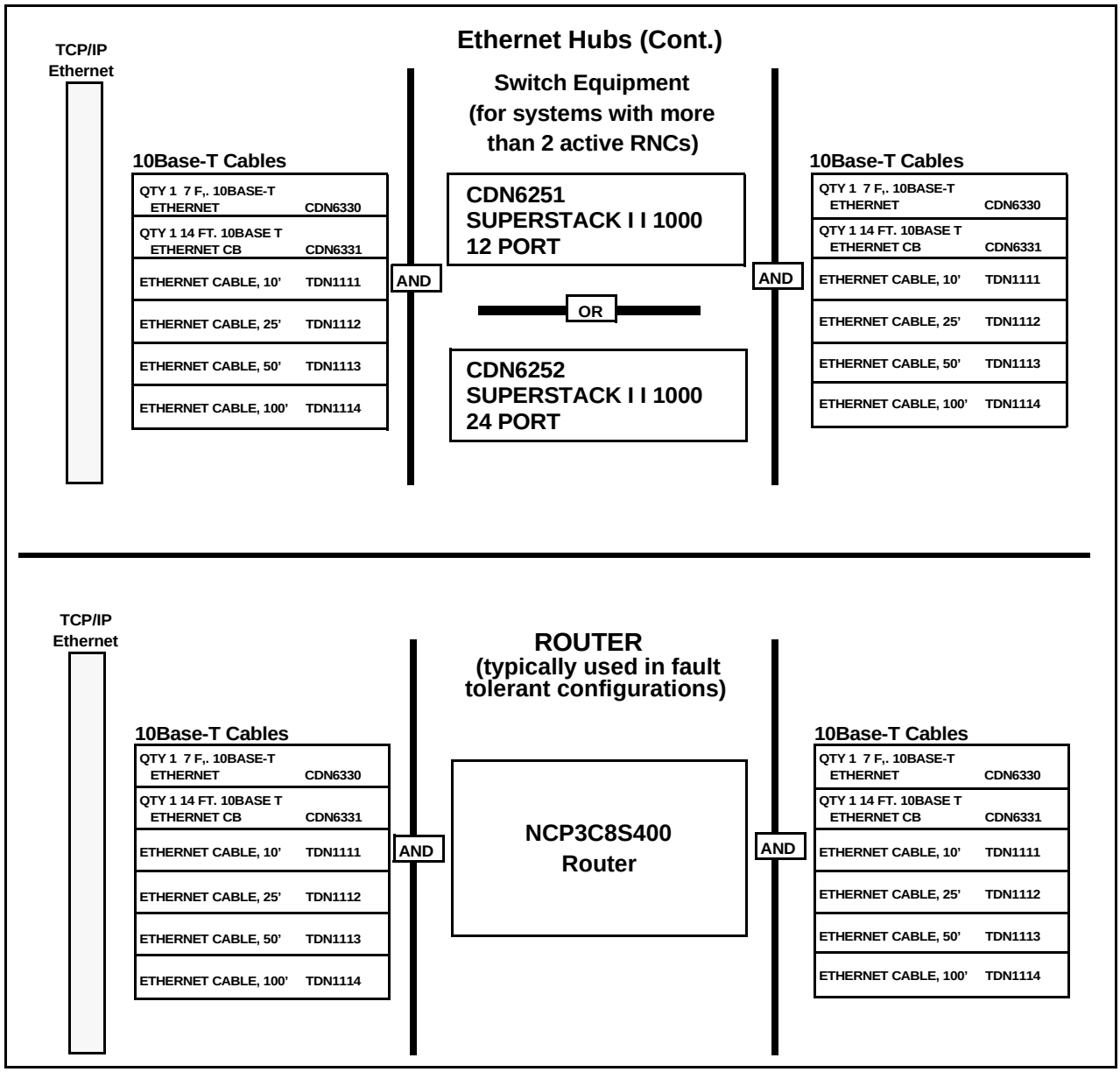


Figure 3-6. Ethernet Hub and Cable Connectivity (Continued)

3.3 Creating the Network Topology

The following decision charts, subsections 3.3.1, "Radio Network Controller 3000 Host Port Connectivity," through 3.3.12, "Global Positioning System," describe and define each product and their relationship to each other.

3.3.1 Radio Network Controller 3000 Host Port Connectivity

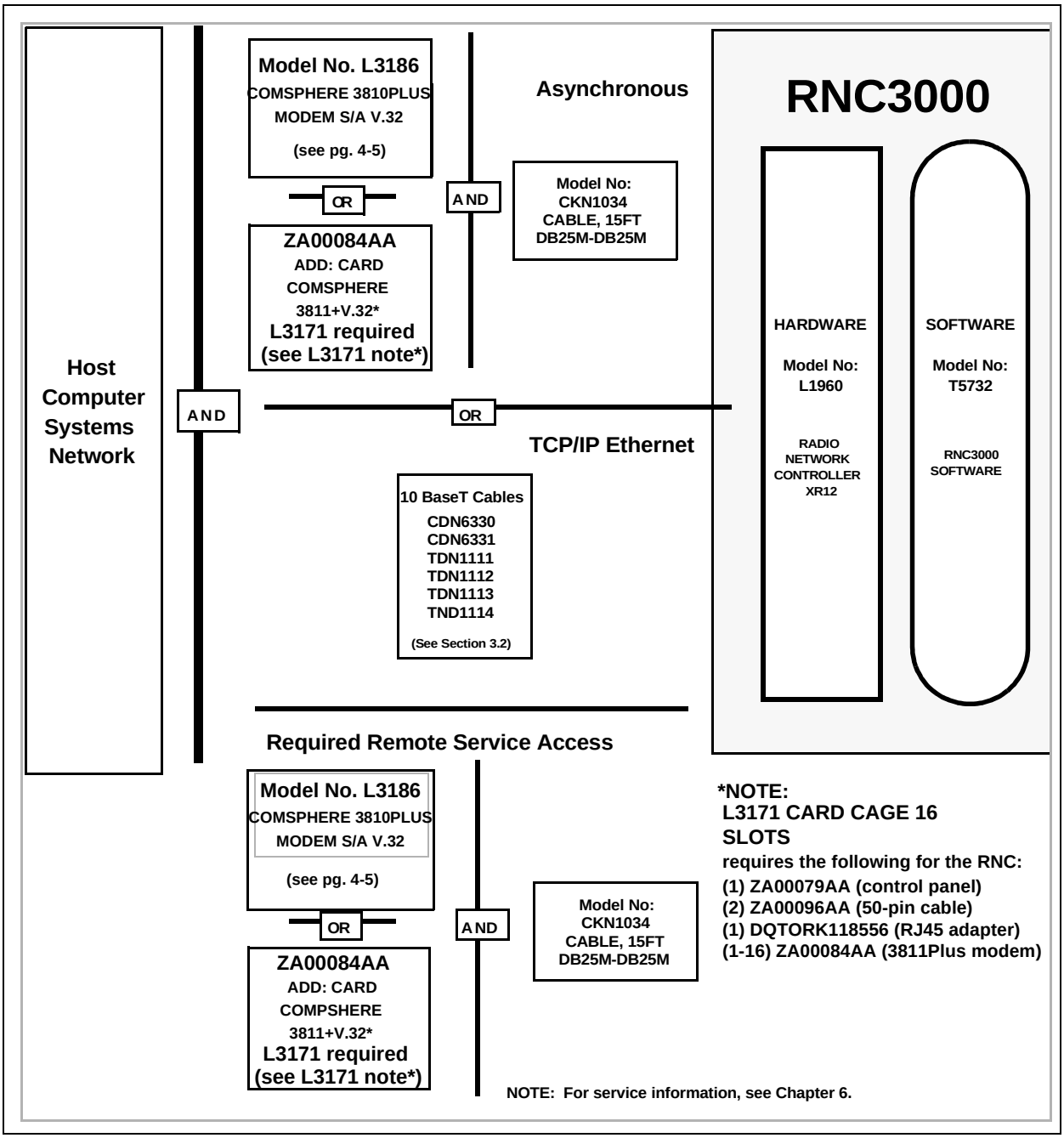


Figure 3-7. RNC3000 Host Port Connectivity Decision Chart

3.3.2 Radio Network Controller 3000 (RNC3000)

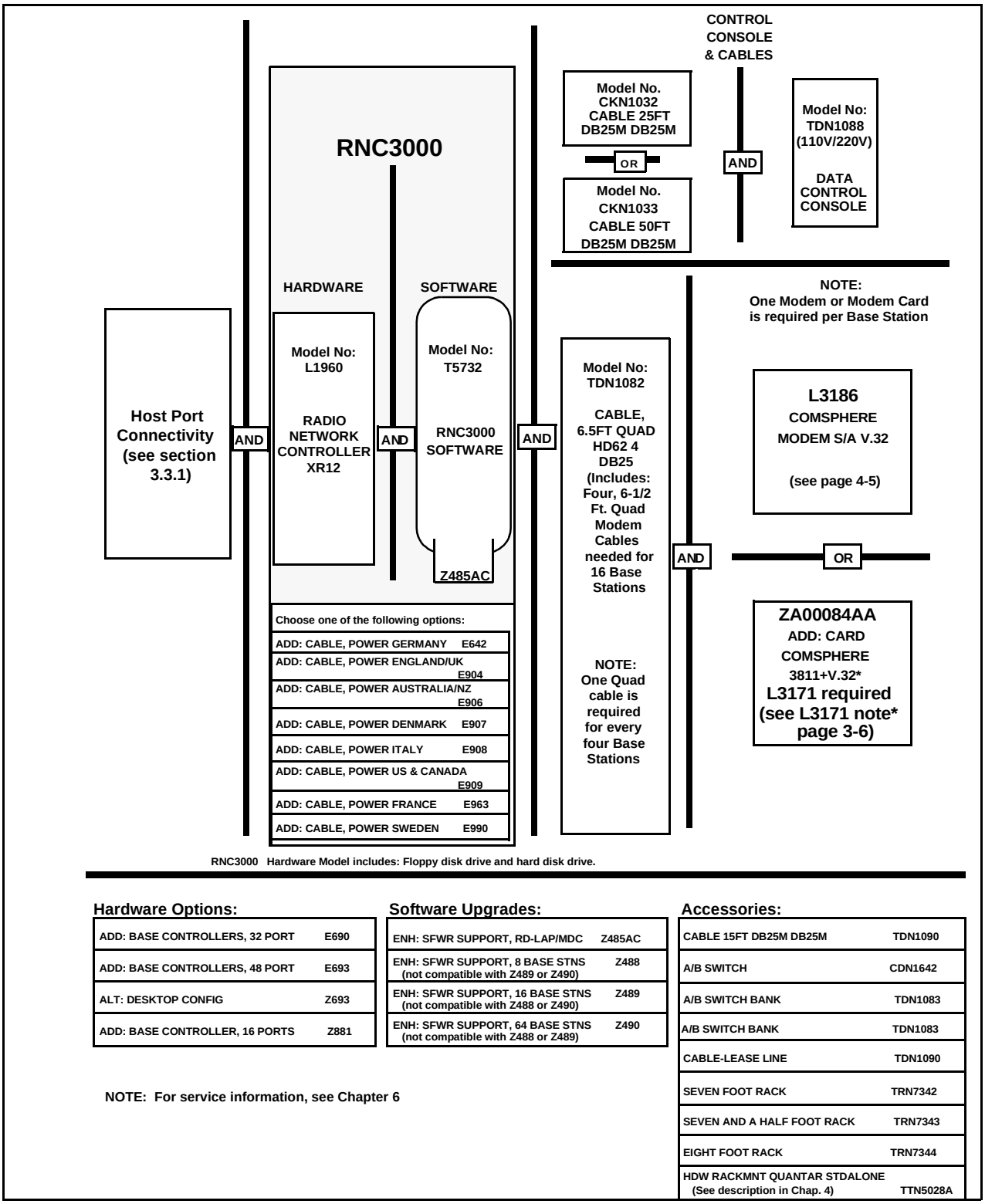


Figure 3-8. Radio Network Controller Decision Chart

3.3.3 Wireless Network Gateway™

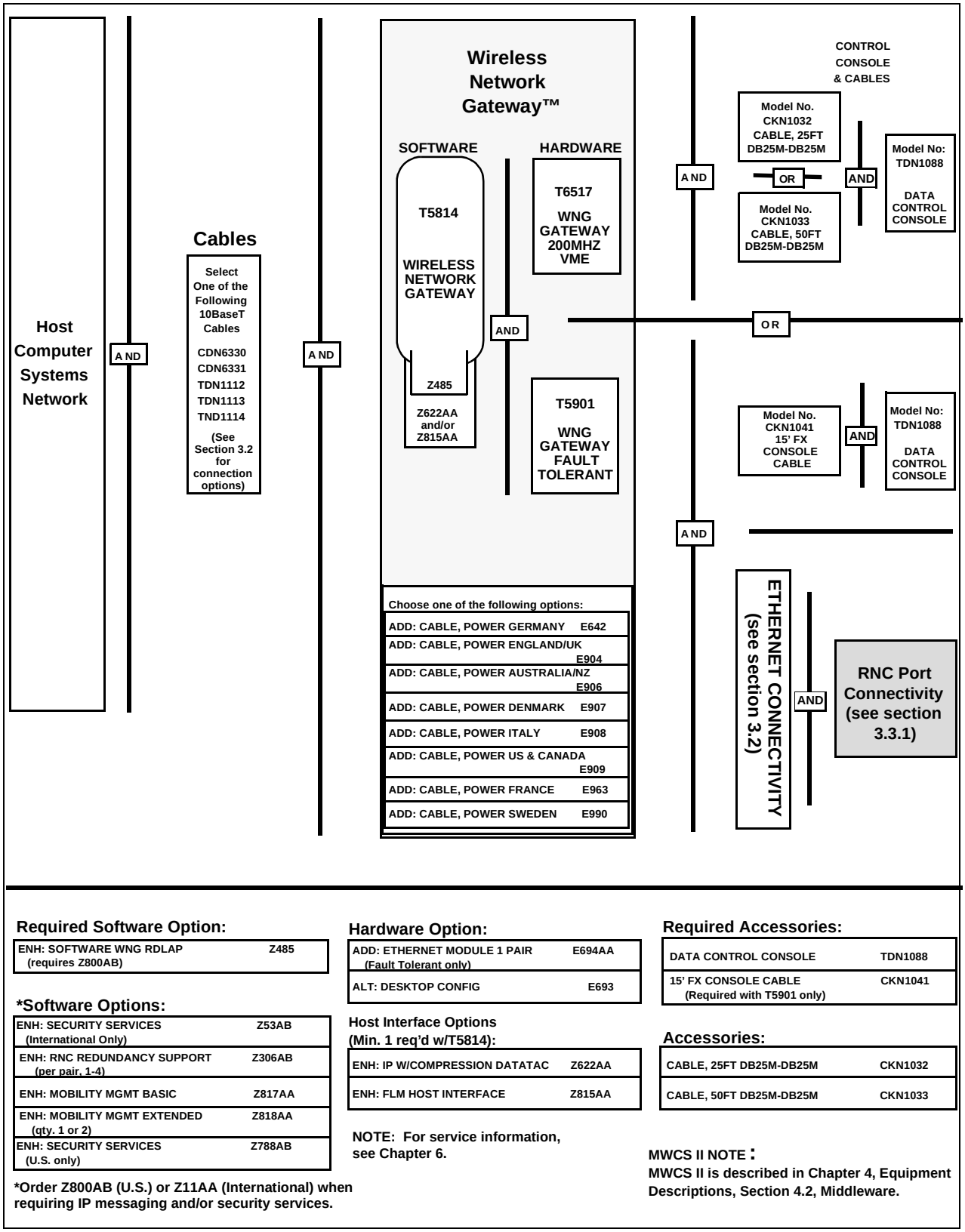


Figure 3-9. Wireless Network Gateway Decision Chart

3.3.4 FullVision Integrated Network Manager

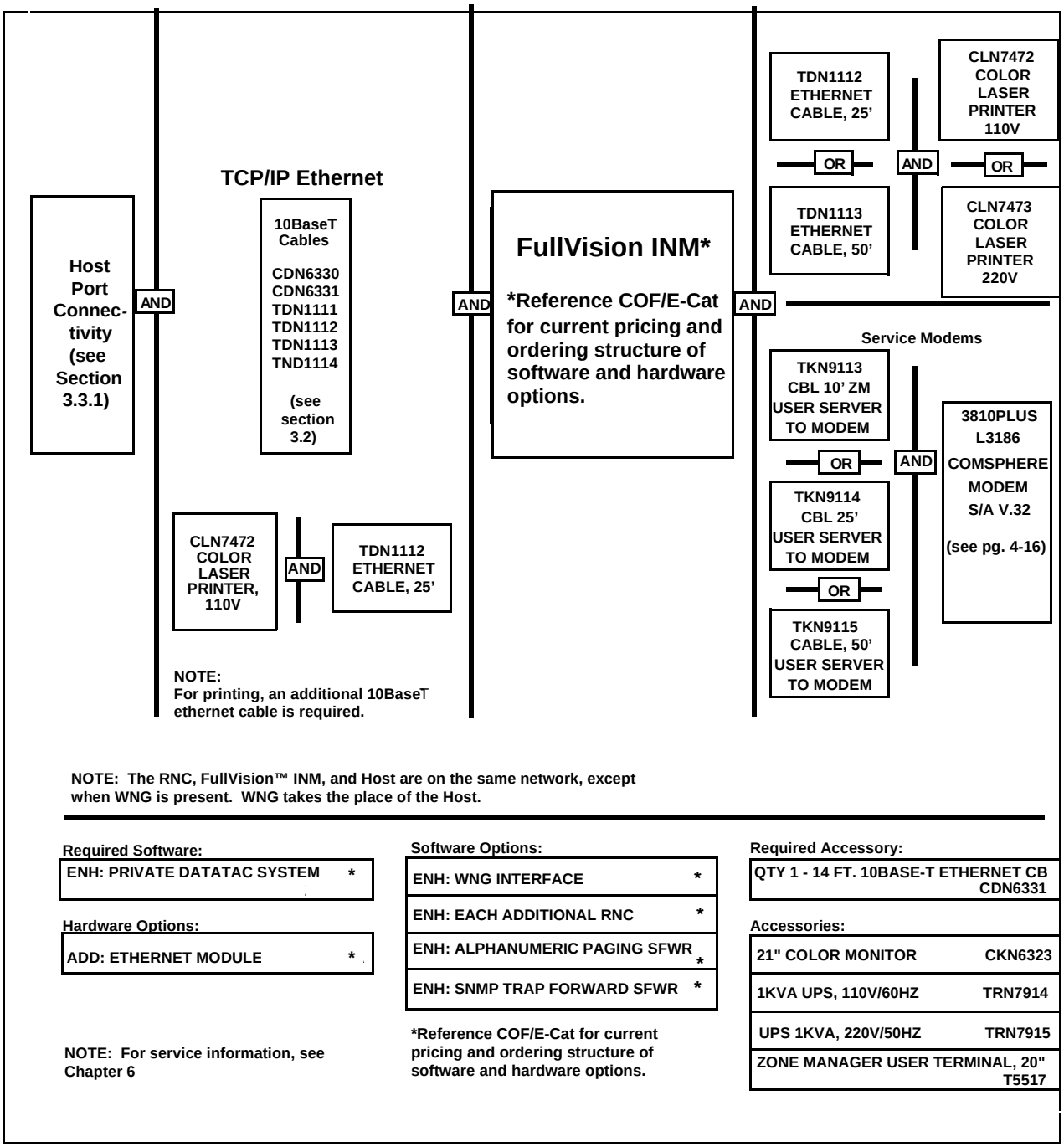


Figure 3-10. FullVision Integrated Network Manager Decision Chart

3.3.5 QUANTAR® Data Base Station

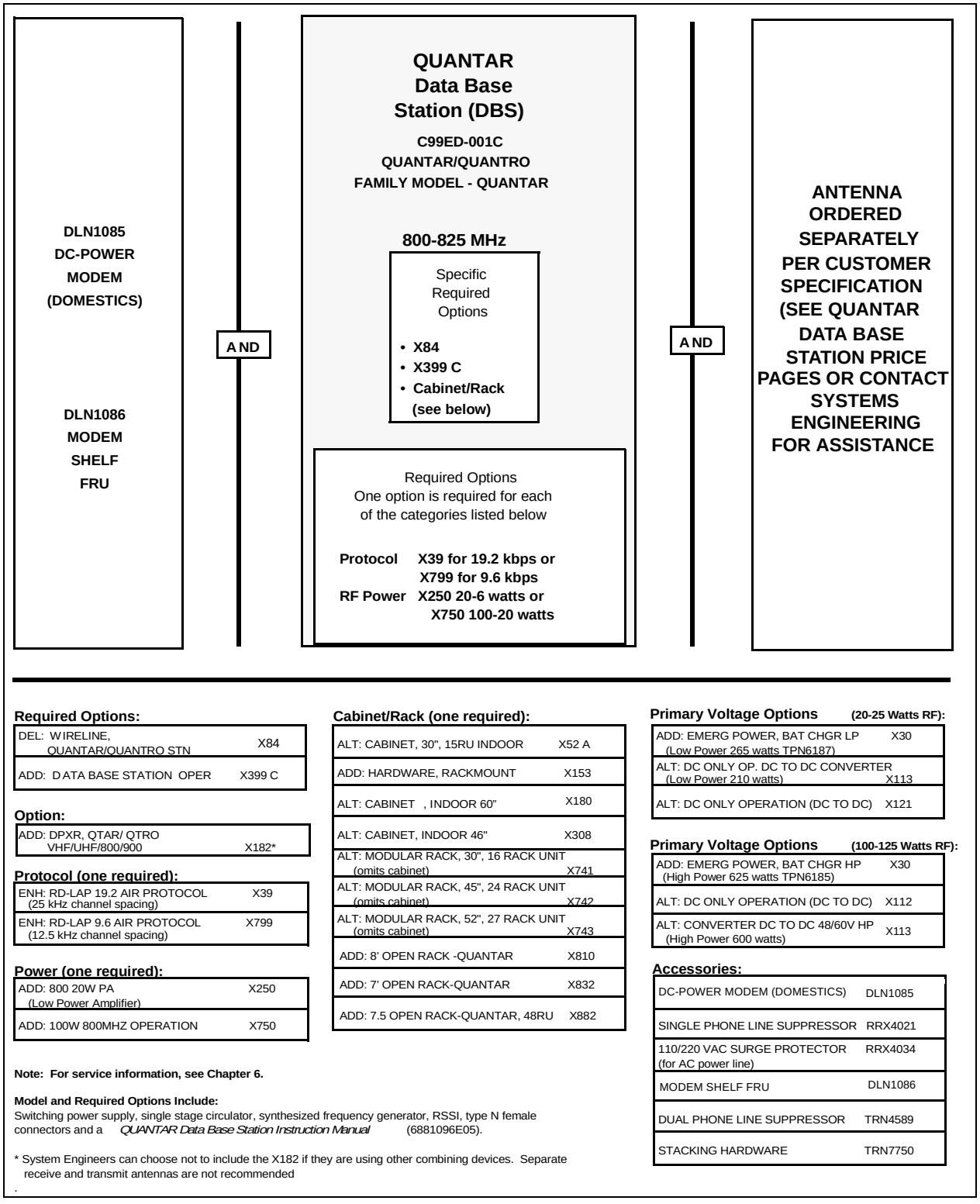


Figure 3-11. QUANTAR Data Base Station Decision Chart

3.3.6 Vehicular Radio Modems 500

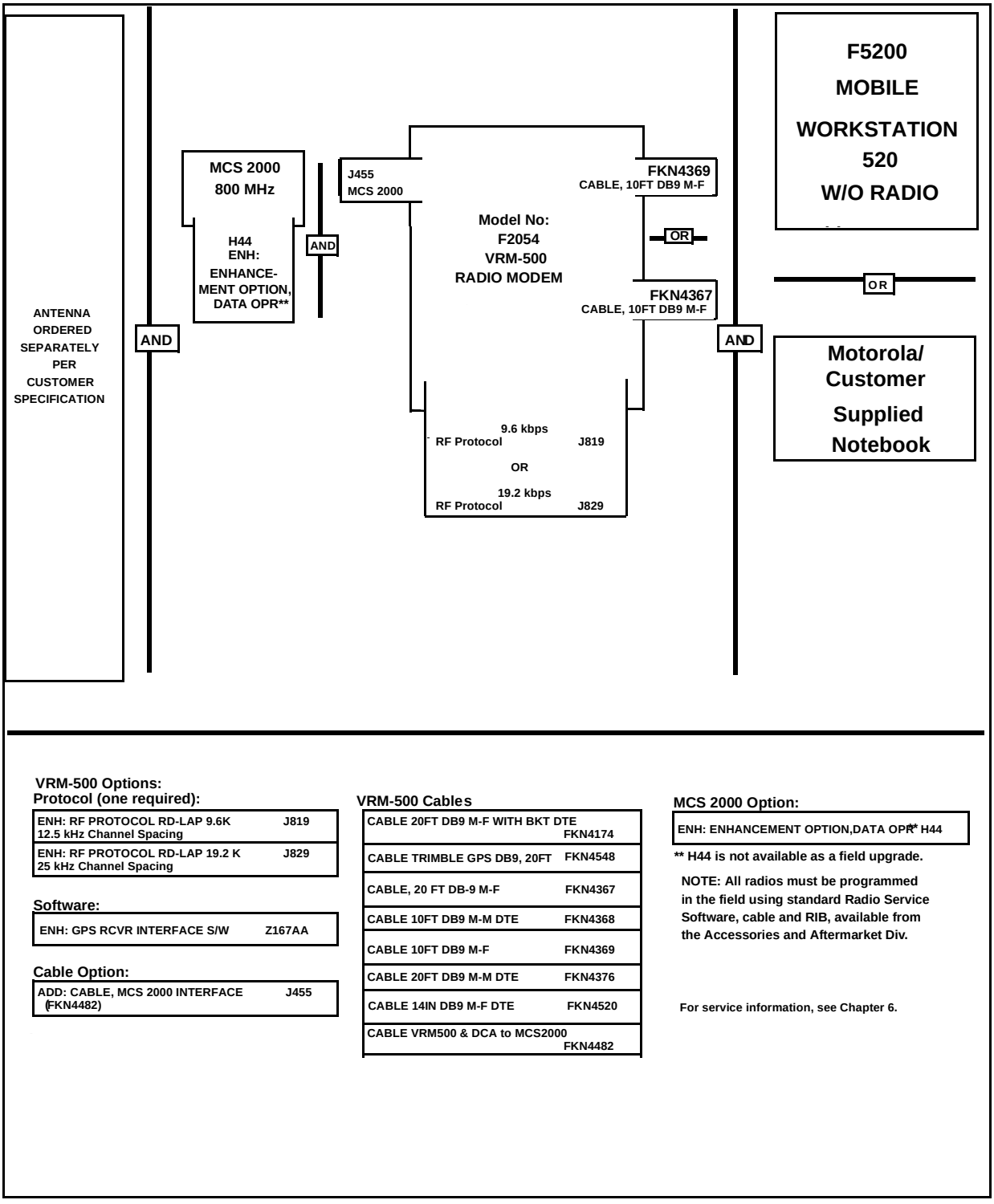


Figure 3-12. Vehicular Radio Modem 500 Decision Chart

3.3.7 Vehicular Radio Modem 650

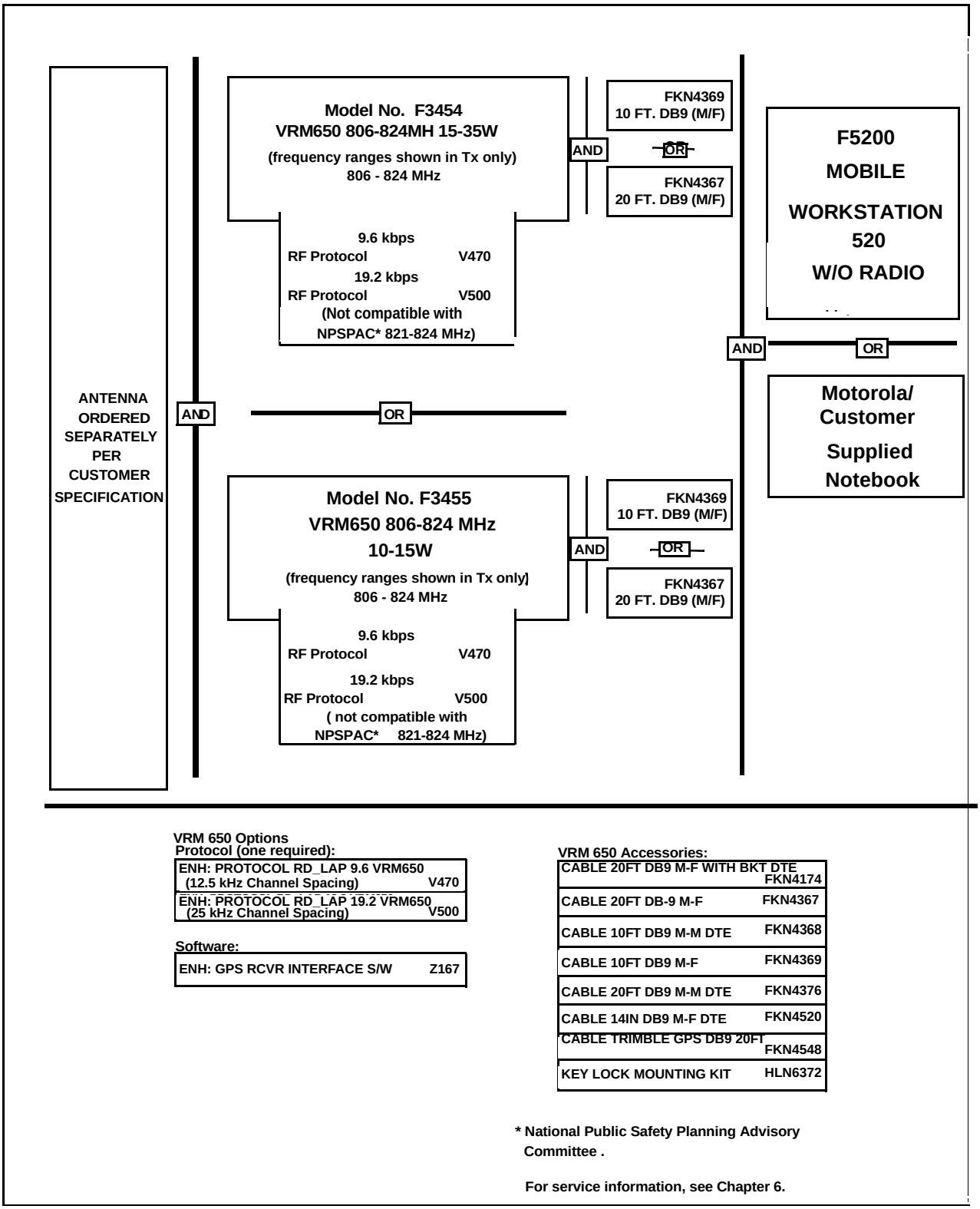
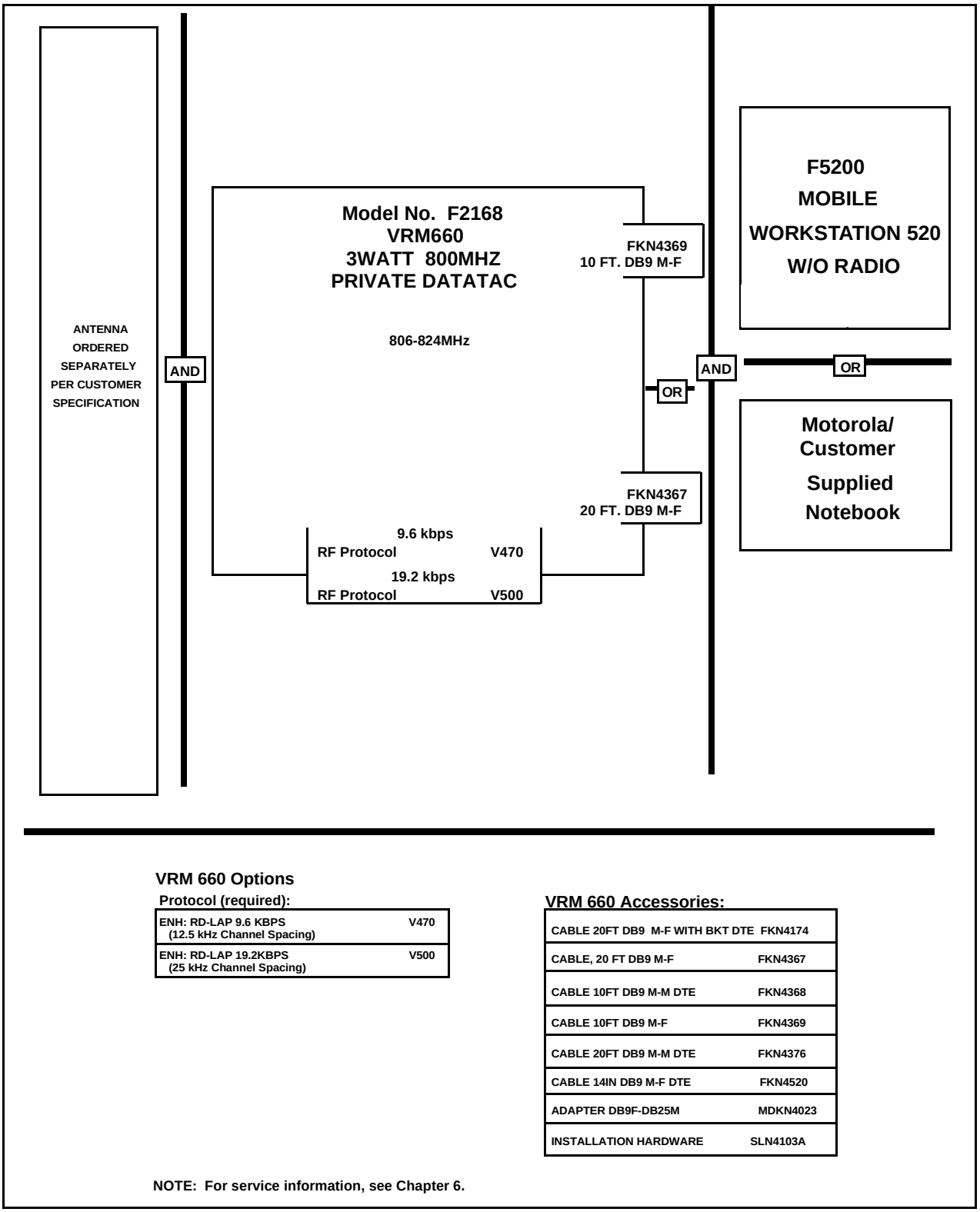


Figure 3-13. Vehicular Radio Modem 650 Decision Chart

3.3.8 Vehicular Radio Modem 660



VRM 660 Options

Protocol (required):

ENH: RD-LAP 9.6 KBPS (12.5 kHz Channel Spacing)	V470
ENH: RD-LAP 19.2KBPS (25 kHz Channel Spacing)	V500

VRM 660 Accessories:

CABLE 20FT DB9 M-F WITH BKT DTE	FKN4174
CABLE, 20 FT DB9 M-F	FKN4367
CABLE 10FT DB9 M-M DTE	FKN4368
CABLE 10FT DB9 M-F	FKN4369
CABLE 20FT DB9 M-M DTE	FKN4376
CABLE 14IN DB9 M-F DTE	FKN4520
ADAPTER DB9F-DB25M	MDKN4023
INSTALLATION HARDWARE	SLN4103A

NOTE: For service information, see Chapter 6.

Figure 3-14. Vehicular Radio Modem 660 Decision Chart

3.3.9 Mobile Workstations 300/350

Color Display

Model No. F5032
MW 350, COLOR DISPLAY

PA00002 ENH: SYSTEM SW WIN CE 2.12 V2.71

OR

Monochrome Display

Model No. F5030
MW 300, MONOCHROME DISPLAY

PA00002 ENH: SYSTEM SW WIN CE 2.12 V2.71

MW 300 and MW 350 Option:
Software Option:

ADD: SYSTEM SW WIN CE 2.12 V2.71	PA00002

MW 300 and MW 350 Option:
Programming Tools

ADD: STARTER KIT, MW 300/350*	VA00006

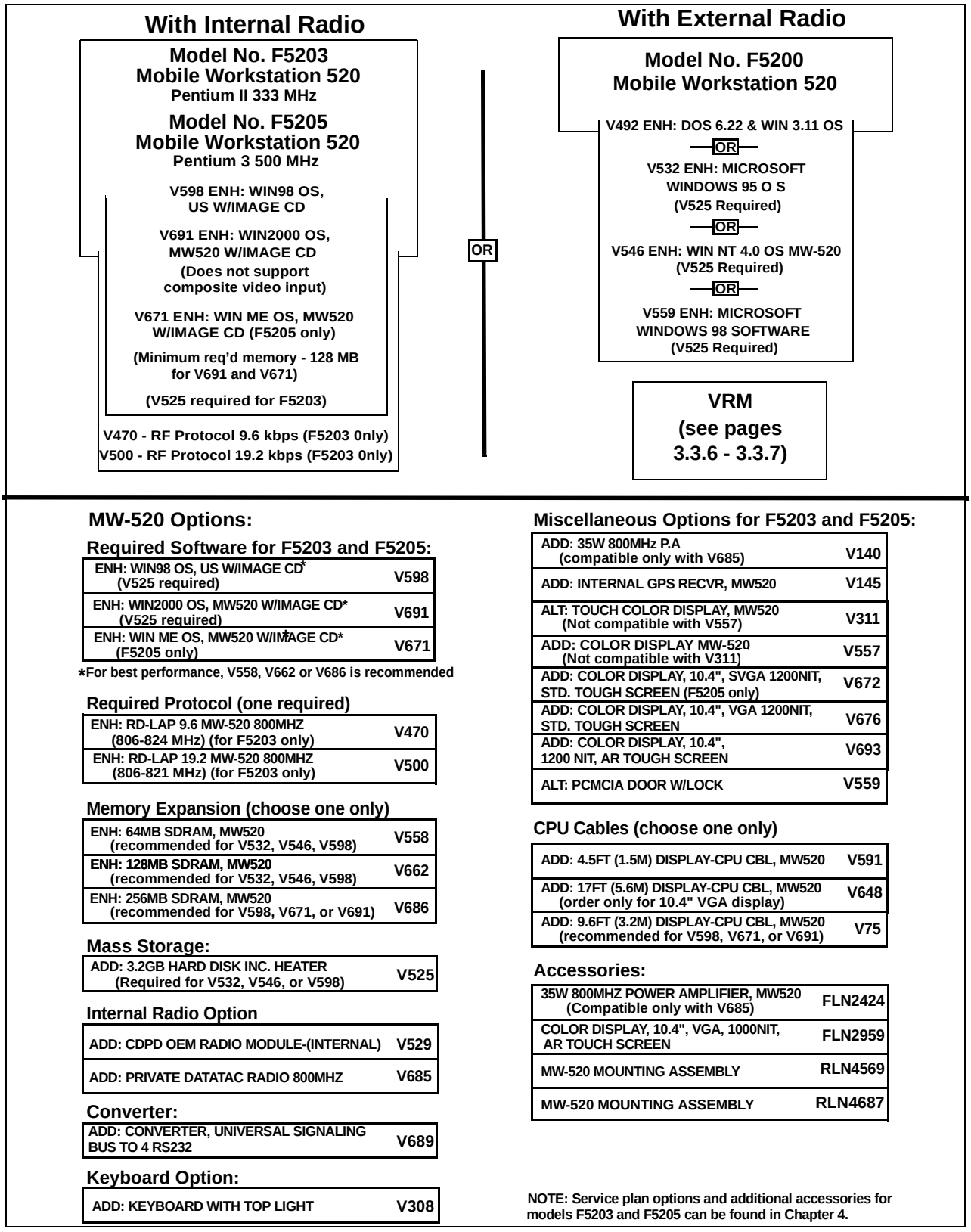
* Includes SDK (CD), Auxiliary cable, Peripheral Interface cable, RS-232 cable, and a set of 5 memory cards.

Accessories:

AUXILIARY CABLE WITH LOOSE TERM	FKN4908
RJ45 TO DB9 BCR/PC INFC CBL (3 foot)	FKN4909
RS232 LAP_LINK D9 TO D9 CBL	FKN4910
VEHICLE MOUNTING	FLN9517
MEMORY CARD (512KB FLASH MEMORY CARD)	FLN9519
VEHICLE/WALL MOUNTING SHORT (RAM)	FLN9592

Figure 3-15. Mobile Workstations 300/350 Decision Chart

3.3.10 Mobile Workstation 520



MW-520 Options:

Required Software for F5203 and F5205:

ENH: WIN98 OS, US W/IMAGE CD* (V525 required)	V598
ENH: WIN2000 OS, MW520 W/IMAGE CD* (V525 required)	V691
ENH: WIN ME OS, MW520 W/IMAGE CD* (F5205 only)	V671

*For best performance, V558, V662 or V686 is recommended

Required Protocol (one required)

ENH: RD-LAP 9.6 MW-520 800MHZ (806-824 MHz) (for F5203 only)	V470
ENH: RD-LAP 19.2 MW-520 800MHZ (806-821 MHz) (for F5203 only)	V500

Memory Expansion (choose one only)

ENH: 64MB SDRAM, MW520 (recommended for V532, V546, V598)	V558
ENH: 128MB SDRAM, MW520 (recommended for V532, V546, V598)	V662
ENH: 256MB SDRAM, MW520 (recommended for V598, V671, or V691)	V686

Mass Storage:

ADD: 3.2GB HARD DISK INC. HEATER (Required for V532, V546, or V598)	V525

Internal Radio Option

ADD: CDPD OEM RADIO MODULE-(INTERNAL)	V529
ADD: PRIVATE DATATAC RADIO 800MHZ	V685

Converter:

ADD: CONVERTER, UNIVERSAL SIGNALING BUS TO 4 RS232	V689

Keyboard Option:

ADD: KEYBOARD WITH TOP LIGHT	V308

Miscellaneous Options for F5203 and F5205:

ADD: 35W 800MHz P.A (compatible only with V685)	V140
ADD: INTERNAL GPS RECVR, MW520	V145
ALT: TOUCH COLOR DISPLAY, MW520 (Not compatible with V557)	V311
ADD: COLOR DISPLAY MW-520 (Not compatible with V311)	V557
ADD: COLOR DISPLAY, 10.4", SVGA 1200NIT, STD. TOUGH SCREEN (F5205 only)	V672
ADD: COLOR DISPLAY, 10.4", VGA 1200NIT, STD. TOUGH SCREEN	V676
ADD: COLOR DISPLAY, 10.4", 1200 NIT, AR TOUGH SCREEN	V693
ALT: PCMCIA DOOR W/LOCK	V559

CPU Cables (choose one only)

ADD: 4.5FT (1.5M) DISPLAY-CPU CBL, MW520	V591
ADD: 17FT (5.6M) DISPLAY-CPU CBL, MW520 (order only for 10.4" VGA display)	V648
ADD: 9.6FT (3.2M) DISPLAY-CPU CBL, MW520 (recommended for V598, V671, or V691)	V75

Accessories:

35W 800MHZ POWER AMPLIFIER, MW520 (Compatible only with V685)	FLN2424
COLOR DISPLAY, 10.4", VGA, 1000NIT, AR TOUCH SCREEN	FLN2959
MW-520 MOUNTING ASSEMBLY	RLN4569
MW-520 MOUNTING ASSEMBLY	RLN4687

NOTE: Service plan options and additional accessories for models F5203 and F5205 can be found in Chapter 4.

Figure 3-16. Mobile Workstation 520 Decision Chart

3.3.11 Portable Radio Modem 660

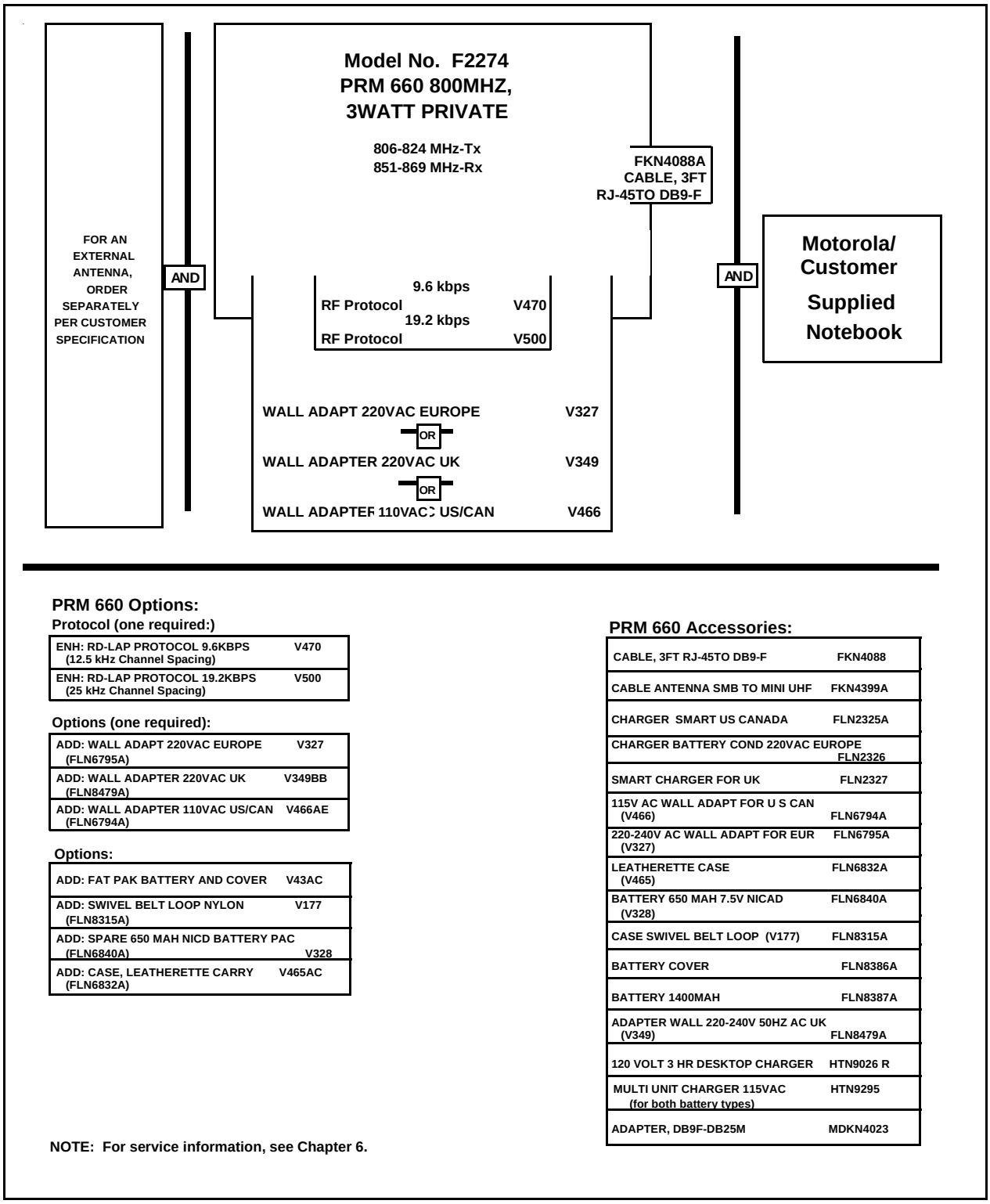


Figure 3-17. Portable Radio Modem 660 Decision Chart

3.3.12 Global Positioning System

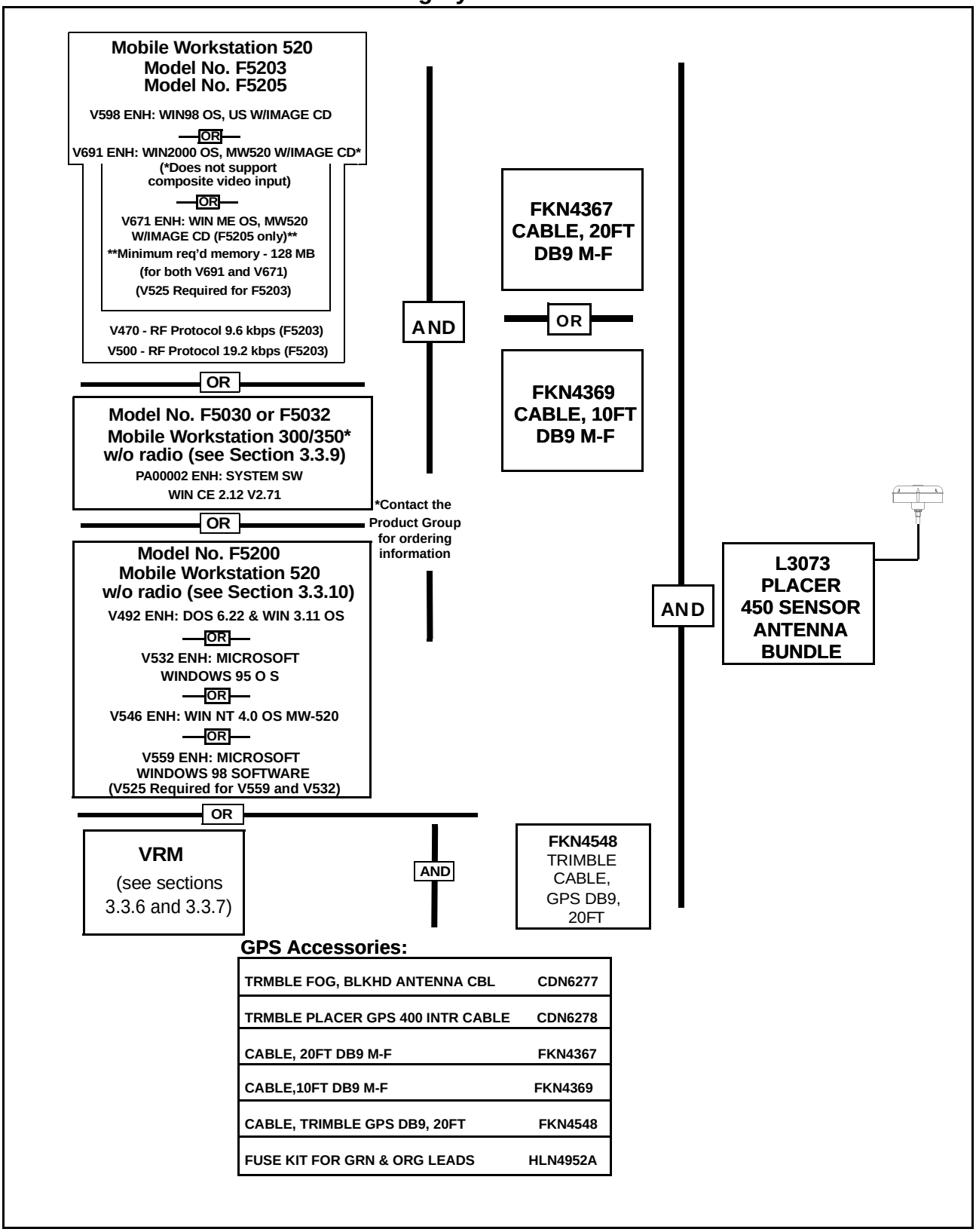


Figure 3-18. Global Positioning System Decision Chart

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Chapter 4
Equipment Descriptions

This chapter describes Private DataTAC™ 2.0.3 product models, options, and accessories. These are listed in the following equipment groups:

- Fixed Network Equipment
- Mobile Equipment
- Portable Equipment
- Global Positioning System Receiver
- Network Equipment

The model, option and accessory descriptions in this chapter list those included in Chapter 3, “Decision Charts.” Not every option or accessory available is listed. Additional information can be found on the price pages. The description titles that are shown in bold are identical to those displayed in the COF order entry system. This approach reduces the errors in creating equipment lists using COF. Some models require a software license agreement.

The option descriptions conform to the following action codes (table 4-1) which paraphrase the back of the invoice and are consistent with customer invoice and internal standards.

Table 4-1. Action Code and Description

ACTION CODE	DEFINITION
ADD:	Indicates the addition of an item or feature to the main model (such as a cable or antenna mount)
ALT:	Indicates an item or feature that is an alternate option to the main model
DEL:	Indicates the deletion of an item or feature from the main model (such as a cable or housing).
ENH:	Reflects the enhancement of the main model with an internal feature or function, usually visible or accessible only to a trained technician, such as software or memory
INC:	Reflects an internal enhancement required by the factory for the main model to optimize performance (options added by TECH EDIT)

4.1 Fixed Network Equipment

This section describes the various components within the RNC3000, WNG, MWCS II, FullVision® INM, and QUANTAR® base site equipment.

4.1.1 Radio Network Controller 3000

The basic RNC3000 configuration includes the following:

- RNC3000 Private DataTAC system software
- XR12 VME-based chassis
- Power cable
- Local console w / keyboard
- Base site modem and modem quad cable (supporting up to 16 modems)

This basic configuration supports a single site and can be expandable up to 64 sites with the addition of software licenses, base station controllers I / O cards and base site modems.

The RNC3000 provides wireless data users with the following features:

- High data throughput
- TCP / IP and async computer protocol support
- Software tiering supporting configurations of 1, 8, 16, and 64 base stations
- Alarm and statistical reporting
- Host-controlled redundancy
- RD-LAP, MDC Air Protocol Support

The RNC3000 provides a data communications interface between RF networks and one or more fixed host computers in the Private DataTAC network.

4.1.1.1 Hardware

The hardware required for the RNC3000 is shown following.

L1960 • RADIO NETWORK CONTROLLER XR12

L1960 is a VersaModule European (VME) computing device manages message routing in Private DataTAC networks. The RNC3000 comes with the following:

- Internal hard drive
- 1.4 MB floppy disk drive
- Small Computer Systems Interface (SCSI) port
- 16-port base station controller card
- TCP / IP or async host interface hardware

TDN1088 • DATA CONTROL CONSOLE

TDN1088 is a local data control console that provides control and monitoring functions for the RNC3000. The console comes with a keyboard. The required cable (CKN1032 or CKN1033) connects the console to the L1960.

4.1.1.2 Software

The RNC software provides the functionality for the RNC3000. This application runs exclusively on the L1960 platform using a pSOS+™ operating system.

A signed Motorola software license agreement must be received before any order will be processed.

T5732 • RNC3000 SOFTWARE

The RNC3000 is a modular software platform supporting a tiered software design allowing for the flexibility to size for today's requirements and expandable to serve future requirements designed to manage data messaging between wireline data networks and Motorola radio frequency networks. This software is supplied on 3 1 / 2-inch floppy disks and includes a license for one base station, TCP / IP or async host link interfaces, and SNMP agents used to support network management via a FullVision INM within a Private DataTAC network.

4.1.1.3 RNC3000 Options

Tables 4-2 through table 4-4 show the options numbers and descriptions for the hardware, power cables and software for the RNC3000. The table for the power cables (table 4-3) includes both option and accessory numbers for ordering purposes.

Table 4-2. Hardware Options for RNC3000

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD, BASE CONTROLLERS, 32 PORT	E690	Adds two 16-port cards (uses two chassis slots) to the L1960 to provide the hardware capability to control up to 32 additional base stations.
ADD: BASE CONTROLLERS, 48 PORT	E693	Adds three 16-port cards (uses three chassis slots) to the L1960 to provide the hardware capability to control up to 48 additional base stations.
ALT: DESKTOP CONFIG	Z693	Adds side panels for RNC3000 desktop installations.
DEL: STARTUP CONFIGURATION	Z873	Used when ordering only one base station system.
ADD: BASE CONTROLLER, 16 PORTS	Z881	Adds one 16-port card (uses one slot) to the L1960 to provide the hardware capability to control up to 16 additional base stations.

Table 4-3. Power Cables for RNC3000

COF DESCRIPTION	OPTION NUMBER	ACCESS NUMBER	DESCRIPTION
ADD: CABLE, POWER AUSTRALIA/NZ	E906	TDN1096	Adds a six-foot cable with connection typical for use in Australia and New Zealand
ADD: CABLE, POWER DENMARK	E907	TDN1097	Adds a six-foot cable with connection typical for use in Denmark
ADD, CABLE, POWER ENGLAND/UK	E904	TDN1095	Adds a six-foot cable with connection typical for use in England and the United Kingdom
ADD: CABLE, POWER FRANCE	E963	TDN1094	Adds a six-foot cable with connection typical for use in France
ADD; CABLE, POWER GERMANY	E642	TDN1093	Adds a six-foot cable with connection typical for use in Germany
ADD: CABLE, POWER ITALY	E908	TDN1098	Adds a six-foot cable with connection typical for use in Italy
ADD: CABLE, POWER SWEDEN	E990	TDN1099	Adds a six-foot cable with connection typical for use in Sweden
ADD: CABLE, POWER US & CANADA	E909	TDN1092	Adds a six-foot cable with connection typical for use in the United States and Canada

Table 4-4. Software Options for RNC3000

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: SFWR SUPPORT PVDT 2.0	Z485AC	Adds the software option that is required for identifying the system type as Private DataTAC network.
ENH: SFWR SUPPORT, 8 BASE STNS	Z488	Adds software to support 8 base stations to T5732.
ENH: SFWR SUPPORT, 16 BASE STNS	Z489	Adds software to support 16 base stations to T5732.
ENH: SFWR SUPPORT, 64 BASE STNS	Z490	Adds software to support 64 base stations to T5732. Order options requires additional base controller cards, (options Z881, E690, or E693 for L1960 model).

4.1.1.4 Accessories

Table 4-5 shows the accessory descriptions and numbers of the hardware for the RNC3000.

Table 4-5. Hardware Accessories for RNC3000

COF DESCRIPTION	ACCESS NUMBER	DESCRIPTION
SNMP A/B SWITCH	CDN1642	Switches the DBSs from the failed RNC to the redundant RNC. Supports up to 16 channels per A/B switch with a maximum of three per RNC configuration.
CABLE 25FT DB25M-DB25M	CKN1032	A 25-foot cable that is DB-25 M-M and connects the RNC to the control console.
CABLE 50FT DB25M-DB25M	CKN1033	A 50-foot cable that is DB-25 M-M and connects the RNC to the control console.
CABLE, 15FT DB25M-DB25M	CKN1034	A 15-foot modem cable is DB-25 M-M and is used for the dial-up modems and connections to the SNMP A/B switch.
CARD CAGE 16 SLOTS COMSHARE 3000	L3171	COMSPHERE 3000 Carrier 16 slot, 19-inch rack mounting card cage for the 3810*Plus* modems with 115V AC transformer module.
COMSPHERE 3810PLUS MODEM S/A V.32	L3186	Stand-alone modem with specific V.32 protocol configuration. For U.S. customers that require CE marking and V.32 protocol. Requires DA00005AA cable.
CABLE 6.5FT QUAD HD62-4 DB25	TDN1082	A kit that contains a set of four six-and-a-half foot quad modem cables. These cables have HD100 to four DB-25 connectors and are used to connect the RNC to the base station modem cards. The cables will interface with up to 16 base stations.
A/B SWITCH BANK	TDN1083	A/B switch bank base that supports up to 16 channels.

Table 4-5. Hardware Accessories for RNC3000 (Continued)

COF DESCRIPTION	ACCESS NUMBER	DESCRIPTION
A/B SWITCH EXPANDABLE BANK	TDN1084	A/B switch bank expansion that supports up to 16 channels. Maximum of three per RNC configuration. Required to be ordered with TDN1083 for systems needing more than 16 channels. Includes a second power supply module installed in the first switch bank for additional channel support. Multiple switch banks are not to exceed four banks, are daisy-chained together using a standard straight through cable with a 9-pin male connector. The host connection to the switch requires a standard RS-232 cable with a 25-pin male connector.
CABLE 5FT LEASE LINE MODEM	TDN1089	Cable used for the connection of A/B switch to the modem bank.
CABLE 15FT LEASE LINE MODEM	TDN1090	Cable used for the connection of A/B switch to the modem bank.
CABLE 30FT LEASE LINE MODEM	TDN1091	Cable used for the connection of A/B switch to the modem bank.
SEVEN FOOT RACK	TRN7342	A 7-foot rack to permit the RNC3000 along with modem card cages and modem rack adapters to be collocated. Used in place of a cabinet at the customer's option.
SEVEN AND A HALF FOOT RACK	TRN7343	A 7-1/2 foot rack to permit the RNC3000 along with modem card cages and modem rack adapters to be collocated. Used in place of a cabinet at the customer's option.
EIGHT FOOT RACK	TRN7344	An 8-foot rack to permit the RNC3000 along with modem card cages and modem rack adapters to be collocated. Used in place of a cabinet at the customer's option.
HDW RACKMNT QUANTAR STDALONE	TTN5028A	A set of two mounting extensions with eight screws. Measures four-and-one-half-inches wide, eight and three-quarters-inches long, and 11/16-inches deep in size. It is used with the 7, 7-1/2, and 8-foot open racks to distribute the weight of the RNC3000 more evenly. Order two sets of these per each RNC unit. Used with the TDN8799 Rack Card Cage shown on the preceding page. Additional holes could be required.
sr001 rackmount with 2 telco 16 RJ45	DQTORK118556	19-inch rack mounted unit with 16 RJ-45 (16 positions) jacks mounted in the front of the panel and 2 Telco 50-pin female jacks mounted in the back. Two ZA00096AA (10 foot) cables OR two ZA00096AB (30 foot) cables are required.
ENH: CARRIER SDCP COMSHARE 3000	ZA00079AA	Shared Diagnostic Control Panel (SDCP) that is mounted below the card cage.

Table 4-5. Hardware Accessories for RNC3000 (Continued)

COF DESCRIPTION	ACCESS NUMBER	DESCRIPTION
ADD; CARD COMSPHERE 3811+V/32	ZA00084AA	Adds COMSPHERE card version of their stand-alone modem that is factory strapped to V.32 with CE markings.
ADD: CABLE, 50PIN TO 50PIN AMP 1	ZA00096AA	Adds 10-foot front mounted amphenol cable. Two cables required. Maximum two cables to a rack. Requires DQTORK118556 RJ45 adapter.
ADD: CABLE, 50PIN TO 50PIN AMP 3	ZA00096AB	Adds 30-foot front mounted amphenol cable. Two cables required. Maximum two cables to a rack. Requires DQTORK118556 RJ45 adapter.

4.1.2 Wireless Network Gateway™

The WNG is a software platform designed to link wireline data networks to Motorola radio frequency (RF) networks by managing message traffic to and from the wireless network. The modular software of the WNG can be ordered to fit system configurations and provides the foundation for supporting future enhancements.

The WNG provides wireless data users with the following:

- Mobile user registration
- Mobile user authorization
- Group messaging
- IP unit-to-unit messaging
- IP outbound message queuing
- IP with header / data compression
- SNMP-based network management support
- WNG controlled RNC redundancy
- Mobility management
- FLM host connectivity
- Over-the-Air Rekeying (OTAR) support
- Security services

WNG provides the interconnection of wireline networks and RF data networks. The WNG requires either a non-fault tolerant VME chassis (T6517) or fault tolerant VME chassis (T5901) hardware platform and software (T5814) to operate in a Private DataTAC system.

The WNG provides detailed statistics and alarm information to monitor operation and loading to support audit, diagnostic, and optimization activities which can be viewed directly via the WNG or through the FullVision INM.

4.1.2.1 WNG Hardware

The Wireless Network Gateway software utilizes the IBM® AIX® operating system running on a powerful Motorola RISC-based hardware platform supporting up to 12,000 registered users. The WNG in both an XR series and the Fault Tolerant hardware platforms assure high availability and data integrity.

A basic WNG configuration would include Private DataTAC system software, an IP and / or FLM host interface, an XR12 or Fault Tolerant VME-based chassis, power cable, and a local console with keyboard.

T6517 • WNG GATEWAY XR

The T6517 is a VME-based 19-inch rack mountable XR series chassis that includes the following main components:

- PowerPC microprocessor
- SCSI CD-ROM drive
- 1.44 MB floppy drive
- 4 mm tape drive
- SCSI hard disk drive
- Power supply
- Two 10baseT ethernet controllers

T5901 • WNG FX FAULT TOLERANT PLATFORM

The WNG Fault Tolerant hardware platform combines automatic fault recovery and intelligent configuration management to assure high availability and data integrity in a UNIX® based application environment providing a broad selection of reliability and configuration alternatives.

The T5901 is a VME-based 19-inch rack mountable fault tolerant platform that includes the following main components:

- Redundant PowerPC® microprocessors
- SCSI CD-ROM drive
- 4mm tape drive
- Redundant SCSI hard disk drive(s)
- Redundant power supplies
- Two redundant 10baseT ethernet controllers

TDN1088 Data Control Console

TDN1088 is a local data control console that provides control and monitoring functions for the WNG. A keyboard is included standard with the console. The CKN1032 or CKN1033 cable is required for connection of the console to the WNG for the XR series platform. The CKN1041 console cable is required for the fault tolerant platform.

4.1.2.2 WNG Software

Software is required for the WNG and is described in the following paragraph.

T5814 • WIRELESS NETWORK GATEWAY

The WNG requires the T5814 software. This software manages message traffic in and out of the wireless network. Option Z485 (Private DataTAC system software) must be specified when ordering WNG software. One or both connectivity options must also be ordered: IP with compression (Z622AA), and / or the FLM host interface (Z815AA). MWCS II is required for each mobile computer using optional IP bearer service, or security services, and can be ordered as an option Z800AB (U.S. only) or Z11AA (international) to the T5814 software model.

T5814 offers the following services to wireless users:

- Mobile device registration
- Group messaging
- IP unit-to-unit messaging
- IP outbound message queuing
- IP with header / data compression
- SNMP-based network management support with optional FullVision INM
- Mobility management (multiple RNC roaming)
- FLM host connectivity
- Alarms, statistics, and message tracing
- Security services
  - — User authentication
  - — Data encryption
  - — Key management

4.1.2.3 Wireless Network Gateway Options

Table 4-6 shows the hardware option, Table 4-7 shows the power cables option and accessory numbers and Table 4-8 shows the software options.

Table 4-6. Hardware Option for WNG

COF DESCRIPTION	OPTION NUMBER	ACCESS NUMBER	DESCRIPTION
ADD: ETHERNET MODULE 1 PAIR	E694AA	CDN6589	Adds an ethernet module to the Fault Tolerant WNG Platform.

Table 4-7. Power Cables for WNG

COF DESCRIPTION	OPTION NUMBER	ACCESS NUMBER	DESCRIPTION
ADD: CABLE, POWER AUSTRALIA/NZ	E906	TDN1096	Adds a six-foot cable with connection for use in Australia and New Zealand
ADD: CABLE, POWER DENMARK	E907	TDN1097	Adds a six-foot cable with connection for use in Denmark
ADD, CABLE, POWER ENGLAND/UK	E904	TDN1095	Adds a six-foot cable with connection for use in England and the United Kingdom
ADD: CABLE, POWER FRANCE	E963	TDN1094	Adds a six-foot cable with connection for use in France
ADD; CABLE, POWER GERMANY	E642	TDN1093	Adds a six-foot cable with connection for use in Germany
ADD: CABLE, POWER ITALY	E908	TDN1098	Adds a six-foot cable with connection for use in Italy
ADD: CABLE, POWER SWEDEN	E990	TDN1099	Adds a six-foot cable with connection for use in Sweden
ADD: CABLE, POWER US & CANADA	E909	TDN1092	Adds a six-foot cable with connection for use in the United States and Canada

Table 4-8. Software Options for WNG

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: MWCSII LICENSE-INTL	Z11AA	Adds the MWCS II license for each device with a new WNG shipped internationally and when requiring IP messaging and/or security services. Up to 999 maximum can be ordered by line item. Use the Z800AB for U.S. shipments.
ENH: SECURITY SERVICES - INTL	Z53AB	Adds 40-bit key encryption international security service option. Use Z788AB for U.S. security service option. **NOTE:** **Z53AB is for all countries outside the U.S. that are not on the U.S. Commerce barred list. Contact CGISS Export Control Department for specific information.**
ENH: SOFTWARE, WNG RDLAP	Z485	Adds the software option required for identifying Private DataTAC system.
ENH: RNC REDUNDANCY SUPPORT	Z306AB	Adds RNC switchover capability. Supports pairing of RNC controllers in a redundant configuration. This improves system availability by eliminating single point of failure problems, allowing the switching of access paths to base stations without the loss of registered devices.
ENH: IP W/ COMPRESSION	Z622AA	Adds the industry standard IP connectivity for the Private DataTAC system. Requires MWCS II installed in mobile computers and includes data and IP header compression.
ENH: SECURITY SERVICES	Z788AB	Adds a 128-bit key encryption security service option for U.S. shipments. Use Z53AB for security service option for international shipments.
ENH: MWCS II/ GATEWAY USER LICENSE	Z800AB	Adds an optional license for each device with a new WNG. Up to 999 maximum can be ordered by line item. The Z800AB is field installed and intended for U.S. shipments. Use Z11AA for international orders.
ENH: FLM HOST INTERFACE	Z815AA	Adds the software option that provides FLM connectivity within Private DataTAC networks. Includes data compression when used with MWCS II.
ENH: MOBILITY MGMT BASIC	Z817AA	Adds mobility management across two RNCs.
ENH: MOBILITY MGMT EXTENDED	Z818AA	Adds mobility management across a third and fourth RNC. Quantity one or two Z818AA required, respectively.

4.1.2.4 Wireless Network Gateway Accessories

Tables 4-9 and 4-10 show the hardware and power cable descriptions for WNG. The power cable accessories are shown with both the accessory and option numbers.

Table 4-9. Hardware Accessories for WNG

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
QTY 4 - 7 FT 10BASE-T ETHERNET CBL	CDN6330	Adds four 7-foot, 10BaseT ethernet cables with RJ-45 connectors on both ends.
QTY 1 - 14 FT 20BASE-T ETHERNET CB	CDN6331	Adds a 14-foot, 10BaseT ethernet cable with RJ-45 connectors on both ends.
FX ETHERNET MODULE	CDN6589	Adds ethernet module to an existing unit already in the field.The module could be ordered for expansion, as a replacement or a spare.
CABLE, 25FT DB25M-DB25M	CKN1032	Adds a 25-foot cable that is DB-25 M-M and is used to connect the non fault-tolerant WNG to the control console.
CABLE, 50FT DB25M-DB25M	CKN1033	Adds a 50-foot cable that is DB-25 M-M and is used to connect the non fault-tolerant WNG to the control console
15’ FX CONSOLE CABLE	CKN1041	Adds a 15’ cable that is DB-25HDM to DB-25M that connects the data control console (TDN1088) to the T5901.
DATA CONTROL CONSOLE	TDN1088	Adds a required terminal that provides control and monitoring functions for the WNG. The terminal is supplied with a 110 volt U.S./Canada power cable only. A cable to connect the console to the T5901 WNG box is required.
ETHERNET CABLE, 25’	TDN1112	Adds a 25-foot, 10BaseT ethernet cable, with RJ-45 connectors on both ends.
ETHERNET, CABLE, 50’	TDN1113	Adds a 50-foot, 10BaseT ethernet cable, with RJ-45 connectors on both ends.
ETHERNET, CABLE, 100’	TDN1114	Adds a 100-foot, 10BaseT ethernet cable, with RJ-45 connectors on both ends.

Table 4-10. Power Cables for WNG

COF DESCRIPTION	ACCESS NUMBER	OPTION NUMBER	DESCRIPTION
CABLE, POWER AUSTRALIA/NZ	TDN1096	E906	Adds a six-foot cable with connection for use in Australia and New Zealand
CABLE, POWER DENMARK	TDN1097	E907	Adds a six-foot cable with connection for use in Denmark
CABLE, POWER ENGLAND/UK	TDN1095	E904	Adds a six-foot cable with connection for use in England and the United Kingdom.
CABLE, POWER FRANCE	TDN1094	E963	Adds a six-foot cable with connection for use in France

Table 4-10. Power Cables for WNG

COF DESCRIPTION	ACCESS NUMBER	OPTION NUMBER	DESCRIPTION
CABLE, POWER GERMAN	TDN1093	E642	Adds a six-foot cable with connection for use in Germany
CABLE, POWER ITALY	TDN1098	E908	Adds a six-foot cable with connection for use in Italy
CABLE, POWER SWEDEN	TDN1099	E990	Adds a six-foot cable with connection for use in Sweden
CABLE, POWER US/ CANADA	TDN1092	E909	Adds a six-foot cable with connection for use in the United States and Canada

4.1.3 FullVision Integrated Network Manager

FullVision INM offers two tiers, high and low, for the workstation. The high tier (C3600) is required for combined monitoring of the Private DataTAC systems with more than two RNCs. It is also the solution suggested for customers that intend to expand their system or add additional network management and configuration software in the future. The low tier (B2000) is for the small system with one or two RNCs.

The FullVision INM is a Motorola software application that provides a view of the status of a communication system. FullVision INM is built on top of HP OpenView® Network Node Manager 250 software, an industry standard network manager. The FullVision INM runs on an HP C3600 workstation with the UNIX v.10.20 operating system. Features for the high and low tier workstations are described as follows:

C3600 High Tier Workstation

- 552 MHz (clocked), PA-8600 Processor +64-bit CPU
- 18 GB Hard Drive
- 512 MB expandable to 8 GB RAM with eight memory slots
- 120 MHz SDRAM RAM type main memory
- 32X (internal) speed CD-ROM drive
- 21” color monitor
- 101-key keyboard and 3-button mouse
- FX-2 Graphics card
- HP external DAT tape drive

HP OpenView is based on SNMP. A 10BaseT ethernet cable and software are required for the Private DataTAC system.

B2000 Low Tier Workstation

- 400 MHz (clocked), PA-8500 Processor +64-bit CPU
- 9 GB Hard Drive
- 256 MB expandable to 4 GB RAM with four memory slots
- 120 MHz SDRAM RAM type main memory
- 4 memory slots
- 32X speed CD-ROM drive
- 21” color monitor
- 101-key keyboard and 3-button mouse
- FX2 Graphics card
- HP external DAT tape drive

HP OpenView is based on SNMP. A 10BaseT ethernet cable and software are required for the Private DataTAC system.

FullVision INM provides tools to manage the system. Users can collect information through the management information base (MIB) of each device. FullVision INM also provides a graphical user interface (GUI) to locate mobile computers and display the current RNC and base station involved in traffic statistics. Users can force a mobile computer to communicate with a different RNC.

The FullVision INM for Private DataTAC 2.0.3 is offered domestically and internationally. FullVision INM is sold as a separate model number for international purchases.

Both FullVision INM models require the purchase of an HP workstation. The exception would be the customer who purchased the C240 high-tier model for Private DataTAC 2.0.2. Customers who have previously purchased the low-tier model, the B132 workstation, need to purchase new hardware and upgrade the software.

Additional information can be found on the price pages or by contacting your local Business Manager.

4.1.3.1 Options for FullVision INM

Tables 4-11 and 4-12 show the Full Vision INM options and descriptions for the hardware and software. For latest pricing and ordering procedures, reference E-Cat on the Motorola intranet website.

Table 4-11. Hardware Option for FullVision INM

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: ETHERNET MODULE	CVN6142	Required for trap forwarding or remote x-terminal access.

Table 4-12. Software Options for FullVision INM

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
FULLVISION UPGRADE	SQM01SUM0088	Required when ordering software options after the original order has been placed or when ordering latest version of FullVision software.
ENH: HEWLETT-PACKARD OPEN VIEW	ZA00244AA	Adds upgrade license for upgrading to Private DataTAC 2.0.3 from Private DataTAC 2.0.2. This is for existing systems using the C240 workstation only. The purchasing of a 4 GB external hard drive is strongly recommended.
ENH: PRIVATE DATATAC SYSTEM	*	Adds required FullVision INM software upgrade, HP OpenView software, and system specific (Private DataTAC) plug-in. For use with single RNC.
ENH: WNG INTERFACE	*	Adds required software to support the WNG. Required for systems with a WNG. Limit of one.
ENH: EACH ADDITIONAL RNC	*	Adds support for an additional active RNC. Limit of three.
ENH: ALPHANUMERIC PAGING SFWR	*	Adds software to allow forwarding system alarms to alphanumeric pager through selected paging service. CDN1545 is required.
ENH: SNMP TRAP FORWARDING SFWR	*	Forwards system alarms to a higher level of Managers-of-Managers. CVN6142 is also required.
ENH: HP OV 250 NODE EXP UPGRADE	Z898AC	Adds HP OpenView 250 Node Expansion. For customers who purchased the 250 Node Expansion for Private DataTAC 2.0.2 and wish to upgrade to Private DataTAC 2.0.3.
*See your local business manager for complete information on the types of packages offered.		

4.1.3.2 Accessories for FullVision INM

Table 4-13 shows the hardware accessory descriptions for FullVision INM.

Table 4-13. Hardware Accessories for FullVision INM

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
ZONE MANAGER USER TERMINAL 21 INCH	T5517	Adds an extra terminal for first or second user. CVN6142 is also required.
COMPSHERE 3810PLUS MODEM S/A V.32	L3186	Stand-alone modem with specific V.32 protocol configuration. For U.S. customers that require CE marking and V.32 protocol.
QTY 1 7 FT 10BASE-T ETHERNET	CDN6330	Adds four 7-foot 10BaseT ethernet cables, with RJ-45 connectors on both ends.
QTY 1 14 FT 20BASE T ETHERNET CB	CDN6331	Adds a 14-foot 10BaseT ethernet cable, with RJ-45 connectors on both ends. A required ethernet cable connects the TCP/IP ethernet to the FullVision INM. Used to connect the color printer (CLN7242) to the FullVision INM.
21 INCH COLOR MONITOR	CKN6323	Adds a 21-inch color graphics monitor and field replaceable unit. Used as a second monitor or as a replacement.

Table 4-13. Hardware Accessories for FullVision INM (Continued)

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
COLOR LASER PRINTER (110V)	CLN7472	Adds a color laser printer equipped with IEEE-1284 parallel interface, includes software drivers, toner cartridge, 110 volt U.S. style power cable, and documentation. **NOTE: An additional 10BaseT ethernet cable is required.**
COLOR LASER PRINTER (220V)	CLN7473	Adds a color laser printer equipped with two EIO interface slots, and includes software drivers, toner cartridge, 220 V, power cable of choice, and documentation. **NOTE: An additional 10BaseT ethernet cable is required.**
DAT TAPE DRIVE	CLN7476	Adds a 2 GB (4 GB compressed) SCSI DAT tape drive with cable and terminator, cleaning tape, one tape cartridge, and manual. The tape drive is required for all systems with backup capability (FRU).
EXTERNAL HARD DRIVE	CLN7477	Adds a 4 GB external hard drive for additional memory when upgrading from the HP C240 to the HP C3000.
ETHERNET CABLE, 10’	TDN1111	Adds a 10-foot 10BaseT ethernet cable, with RJ-45 connectors on both ends.
ETHERNET CABLE, 25’	TDN1112	Adds a 25-foot 10BaseT ethernet cable, with RJ-45 connectors on both ends.
ETHERNET, CABLE, 50’	TDN1113	Adds a 50-foot 10BaseT ethernet cable, with RJ-45 connectors on both ends.
ETHERNET, CABLE, 100’	TDN1114	Adds a 100-foot 10BaseT ethernet cable, with RJ-45 connectors on both ends.
CBL 10’ ZM USER SERVER TO MODEM	TKN9113	Adds a DB9-F to DB25-M modem cable for remote dial-in for the V.3400 desktop modem.
CBL 25’ USER SERVER TO MODEM	TKN9114	Adds a DB9-F to DB25-M modem cable for remote dial-in for he V.3400 desktop modem.
CBL 50’ USER SERVER TO MODEM	TKN9115	Adds a DB9-F to DB25-M modem cable for remote dial-in for the V.3400 desktop modem.
1KVA UPS, 110V 60HZ	TRN7914	Adds an uninterruptible power supply with IEC-320 (10A) interface. Supplied with 100 volt U.S. style power cord.
UPS 1KVA, 220V 50HZ	TRN7915	Adds an uninterruptible power supply with IEC-320 (10A) interface. For international use.

4.1.4 QUANTAR® Data Base Station Equipment

The QUANTAR Data Base Station is part of the family of Fixed Network Equipment. This section describes the model, options and accessories for the QUANTAR.

C99ED • QUANTAR/QUANTRO FAMILY

001C • QUANTAR/QUANTRO CONFIGURATION

The QUANTAR C99ED/001C is a 806-825 MHz synthesized field programmable single channel radio. QUANTAR operation is full duplex when ordered as specified with all five required options. The 20 watt or 100 watt station comes in a 30-inch cabinet, which is the minimum required.

A complete QUANTAR DBS configurations must include: X84 and 399 C, and choices between cabinets or racks. In addition to these options, the system designer should choose X39 or X799 for an RF protocol, and X250 or X750 for an RF power level. X182 is not required, but is preferred, whenever possible.

4.1.4.1 Options for the QUANTAR DBS

Tables 4-14 and 4-15 describe the hardware and software options for the QUANTAR DBS.

Table 4-14. Hardware Options for QUANTAR DBS

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: EMERG POWER, BAT CHGR LP	X30	Adds automatic power revert and a battery charging power supply (**low power**) to the base station. Included are three cables, battery backup (TKN8732), battery temperature sensor (TKN8786), 10-foot external battery (TRN5155), one power supply (TPN6187 - 265 watt low power (25-6 watts RF) for charging 12V DC external batteries), and hardware (TRN7998). Batteries are not included.
ADD: EMERG POWER, BAT CHGR HP	X30	Adds automatic power revert and a battery charging power supply (**high power**) to the base station. Included are three cables, battery backup (TKN8732), battery temperature sensor (TKN8786), 10-foot external battery (TRN5155), one power supply (TPN6185 - 625 watt high power (110-25 watts RF) for charging 24V DC external batteries), and TRN7998 (hardware). Batteries are not included.
ALT: CABINET, 30”, 15RU INDOOR	X 52 A	Adds a 30-inch housing for the base station with 15 rack units. This is the minimum size housing for a DBS.
ALT: DC ONLY OPERATION (DC TO DC)	X112	Adds a 24V Direct Current (DC) 600 watt DC-to-DC converter instead of an AC power supply. Comes with a battery backup cable (TKN8732) and a 10-foot external battery cable (TRN5155). Required for high power stations operating from batteries. A 24V DC battery or power source is required.

Table 4-14. Hardware Options for QUANTAR DBS (Continued)

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ALT: DC ONLY OP. DC TO DC CONVERTER	X113	Adds a 48/60V DC 210 watt (**low power**) DC-to-DC converter instead of an AC power supply. Comes with a battery backup cable (TKN8732) and a 10-foot external battery cable (TRN5155). A 48/60V DC battery or power source is required.
ALT: CONVERTER DC TO DC 48/60V HP	X113	Adds a 48/60V DC 600 watt (**high power**) DC-to-DC converter instead of an AC power supply. Comes with a battery backup cable (TKN8732) and a 10-foot external battery cable (TRN5155). A 48/60V DC battery or power source is required.
ALT: DC ONLY OPERATION (DC TO DC)	X121	Adds a 12/24V DC 210 watt DC-to-DC converter instead of an AC power supply. Comes with a battery backup cable (TKN8732) and a 10-foot external battery cable (TRN5155). Required for low power stations being operated from batteries. A 12/24V DC battery or power source is required.
ADD: HARDWARE, RACKMOUNT	X153	Adds a set of two mounting extensions with eight screws included. The size is four-and-a-half-inches wide, eight and three-quarters inches long, and 11/16-inches deep. It is used with the seven, seven-and-a-half, and eight-foot open racks to distribute the weight more evenly.
ALT: CABINET, INDOOR 60”	X180	Adds a 60-inch housing for the base station. This is the largest size enclosed housing (30 rack units) for a DBS. Cabinet can hold two DBSs without duplexers.
ADD: DPXR, QTAR/ QTRO VHF/UHF/800/ 900	X182*	Adds a duplexer (TDF6980 and installation hardware) for full duplex operation. This option is mandatory for maximum data throughput. **•NOTE: Systems engineers can choose not to include the X182 if they are using other combining devices. Separate receive and transmit antennas are not recommended.**
ADD: 800 20W PA	X250	Adds a low power RF power amplifier to the base station.
ALT: CABINET, INDOOR 46”	X308	Adds a 46-inch housing for the base station. This is the medium size enclosed housing (23 rack units) for a DBS.
ADD: DATA BASE STATION OPER	X399 C	Adds an enhanced performance integrated controller card to the station to support the additional functions and features required in a data configuration. This option is mandatory.
ALT: MODULAR RACK, 30”; 16 RACK UNIT	X741	Adds a 30-inch high modular rack that supports 16 rack units.
ALT: MODULAR RACK, 45”, 24 RACK UNIT	X742	Adds a 45-inch high modular rack that supports 24 rack units.
ALT: MODULAR RACK, 52”,27 RACK UNIT	X743	Adds a 52-inch high modular rack that supports 27 rack units.
ADD: 100W 800MHZ OPERATION	X750	Adds a high power RF power amplifier to the base station.

Table 4-14. Hardware Options for QUANTAR DBS (Continued)

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: 8’ OPEN RACK - QUANTAR	X810	Adds an eight-foot open rack to hold the QUANTAR units. This is used in place of a cabinet at the customer’s option.
ADD: 7’ OPEN RACK-QUANTAR	X832	Adds a seven-foot open rack to hold the QUANTAR units. This is used in place of a cabinet at the customer’s option.
ADD: 7.5’ OPEN RACK-QUANTAR, 48RU	X882	Adds a seven-and-a-half foot open rack to hold the QUANTAR units. This is used in place of a cabinet at the customer’s option.

Table 4-15. Software Options for QUANTAR DBS

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: RD-LAP 19.2 AIR PROTOCOL	X39	Adds software to the base station that enables it to transmit and receive RD-LAP at 19.2 kbps. Station frequencies must use 25 kHz channel spacing. It is not compatible with 12.5 kHz channel spacing. Either this option or X799 must be ordered.
DEL: WIRELINE, QUANTAR/QUANTRO STN	X84	Delete option (required) that removes wireline control support of the base station.
ENH: RD-LAP 9.6 AIR PROTOCOL	X799	Adds software to the base station that enables it to transmit and receive RD-LAP at 9.6 kbps. Station frequencies must use 12.5 kHz channel spacing. Not compatible with 25 kHz channel spacing. Either this option or X39 must be ordered.

Table 4-16 shows a summary of the *required* options and descriptions for the QUANTAR DBS.

Table 4-16. Required Options For QUANTAR DBS

Required Options	Choice of Required Cabinet or Rack	Choice of Required RF Protocol (kbps)	Choice of Required RF Power Level (watts)
X84	X52 A	X39 (19.2)	X250 Low (20-6)
X399 C	Z153	X799 (9.6)	X750 High (100-20)
	X180		
	X308		
	X741		
	X742		
	X743		
	X810		
	X832		
	X882		

Tables 4-17 and 4-18 list the hardware and surge protection accessories for the QUANTAR DBS.

Table 4-17. Hardware Accessories for QUANTAR DBS

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
DC-POWER MODEM (DOMESTICS)	DLN1085	Adds a stand-alone 12V DC modem and is configured to run 14.4 kbps for the RD-LAP 19.2 RF protocol, and configured to run at 7.2 kbps for the RD-LAP 9.6 protocol. EIA-232 connector, an 8-pin AUX jack, an 8-pin line jack, power switch, fuse and cord. It is for domestic (U.S. or Canada) use.
MODEM SHELF FRU	DLN1086	Adds an EIA standard shelf for installing one or two desktop modems in a 19-inch equipment rack.
STACKING HARDWARE	TRN7750	Adds a kit that permits the stacking of the base station cabinets.

NOTE

Every station must be protected from electrical surges that can take it out of service. Antenna lightning arrestors typically are installed with the transmission line. The design and installation by area systems engineering follow commonly accepted practices. Table 4-18 lists the recommended surge protectors for AC power and telco or short haul data and control lines.

Table 4-18. Surge Protection Accessories for QUANTAR DBS

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
SINGLE PHONE LINE SUPPRESSOR	RRX4021	Adds a three electrode gas tube protector used for a single telephone or dedicated local line
110/220 VAC SURGE PROTECTOR	RRX4034	Adds a protector used for a single AC power line
DUAL PHONE LINE SUPPRESSOR	TRN4589	Adds a three electrode gas tube protector used for dual telephone or dedicated local lines

4.2 Middleware

Middleware is software that interfaces applications to underlying network protocols, thereby, facilitating mobile application software development. Middleware usually provides value-added services, such as data compression and encryption.

4.2.1 MWCS II

MWCS II is an Network Device Interface Specification (NDIS) compliant communication device driver, and is also referred to as middleware, for use with Microsoft® Windows® 95 or Windows 98 operating system. It is not compatible with Windows 3.1 or earlier versions.

Application Programming Interface (API)

MWCS II software is a wireless communication middleware that provides a standard API to help wireless device application development. MWCS II provides a simplified application access to the Private DataTAC 2.0.3 network through a choice of APIs. The API provides a simplified application interface for programmers to eliminate writing radio modem control code at the native mode level. It supports the industry standard WinSock interface for sending and receiving data over the network and can work in conjunction with another API for programmatic radio modem control (Radio API or RAPI). WinSock and RAPI together provide communication services equivalent to those available through Motorola's lower level Native Command Language (NCL) or Native Mode, without the complexity. MWCS II also supports the optional enhanced services of Private DataTAC.

The WNG and MWCS II are shipped configured with data compression as a standard capability. The user data portions of messages are compressed and sent to either the fixed-end host interface or mobile communications software interfaces for both FLM and IP communication protocols. The content of user data within messages presented to the WNG or MWCS II dictate relative gains of compression.

WNG and MWCS II use a compression algorithm to reduce the length of IP, TCP/IP, and User Data Protocol (UDP)/IP datagram headers.

WinSock provides a TCP/IP interface under Windows operating systems. Standard WinSock applications can be run over a Private DataTAC system, provided they anticipate and are compatible with the higher latency encountered with wireless networks.

In addition to WinSock and RAPI support, MWCS II also supports a simplified RFIO interface for programmers who are not fluent in WinSock programming, and applications that do not need extensive modem control features. Both RAPI and RFIO interfaces require the use of the Software Development Kit (SDK), model T5916.

MWCS II includes a feature that senses DTE, such as an MW-520 or a notebook PC, shut down and issues a power-down command to the external

radio modem. The soft power-off feature can be enabled or disabled by the customer's administrator.

MWCS II works in conjunction with the WNG at the FNE end of the system. An MWCS II license must be ordered for each mobile device using one or more of the following optional services:

- end-to-end IP connectivity and related services
- IP header compression
- data compression (IP bearer services)
- security services
  - — user authentication
  - — data encryption
  - — key management

MWCS II can be ordered as option to the WNG main software model, T5814, along with the required Z485 Private DataTAC system software option, or separately under MWCS II's own model number T5915 (see chapter 4.2.1.1).

For new system orders, the WNG option is used. MWCS II can also be ordered separately when the system does not have a WNG, e.g., when MWCS II will serve only as an API or when a WNG with enhanced services will be added later.

4.2.1.1 SOFTWARE

T5915 • MWCS II/USER LICENSE/SOFTWARE

One T5915 license is required for each device running in the PrivateDataTAC system. MWCS II can be ordered for use as an API only. This license / software package is structured to work with the required option, Z800AB (U.S.) or Z11AA (international).

Included with each license is an MWCS II Quick Reference Card. One MWCS II Administrator's Manual and two 3.5-inch installation disks are shipped for each 100 licenses or fraction thereof.

T6225 • MWCS II SOFTWARE UPGRADE

T6225 is a software upgrade that is ordered for upgrading earlier versions of MWCS II, which supported Windows 95, IP, FLM, and compression services only. The kit adds external modem power control, advanced power management support, security services capability, and Windows 98 support. To enable security services, the WNG must include the security services option (Z788AB, U.S. only, or Z53AB, international), installed at the factory or as a field upgrade.

There isn't any limit on the number of licenses that can be upgraded with one kit. Multiple copies of this kit can be purchased to help expedite the

actual installation when a large number of units are involved. T6225 requires either the Z800AC (U.S.) or the Z11AB (international) option.

4.2.1.2 MWCS II Required Option

Z11AA • ENH: MWCSII LICENSE-INTL

Adds the MWCS II license for each device with a new WNG shipped internationally. Up to 999 maximum can be ordered by line item. Z11AA is ordered with T5915 or the WNG T5814.

Z11AB • ENH: MWCSII LICENSE UPGRADE-IN

Adds the MWCS II software upgrade license option required for each device that is shipped internationally. Up to 999 maximum can be ordered by line item. Z11AB is ordered with T6225.

Z800AB • ENH: MWCS II/GATEWAY USER LICENSE

Adds the MWCS II license option required for each device that is shipped domestically. Up to 999 maximum can be ordered by line item. It is ordered with T5915 or the WNG T5814.

Z800AC • ENH: MWCS II LICENSE UPGRADE

Adds the MWCS II software license upgrade option required for each device that is shipped domestically. Up to 999 maximum can be ordered by line item. It is required with T6225.

4.3 Mobile Equipment

Modems certified for Private DataTAC 2.0.3 use an enhanced roaming algorithm to reduce channel reacquisition time. Modems in this release also are enhanced to support FullVision INM performance monitoring and RD-LAP rate agility.

This section describes the models, options and accessories for the VRM-500, VRM 650, VRM 660, Mobile Workstation 300, Mobile Workstation 350, and the Mobile Workstation 520™ (MW-520).

Mobile computer configurations allow field user applications to access customer computers. This variety of wireless computer configuration provides flexibility to meet customer needs.

The system designer can choose the following mobile hardware applications:

- Mobile Workstation 520™ (MW-520) with built-in radio modem
- MW-520 with a vehicular radio modem (VRM)
- Notebook with a VRM

4.3.1 Vehicular Radio Modem 500

The VRM-500 is an external radio modem and is paired with a data capable Motorola MCS 2000® mobile radio optioned for RD-LAP data service.

F2054 • VRM-500 RADIO MODEM

F2054 is for use on private radio channels. The VRM-500 can be dash or remote mounted, but must be within the proximity of the radio to which it is connected.

There are five LED indicators on the front panel, one for power and four for status. Located on the back of the VRM-500 are two different connector inputs for data terminals: one providing RS-232 voltage levels and the other compatible with Complementary Metal-Oxide Semiconductor (CMOS) 0-5v levels. The RS-232 is supported via a DB9-F connector and the CMOS is supported by a Hirose QM10-8R connector. A DB-9 male connector provides access for GPS inputs. Option Z167 enables the port and software to handle the GPS messages. A 13-pin Hirose RP13A connector interfaces to the external radio.

Included are install hardware with bracket (FRN5755) and the VRM-500 Owner's & Installation Manual. The VRM-500 requires one of two RF protocols to be specified at the time of order (J819 - RD-LAP 9.6 kbps protocol, or J829 - RD-LAP 19.2 kbps protocol). Modem-to-radio cables are available for the MCS 2000® mobile radios with the data operation option (H44).

NOTE:

The H44 is not available as a field upgrade.

See MCS 2000 sales literature for more information.

4.3.1.1 Options for VRM-500

Tables 4-19 and 4-20 list the hardware and software options for the VRM-500.

Table 4-19. Hardware Option for VRM-500

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: CABLE, MCS 2000 INTERFACE	J455	Adds a 3-foot cable (FKN4482). The modem side is a Hirose 13-pin female connector and the MCS 2000 side is a 25-pin female accessory connector. Must be ordered for use with the MCS 2000.

Table 4-20. Software and Protocol Options for VRM-500

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: RF PROTOCOL RD-LAP 9.6K	J819	Adds RD-LAP 9.6 kbps software driver and is loaded into the VRM. For use with 12.5 kHz or 25 kHz channel spacing.
ENH: RF PROTOCOL RD-LAP 19.2 K	J829	Adds RD-LAP 19.2 kbps software driver and is loaded into the VRM. For use with 25 kHz channel spacing.
ENH: GPS RCVR INTERFACE S/W	Z167AA	Adds software that handles GPS message strings.

4.3.1.2 Accessories for VRM-500

Table 4-21 shows the hardware accessory descriptions for the VRM-500.

Table 4-21. Hardware Accessories for VRM-500

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
CABLE 10FT DB9 M-M DTE	FKN4368	Adds a 10-foot DB-9 M-M cable used to connect a VRM to a DTE device.
CABLE 20FT DB9 M-M DTE	FKN4376	Adds a 20-foot DB-9 M-M cable used to connect a VRM to a DTE device.
CABLE, VRM500 & DCA TO MCS2000	FKN4482	Adds a 3-foot cable (J455). The modem side is a Hirose 13-pin female connector and the MCS 2000 side is a 25-pin female accessory connector.
CABLE 14IN DB9 M-F DTE	FKN4520	Adds a 14-inch DB-9 M-F cable when the MW-520 and the VRM are located in close proximity to one another.
CABLE TRIMBLE GPS DB9 20FT	FKN4548	Adds a 20-foot DB-9 M-F cable that connects the VRM to the Trimble receiver.

4.3.1.3 Options for MCS 2000®

Table 4-22 lists the options for MCS 2000 which are used with the VRM-500.

4.3.1.3.1 MCS 2000

H44 is a Private DataTAC data capability option for the MCS 2000 mobile and is available on enhanced radio packages, models II and III only. The H44 option is compatible with conventional, SmartNet® and SmartZone® System Software Package options.

Table 4-22 shows the data software option for the MCS 2000.

Table 4-22. Software Option for MCS 2000

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: ENHANCEMENT OPTION,DATA OPR	H44	Adds required data option for the MCS 2000. Supports RD-LAP 9.6 or 19.2 kbps for 800 MHz only.

4.3.2 Vehicular Radio Modem 650

The VRM 650 is a data-only, mobile radio modem based on the MCS 2000 platform. The VRM 650 handles dedicated, data-only applications. The VRM 650 provides connectivity between a vehicle-mounted data terminal and the system's host computer through the Private DataTAC radio network. The VRM 650 can be dash or remote mounted and requires a 12V DC negative ground power source. Included with both models are the following:

- 20-foot power cable (HKN4192)
- Mounting bracket hardware and screws trunnion kit (FLN8212)
- 7.5' fused ignition sense cable kit (FKN4500)
- *VRM 650 Vehicular Radio Modem for Private DataTAC Networks Owner's and Installation Manual*

The front of the modem has a pushbutton on/off switch and seven LED indicators (six status and one power). Also located on the front of the VRM 650 are connectors for the data terminal and GPS receiver. The data terminal can be connected via a DB-9 female connector. The DB-9 male connector provides access for GPS inputs. Option Z167 enables the port and software to handle the GPS messages.

On the back of the device are three connectors: DC power for connecting the power cable, Mini-UHF female antenna connector, and an ignition cable (fused) for supporting ignition sense. Also, located on the back of the modem is a heat sink attachment.

The VRM 650 requires RD-LAP 9.6 kbps RF protocol (V470) or 19.2 kbps RF protocol (V500) to be specified at the time of order. Data terminal to modem cables are available as accessories.

F3454 • VRM650 806-824MH 15-35W

F3454 is a data-only mobile packet radio modem with built-in 806-824 MHz (transmit frequency) 15-35 watt two-way radio for use on private radio channels. The device provides connectivity between vehicle mounted data terminals, workstations, or notebook computers and the system's host computer, through Motorola's Private DataTAC radio data network.

F3455 • VRM650 806-824MH 10-15W

F3455 is a data-only mobile packet radio modem with built-in 806-824 MHz (transmit frequency) 10-15 watt two-way radio for use on private radio channels. The device provides connectivity between vehicle mounted data terminals, workstations, or notebook computers and the system's host computer, through Motorola's Private DataTAC radio data network.

4.3.2.1 Options for the VRM 650

Table 4-23 and Table 4-24 list the options for the hardware and the software for VRM 650.

Table 4-23. Software Options for VRM 650

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: PROTOCOL RD_LAP 9.6 VRM650	V470	Adds RD-LAP 9.6 kbps software driver loaded into the VRM. For use with 12.5 kHz channel spacing.
ENH: PROTOCOL RD_LAP 19.2 VRM650	V500	Adds RD-LAP 19.2 kbps software driver loaded into the VRM. For use with 25 kHz channel spacing.
ENH: GPS RCVR INTERFACE SFWR	Z167	Adds software that handles GPS message strings. Not for use in systems with end-to-end IP or compression, or security services.

4.3.2.2 Accessories for the VRM 650

Table 4-24 shows the hardware accessory descriptions for the VRM 650.

Table 4-24. Hardware Accessories for VRM 650

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
CABLE 20FT DB9 M-F WITH BKT DTE	FKN4174	Adds a 20-foot DB-9 M-F cable for connecting to a DTE, and comes with a retaining bracket. Connector is intended to be surface mounted at a convenient location where the user can readily plug and unplug a separate cable attached to the DTE device. (Use AMP #745255-2 or 745779-2 connectors only.)
CABLE 10FT DB9 M-M DTE	FKN4368	Adds a 10-foot DB-9 M-M cable used to connect the VRM to a DTE device.
CABLE 20FT DB9 M-M DTE	FKN4376	Adds a 20-foot DB-9 M-M cable added to the VRM to connect it to external DTE devices.

Table 4-24. Hardware Accessories for VRM 650 (Continued)

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
CABLE, 14IN DB9 M-F DTE	FKN4520	Adds a 14-inch DB-9 M-F cable that collocates the MW-520 with the VRM.
CABLE, TRIMBLE GPS DB9, 20FT	FKN4548	Adds a 20-foot DB-9 M-F cable that connects the VRM to the Trimble receiver.
KEY LOCK MOUNTING KIT	HLN6372	Keylock mount for dash or remote mount.

4.3.3 Vehicular Radio Modem 660

The VRM 660 is a three-watt radio modem that provides connectivity between a data terminal, notebook computer or other data terminal equipment (DTE) and a customer's host computer through the Private DataTAC radio network. The VRM 660 is primarily intended for remote mount automotive installation and requires a 12V DC negative ground source from the vehicle, connected through its standard automotive power connector.

The VRM 660 has an integrated radio packet modem configurable for private RD-LAP protocols. These half-duplex packet modems operate only in concert with the full duplex Private DataTAC infrastructure, and are not designed for direct, unit-to-unit or circuit switched operation.

Included with the VRM 660 is as follows:

- 20-foot power cable (FKN4448)
- Installation kit that includes mounting bracket hardware, mating antenna connector, and remote on / off control connector
- Remote on / off control connector that is a four-pin Molex® plug and crimp-on pins for using the remote off / on feature (FLN8938)
- Native mode and transparent mode (AT commands) interface
- TNC-type crimp-on connector (Motorola part number 09-80372A88)
- *VRM 660 Vehicular Radio Modem for Private DataTAC Networks Owner's and Installation Manual*

F2168 • VRM660, 3WATT 800MHZ PRIVATE DATATAC

F2168 is a is a Vehicular Radio Modem in the 806-824 MHz range, with 12.5 MHz and 25 MHz channel spacing. The front of the unit has a power switch and a DB-9 female serial port (serial cable not included).

The back of the device has a remote control connector, a threaded BNC (antenna) connector (TNC), and a 12V DC two-pin power connector.

Table 4-25 lists the software options for VRM 660.

Table 4-25. Software Options for VRM 660

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: RD-LAP PROTOCOL 9.6 KBPS	V470	Adds the RD-LAP 9.6 kbps software driver and is loaded into the VRM 660. For use with 12.5 kHz channel spacing.
ENH: RD-LAP PROTOCOL 19.2 KBPS	V500	Adds the RD-LAP 19.2 kbps software driver and is loaded into the VRM 660. For use with 25 kHz channel spacing.

4.3.3.1 Accessories for VRM 660

Table 4-26 shows the hardware accessory descriptions for the VRM 660.

Table 4-26. Hardware Accessories for VRM 660

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
CABLE, 20FT DB9 M-F WITH BKT DTE	FKN4174	Adds a 20-foot DB-9 M-F cable for connecting to a DTE, and comes with a retaining bracket. Connector is intended to be surface mounted at a convenient location where the user can readily plug and unplug a separate cable attached to the DTE device. (Use AMP #745255-2 or 745779-2 connectors only.)
CABLE 10FT DB9 M-M DTE	FKN4368	Adds a 10-foot DB-9 M-M cable used to connect a VRM to a DTE device.
CABLE 20FT DB9 M-M DTE	FKN4376	Adds a 20-foot DB-9 M-M cable added to the VRM to connect it to external DTE devices.
CABLE 14IN DB9 M-F DTE	FKN4520	Adds a 14-inch DB-9 M-F cable that collocates the MW-520 with the VRM.
ADAPTER, DB9F-DB25M	MDKN4023	Adds a DB9-F to a DB25-M adapter when the DTE has a DB25-M serial port.
INSTALLATION HARDWARE	SLN4103A	Adds a retaining bracket that also can be used as a template for mounting the VRM 660.

4.3.4 Mobile Workstation 300 (MW 300) and Mobile Workstation 350 (MW 350)

The MW 300 and MW 350 are mid-tier mobile workstations designed to support a variety of Windows CE-based applications. The MW 300 and MW 350 include the following:

- PowerPC processor running Windows CE with 16MB Flash memory and 16MB SDRAM
- Integrated ISO / IEC smartcard reader / writer
- Backlit display and keypad
- Small form factor allowing for easier mounting

These mobile workstations provide wireless data users with the following features:

- 5.7-inch backlit VGA screen with large fonts and built-in speaker, and bright LED alerts in support of dispatch messaging
- Recessed angled display design providing a sunshield for better visibility
- Backlit keys with ease access spaced soft function keys
- Full QWERTY keyboard with 12 large numeric keys and navigation arrows for flexible database inquiry
- Smartcard data transfer capabilities for recording of vehicle and driver activity
- Rugged design with small form factor to fit between air bags
- External radio modem support via RS-232 port
- General input / output support for external devices such as panic buttons and vehicle lights and horn
- External printer support via parallel port
- RS-232 interface to the external bar code scanner
- Built-in ethernet port for LAN connectivity
- Optional swivel and tilt mounting
- Auxiliary port
- Power cable (8 foot)
- Connector to Vehicle Data Bus

F5030 MW 300, MONOCHROME DISPLAY, 16MB FLASH

The F5030 is a mobile workstation offering a 5.7-inch 1 / 4-VGA (240 by 320 pixels) backlit monochrome display. Comes with MW 300 / MW 350 Owner's Manual.

F5032 - MW 350, COLOR DISPLAY, 16MB FLASH

The F5032 is a mobile workstation offering a 5.7-inch 1/4-VGA (240 by 320 pixels) color LCD 350 nit backlit display with optional touch screen. Comes with MW 300/MW 350 Owner's Manual.

4.3.4.1 Software Options for the MW 300 and MW 350

Table 4-27 shows the software options for the MW 300 and MW 350.

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Table 4-27. Software Option for MW 300 and MW 350

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: SYSTEM SW WIN CE 2.12 V2.71	PA00002	Adds the required option Windows CE Operating System.

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Table 4-28. Programming Tool Option for MW 300 and MW 350

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: STARTER KIT, MW 300/350	VA00006	Adds a programming starter kit. Kit includes an SDK (CD), auxiliary cable, peripheral interface cable, RS-232 cable, and a set of 5 memory cards.

4.3.4.2 Accessories for MW 300 and MW 350

Table 4-29 shows the hardware accessory descriptions for the MW 300 and MW 350.

Table 4-29. Hardware Accessories for MW 300 and MW 350

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
AUXILIARY CABLE WITH LOOSE TERMINATION	FKN4908	Auxiliary with loose termination (6 feet long) cable.
RJ45 TO DB9 BCR/PC INFC CBL	FKN4909	RJ45 to DB BCR/PC interface (3 feet long) cable.
RS232 LAP_LINK D9 TO D9 CBL.	FKN4910	RS232 DB9 to DB9 (lap link) (6 foot) cable.
VEHICLE MOUNTING	FLN9517	Long mount (panavisw) for vehicle.
MEMORY CARD (512KB FLASH MEMORY CARD)	FLN9519	Adds 512KB flash memory.
VEHICLE/WALL MOUNTING SHORT (RAM)	FLN9592	Short mount (RAM) for vehicle or wall.

4.3.5 Mobile Workstation 520 (MW-520)

The MW-520 was specifically designed for computing and communications in a mobile environment, while offering the power of a desktop computer. The MW-520 basic package includes:

- Intel® Pentium® processor
- Integral PCMCIA slots (2 Type II or 1 Type III)
- 10.4-inch diagonal monochrome display with six softkeys and speaker
- Four-foot display cable
- 32 MB RAM, full keyboard with keyboard lighting
- Attached cable (DB-9 male connector on the opposite end)
- Integrated touchpad pointing device interface
- 20-foot fused power cable
- RF modem (except for the F5200 model)
- Cable kit with a mounting screw kit
- *MW-520 Mobile Workstation Owner's Manual*
- *MW-520 Mobile Workstation Quick Reference Card*

The customer must choose the operating system software from, Windows 98 (V598), or Windows CE (V691) for both models, or Windows CE (V671) for model F5205 only. See Table 4-31 for the recommendations and restrictions of the operating system software.

The MW-520 can handle applications with local databases and detailed graphical images, including fingerprints, mug shots, and maps.

NOTE

The MW-520 requires application software to exchange information with the host computer. The host computer requires application software specifically designed to use the Private DataTAC wireless network to exchange information with this device.

The rear panel on both MW-520 models, except where noted, comes equipped with the following:

- Six DB connectors consisting of
  - — Two male DB-9 COM ports (COM1 and COM2)
  - — One female DB-9 keyboard connector for keyboard
  - — One DB-15 AUX port connector
  - — One-DB-44 female connector for the Liquid Crystal Display (LCD)
  - — One DB-25 female connector for the parallel printer port
  - — GPS antenna port
- Mini-UHF antenna connector (F5201 model only)
- Two audio jacks (input and output)
- One two-pin 12V DC power connector
- GPS antenna port (with GPS V145 option only)

Memory is expandable to 256MB of RAM.

F5203 • MOBILE WORKSTATION 520 800MHZ 3W

F5203 is a Mobile Workstation 520 designed specifically for computing and communications in a mobile environment. The MW-520 comes as a three-piece unit that includes a separate keyboard, display, and CPU. The F5203 model is equipped with a radio. The front of the processor has a main power switch (on / off), reset button and two Type II PCMCIA slots.

F5205 • MOBILE WORKSTATION 520 800MHZ 3W

F5205 is a Mobile Workstation 520 designed specifically for computing and communications in a mobile environment. The MW-520 comes as a three-piece unit that includes Pentium III 500 MHz microprocessor, operating on one of three operating system choices, touch screen display**.** The F5205 model is equipped with a radio. The front of the processor has a main power switch (on / off), reset button and two Type II PCMCIA slots. The F5205 model comes with 19.2 kbps built in as a default. 9.6 kbps is a field modification.

F5200 • MOBILE WORKSTATION 520

F5200 is the Mobile Workstation 520 without a radio that connects to a VRM (500 / 650 / 660). The front of the processor has a main power switch (on / off), reset button and two Type II PCMCIA slots.

4.3.5.1 Options for MW-520

Tables 4-30 and 4-31 list the options for the hardware and the software for MW-520.

Table 4-30. Hardware Options for MW-520

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: 9.6FT (3.2) DISPL-CPU CBL	V75	Adds a nine-and-a-half foot cable for connecting the display monitor to the MW-520.
ADD: 35W 800MHZ P.A	V140	Adds a power amplifier (FLN2424) that connects to the antenna port of the MW-520 and boosts the power of the device to 35 W. The Owner's and Installation Manual (6802949C50) is included.
ADD: INTERNAL GPS RECVR, MW520	V145	Adds an internal GPS receiver to the MW-520 for connection to the GPS. Includes cable and antenna.
ADD: EXTERNAL SPEAKER	V147	Adds external speaker to the workstations.
ALT: TOUCH COLOR DISPLAY, MW-520	V311	Replaces the monochrome display monitor and adds a touch-screen color display monitor for the MW-520. Requires option V532. Not compatible with V492 and V557.
ALT: CPU ASSY. ONLY MW-520	V424AC	Adds CPU only. Eliminates keyboard and display.
ADD: 3.2GB HARD DISK, INCLUDING HEATER	V525	Adds a 3.2 GB fixed hard disk. Required option for V532, V546, and V598.
ADD; COLOR DISPLAY MW-520	V557	Adds a 300 NIT color display monitor to the MW-520. Not compatible with V311.
ALT: COLOR DISPLAY, 1000NIT	V572AA	Adds color display, 1000 NIT to the MW-520.
ALT: TOUCH COLOR DISP, 1000NIT	V577AA	Adds color display, 1000 NIT with a touch screen to the MW-520.
ADD: 4.5FT (1.5M) DISPLAY CBL	V591	Adds a four-and-a-half foot cable for connecting the display monitor to the MW-520.
ADD: 9.4" MONOCHROME DISPLAY	V663	Adds monochrome (no color) display to the MW-520.

Table 4-31. Software Options for MW-520

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: RD-LAP 9.6 MW-520 800 MHZ	V470	Adds the RD-LAP 9.6 kbps software driver (806-824 MHZ) and is loaded into the MW-520. For use with 12.5 kHz channel spacing.
ENH: DOS 6.22 & WIN 3.11 OS	V492	Adds Microsoft DOS 6.22 and Windows 3.11 OS, PCMCIA drivers, and system software.
ENH: RD-LAP 19.2 MW-520 800 MHZ	V500	Adds RD-LAP 19.2 kbps software driver (806-821) and is loaded into the MW-520. For use with 25 kHz channel spacing.
ADD: CDPD OEM RADIO MODULE-(INTERNAL)	V529	Adds assigned electronic identification number that is on the back of the CPU box, and used to register the unit with the network provider
ADD: 64MB SDRAM, MW520	V558	Replaces the existing 32 MB with 64MB of RAM for the MW-520.
ALT: MICROSOFT WINDOWS 98 SOFTWARE	V598	Adds Windows 98 operating system. PCMCIA drivers and other system software are included. V525 is required. For optimum performance of this O/S, V558 or V662 is recommended.
ADD: 17FT (5.6M) DISPLAY-CPU CBL,MW520	V648	Adds 17 foot cable to CPU. This is orderable only for the 10.4" VGA (not SVGA) display.
ADD: 128MB SDRAM, MW520	V662	Replaces the existing 32 MB with 128 MB of RAM for the MW-520.
ENH: WIN ME OS MW-520	V671	Adds Windows ME operating system to the MW-520.
ADD: PRIVATE DATATAC RADIO 800MHZ	V685	Adds Private DataTAC internal radio
ADD: 256MB SDRAM	V686	Replaces the existing 32 MB with 256 MB of RAM for the MW-520.
ENH: WIN 2000 OS MW-520	V691	Adds Windows 2000 operating system to the MW-520.
1-YEAR EXTENDED SERVICE PLAN,MW520	V698AD	Service plan that allows customer an extra year of coverage.
2-YEAR EXTENDED SERVICE PLAN,MW520	V699AD	Service plan that allows the customer two additional years of coverage.

4.3.5.2 Accessories for MW-520

Table 4-32 shows the hardware accessory descriptions for the MW-520.

Table 4-32. Hardware Accessories for MW-520

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
COLOR DISPLAY 10.4, VGA, 350 NIT	FLN2946	Adds 350 NIT display.
RETROFIT H.D TO 3D	FLN9560	Adds retrofit.
KEYBOARD, BRACKET	FLN9674	Offers customer extra keyboard bracket.
MW-520 MOUNTING ASSEMBLY	RLN4929	Adds mounting assembly for the 1000 NIT display. Also works with the 350 NIT display.
AMNON: Which description works best here?		Adds a display and keyboard mounting assembly that attaches the MW-520 workstation to the inside of a vehicle, usually over the vehicle's transmission hump.

4.4 Portable Equipment

This section covers the portable radio modem (PRM) 660.

Private DataTAC portable configurations include field computers that can be vehicle-mounted and connected to a radio modem. A portable computer can connect to a radio modem to communicate with a host network.

The system designer can choose the notebook with the portable radio modem (PRM) 660 for portability:

4.4.1 Portable Radio Modem 660

The PRM 660 is a three-watt portable radio modem that provides connectivity between a data terminal, notebook computer or other DTE devices and a customer's host computer, through the Private DataTAC network. These are half-duplex packet modems that operate only in concert with the full duplex Private DataTAC infrastructure, and are not designed for direct, unit-to-unit or circuit-switched operation.

The standard model package includes:

- AC Wall adapter / trickle charger, which plugs directly into the PRM 660 and trickle charges the battery while it is in the unit
- SMB remote antenna connector (external antenna adapter cable (FKN4399) is required to connect the PRM 660 to external antennas that are terminated with mini-UHF connectors)
- 650 mAh three-cell 7.5-volt nickel cadmium (NiCd) battery (FLN6840) (battery includes approximately 3.5 hours of use under normal operating conditions)
- Internal and flip-up antenna
- RJ45 serial port (cable not included)
- *PRM 660 Quick Reference* card
- *PRM 660 Portable Radio Modem for Private DataTAC Networks Owner's and Installation Manual*

F2274 • PRM 660 800MHZ 3WATT PRIVATE

F2274 is a three-watt portable radio modem (PRM) in the 806-824 MHz transmit (Tx) range 851-869 MHz receive (Rx) range, with 12.5 kHz or 25 kHz channel spacing.

The top of the unit has a flip-up antenna, an LCD, four arrow keys, home key, help key, four soft keys (works with the display), and a battery charger indicator.

The side of the unit has an external antenna connector, an external power connector, and an eight-pin serial port connection.

The PRM 660 requires RD-LAP 19.2 kbps RF protocol (V500) or RD-LAP 9.6 kbps RF protocol (V470) to be specified at the time of order. Data terminal to modem cables are available as accessories.

The battery supplied is uncharged. Follow slow-charge instructions before first time usage. These instructions are found in the *PRM 660 Portable Radio Modem for Private DataTAC Networks Owner's and Installation Manual.*

4.4.1.1 Options for PRM 660

Tables 4-33 and 4-34 list the options for the hardware and the software for the PRM 660.

Table 4-33. Hardware Options for PRM 660

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ADD: FAT PAK BATTERY AND COVER	V43AC	Adds a 1400 mAh high capacity battery and battery cover.
ADD: SWIVEL BELT LOOP NYLON	V177	Adds flexible nylon holder (FLN8315A) for the PRM 660 and can be swiveled up from the belt position.
ADD: WALL ADAPT 220VAC EUROPE	V327	Adds small AC adapter (FLN6795A) that plugs into a 220V AC wall outlet to charge the PRM 660 internal battery.
ADD: SPARE 650 MAH NICD BATTERY PAC	V328	Adds spare battery pack (FLN6840A) of 7.5 NiCd batteries (FLN6840A) that can be charged while installed in the PRM 660.
ADD: WALL ADAPTER 220VAC UK	V349BB	Adds an AC adapter/charger (FLN8479A) for use in the United Kingdom.
ADD: CASE, LEATHERETTE CARRY	V465AC	Adds a leather-type carrying case (FLN6832A) to protect the PRM 660.
ADD: WALL ADAPTER 110VAC US/CAN	V466AE	Adds an adapter/charger (FLN6794A) for use in the United States and Canada.

Table 4-34. Software Options for PRM 660

COF DESCRIPTION	OPTION NUMBER	DESCRIPTION
ENH: RD-LAP 9.6 KBPS	V470	Adds RD-LAP 9.6 kbps software driver that is loaded into the PRM 660. For use with 12.5 kHz channel spacing.
ENH: RD-LAP 19.2KBPS	V500	Adds RD-LAP 19.2 kbps software driver that is loaded into the PRM 660. For use with 25 kHz channel spacing.

4.4.1.2 Accessories for PRM 660

Table 4-35 lists the accessories for the PRM 660 and equivalent option numbers, if applicable.

Table 4-35. Hardware Accessories for PRM 660

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
CABLE, 3FT RJ45TO DB9-F	FKN4088	Adds a 3-foot RS-232 serial cable with a DB-9 female connection on one end, and an 8-pin connector (RJ-45) at the other end. This cable is for connecting the PRM 660 to a personal computer or other suitable DTE device.
CABLE ANTENNA SMB TO MINI UHF	FKN4399A	Adds required external antenna adapter cable to connect the PRM 660 to external antennas that are terminated with mini-UHF connectors.
CHARGER SMART US CANADA	FLN2325A	Adds a smart charger that plugs into a 110V AC wall outlet to charge the PRM 660 internal battery. This charger has a conditioning function that gets extended life out of NiCd chemistry batteries.
CHARGER BATTERY COND 220VAC EUROPE	FLN2326	Adds a smart charger that plugs into a 220V AC wall outlet to charge the PRM 660 internal battery. This charger has a conditioning function that gets extended life out of NiCd chemistry batteries.
SMART CHARGER FOR UK	FLN2327	Adds a smart charger that plugs into a 220V AC wall outlet to charge the PRM 660 internal battery. This charger has a conditioning function that gets extended life out of NiCd chemistry batteries.
115 AC WALL ADAPT FOR U S CAN	FLN6794A	Adds a 115V AC wall transformer (V466) used to charge the battery in the PRM 660.
220-240V AC WALL ADAPT FOR EUR	FLN6795A	Adds a 220V AC wall transformer (V327) used to charge the battery in the PRM 660.
LEATHERETTE CASE	FLN6832A	Adds a leather-type carrying case (V465) to protect the PRM 660.
BATTERY 650MAH 7.5V NICAD	FLN6840A	Adds a spare battery pack (V328) of 7.5 NiCd batteries (V328) that can be charged while installed in the PRM 660.
CASE SWIVEL BELT LOOP	FLN8315A	Adds a flexible nylon holder (V177) for the PRM 660 and can be swiveled up from the belt position.
BATTERY COVER	FLN8386A	Adds a spare battery cover for the FLN8387A battery.
BATTERY, 1400MAH	FLN8387A	Adds a spare 1400 mAh high capacity battery that can be charged while installed in the PRM 660.
ADAPTER WALL 220-240 50HZ AC UK	FLN8479A	Adds a 220V AC, 50 Hz wall transformer (V349), used to charge the battery in the PRM 660.
120 VOLT 3 HR DESKTOP CHARGER	HTN9026 R	Adds a 120 volt 3 or 16-hour desktop charger that charges the standard 650 mAh NiCd battery.
MULTI UNIT CHARGER	HTN9295	Adds a multi-unit charger holder.
ADAPTER DB9F-DB25M	MDKN4023	Adds a DB9-F to a DB25 male adapter when the DTE has a DB25 male serial port.

4.5 Global Positioning System Receiver

The GPS receiver can be connected to the AUX port of a VRM-500 or VRM 650 modem that includes the GPS interface option (Z167), as part of a legacy AVL solution only. Concurrent Private DataTAC 2.0 value-added services are not supported by the modem or any device connected to the DTE port of the same modem. Any connected DTE is limited to communicate only with the same FLM host or message switch as the GPS receiver, and cannot enable IP, data compression, or security services.

Alternatively, the GPS receiver can be connected to the comm port of an MW-520 (the MW-520 has an available internal GPS receiver option) or a second comm port of notebook computer (the other port being connected to a VRM).

In the first configuration, the VRMs and Private DataTAC network serve as a communications pipe between the AVL application running in the host computer and the GPS receivers in the vehicles. This bi-directional communications between the host and the GPS receiver support a broad range of AVL and fleet management solutions. Customers can program the receiver to report autonomously at regular intervals or on demand by the host. The host can use the mobile network to dynamically control the mobile unit's reporting location report content.

The VRM provides a controller function that initializes the GPS receiver at start-up to a specific configuration. This default is stored in the VRM's non-volatile memory. The VRMs do not require separate intelligent controllers or DTE applications.

The VRM message arbitration and queuing supports concurrent operation with a computer device connected to the DTE. This application independence allows the user to maintain the vehicle tracking function even when the DTE is disconnected.

L3073 • PLACER 450 SENSOR ANTENNA BUNDLE

The L3073 is a Trimble® Placer™ 450 GPS receiver and antenna bundle, which includes the GPS receiver, power cable, a mini bulkhead antenna, a 5mm cable to connect the receiver and antenna, and an antenna mount gasket. The Placer 450 GPS sensor is an eight-channel receiver with two I/O ports that can be connected to modems and radios. Each receiver provides two input and two output lines.

4.5.1 Accessories for GPS

Table 4-36 lists the accessories for the GPS.

Table 4-36. Hardware Accessories for GPS

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
TRMBLE FOG, BLKHD ANTENNA CBL	CDN6277	Adds an 18-foot antenna cable that links the antenna to the receiver processing unit.
TRMBLE PLCR GPS 400 INTR CBL	CDN6278	Adds a DB-9 M-F 3-foot cable used to connect the GPS to the computer used for programming or testing.
CABLE, 20 FT DB9 M-F	FKN4367	Adds a DB-9 M-F 20-foot cable added to the F5200 to connect it to the GPS receiver.
CABLE, 10FT DB9 M-F	FKN4369	Adds a DB-9 M-F 10-foot cable added to the F5200 to connect it to the GPS receiver.
CABLE, TRIMBLE GPS DB9, 20FT	FKN4548	Adds a DB-9 M-F 20-foot cable used to connect the Trimble Placer GPS receiver to the VRMs.
FUSE KIT FOR GRN & ORG LEADS	HLN4952A	Adds a fuse kit that consists of two complete in-line fuse holders and fuses with hardware. No installation hardware or wire is included.

4.6 Network Equipment

Table 4-37 lists the networking equipment, describing the hubs, switches and cables.

Table 4-37. Cables, Hubs, and Switches

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
12 PORT NON-SNMP HUB	CDN1643	A hub equipped with 12 RJ-45 10BaseT ports, hub for use in shared ethernet networks without FullVision INM, and is non - SNMP. It has an extra port for a backbone connection, if necessary. The hubs are rack mountable and comes with a mounting kit.
24 PORT NON-SNMP HUB	CDN1644	A hub equipped with 24 RJ-45 10BaseT ports for use in shared ethernet networks without FullVision INM and is non-SNMP. It has an extra port for a backbone connection, if necessary. The hubs are rack mountable and comes with a mounting kit.
QTY 4 - 7 FT 10BASE-T ETHERNET CBL	CDN6330	Adds four 7-foot, 10BaseT ethernet cables with RJ-45 to RJ 45 connectors on both ends. Two cables are required per hub. One connects to the ethernet. The other connects to the network.
QTY 1 - 14 FT 10BASE-T ETHERNET CB	CDN6331	Adds a 14-foot, 10BaseT ethernet cable, with RJ-45 to RJ-45 connectors on both ends. Two cables are required per hub. One connects to the ethernet, and the other connects to the network.

Table 4-37. Cables, Hubs, and Switches (Continued)

COF DESCRIPTION	ACCESS. NUMBER	DESCRIPTION
SUPERSTACK II 12 PORT	CDN6392	A stackable ethernet hub equipped with 12 RJ-45 10BaseT ports and extend from a basic hub for unmanaged workgroups to a segmentable hub with full remote monitoring (RMON) support, web-based management, advanced load balancing, SNMP management, security and resilient links. For use in shared ethernet networks with FullVision INM.
SUPERSTACK II 24 PORT	CDN6393	A stackable ethernet hub equipped with 12 RJ-45 10BaseT ports and extend from a basic hub for unmanaged workgroups to a segmentable hub with full RMON support, web-based management, advanced load balancing, SNMP management, security and resilient links. For use in shared ethernet networks with FullVision INM.
SUPERSTACK II 1000 12 PORT	CDN6251	This is switch equipment used for systems with more than two active RNCs and require up to 24-ports.
SUPERSTACK II 1000 24 PORT	CDN6252	This is switch equipment used for systems with more than two active RNCs and require up to 24-ports.
S400 WAN MULTI-PORT CONVERSION SWITCH	NP3C8S400	Adds a router to a fault tolerant configuration and connects to either the primary LAN or secondary LAN.
ETHERNET CABLE, 10’	TDN1111	Adds a 10-foot, 10BaseT ethernet cable, with RJ-45 to RJ-45 connectors on both ends. Two cables are required per hub. One connects to the ethernet, and the other connects to the network.
ETHERNET CABLE, 25’	TDN1112	Adds a 25-foot, 10BaseT ethernet cable, with RJ-45 to RJ-45 connectors on both ends. Two cables are required per hub. One connects to the ethernet, and the other connects to the network.
ETHERNET CABLE, 50’	TDN1113	Adds a 50-foot, 10BaseT ethernet cable, with RJ-45 to RJ-45 connectors on both ends. Two cables are required per hub. One connects to the ethernet, and the other connects to the network.
ETHERNET CABLE, 100’	TDN1114	Adds a 100-foot, 10BaseT ethernet cable, with RJ-45 to RJ-45 connectors on both ends. Two cables are required per hub. One connects to the ethernet, and the other connects to the network.

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Chapter 5
Site Planning Data

Table 5-1 lists the electrical specifications and dimensions of products presented in this manual.

Table 5-1. Electrical Specifications and Dimensions of Equipment

Equip. Desc.	Equip. Model	Elec. Input Volt.	Elec. Freq. HZ	Elec. Input Amps	Elec. Input Watts	BTUs	Ht. in./cm	Wdth. in./cm	Length in./cm	Wt. lbs/kg
RNC3000 12-slot	L1960	115/230 VAC	60/50	6.1	700	775	21/53.2	19/48.2	13.5/34.3	60/27.3
COM-SPHERE 3810*Plus* Desktop	L3186	110 VAC	60/50	-	8W w/ speaker off 9W on	27.3 w/ speaker off	2.1/5.4	7.6/19.4	12.1/30.8	2.5/1.14 (w/o power supply)
COM-SPHERE 3811*Plus* Card	ZA00084 AA	110 VAC	60/50	-	6	20.5	7.1/18.1	1.8/4.6	13.4/34.0	1.0/0.45
Card rack	L3171	115 VAC	60	1.4	150	47 fully loaded	7/17.78	19/48.3	10.75/27.3	20/9.09
WNG	T6517	115 VAC 230 VAC	60/50	1.5 3.0			20.94/ 53.19	18.97/ 48.18	13.5/34.29	60/27.3
WNG	T5901	115 VAC 230 VAC	60/50	1.5 3.0			21.0/53.34	19.0/ 48.26	23.9/60.71	100/45.4
Full Vision High-tier	HP C3600 W/S	100-120/ 220-240	60/50	7.4 3.8	805		17.5/45.1 (w/stand)	9.0/22.9	25.8/49.5	25.4-55.8/ 20.9-45.9
Full Vision Low-tier	HP B2000 W/S	100-120/ 220-240	60/50	7.4 3.8	805		17.5/44.5 (w/stand)	9.0/22.9	19.5/49.5	21.4/47.6/ 18.6/41.0
21" Color Monitor	HP	110/120 220/240	60/ 50	2.0 1.0	160	546	19.8/50.4	19.6/49.8	18.7/47.4	68.2/31
COM-SPHERE 3810*Plus* Desktop	L3186	110 VAC	60/50	-	8W w/ speaker off 9W on	27.3 w/ speaker off	2.1/5.4	7.6/19.4	12.1/30.8	2.5/1.14 (w/o power supply)
COM-SPHERE 3811*Plus* Card	ZA00084 AA	110 VAC	60/50	-	6	20.5	7.1/18.1	1.8/4.6	13.4/34.0	1.0/0.45
Laser Printer	CLN6844	110 VAC	60/50	6.8	260	990.1	11.8/30.0	17.4/44.2	16.0/40.8	37/16.8
UPS	TRN7915	120 VAC	60				15.1/38.5	15.2/39.0	20.2/51.5	148/70
QUAN-TAR® DBS 20W (X250)	C99ED-011C	120/240 VAC	60/50	1.6	180		30/76.2	22/55.9	20/50.8	55/25
QUAN-TAR DBS 100W (X750)	C99ED-011C	120/240 VAC	60/50	3.5	400		30/76.2	22/55.9	20/50.8	55/25
COM-SPHERE 3810*Plus* Desktop	L3186	110 VAC	60/50	-	8W w/ speaker off 9W on	27.3 w/ speaker off	2.1/5.4	7.6/19.4	12.1/30.8	2.5/1.14 (w/o power supply)

Table 5-1. Electrical Specifications and Dimensions of Equipment

Equip. Desc.	Equip. Model	Elec. Input Volt.	Elec. Freq. HZ	Elec. Input Amps	Elec. Input Watts	BTUs	Ht. in./cm	Wdth. in./cm	Length in./cm	Wt. lbs/kg
VRM-500	F2054	13.6 VDC	—	180 mA	2.5	—	5/12.7	1.1/2.8	4.7/11.9	1.1/5
VRM 650	F3454 F3455	13.8 VDC	—	6.5 13.5			1.85/4.7 1.97/5	6.61/16.8 6.61/16.8	7.68/19.5 8.47/21.5	3.8/1.57 3.10/1.65
VRM 660	F2168	10.6-16.6 VDC	DC	200 mA max.	2.76		2.1/5.3	3.5/8.8	5.3/13.5	1.7/.765
MW 300/ MW 350 w/o radio	F5030 F5032	—	—	—	—	—	5.0/12.6	8.0/20.3	11.2/28.3 1.8/4.5 (deep)	3.5/1.5
MW-520 Process Ut. Display Ut. Keybd. Ut.	F5203 F5205 F5200	13.6 VDC	DC	1.2A max.	16.4		2.65/6.7 10.3/26.2 2.0/5.1	7.0/17.8 11/27.9 12/30.1	8.5/21.6 1.3/3.3 8.0/20.3	37/16 w/packing
800 MHz RF PA	FLN2424	13.8	—	12	176		2/5.1	8/20.3	8.6/21.8	4.23/1.92
PRM 660	F2274	7.5 VDC	DC	2.5A	19		3.3/8.2	6.8/17.0	1.3/3.4	18.5oz./ .525
Placer™ 450 Sensor Antenna Bundle	L3073	10-32 VDC	1565-1585 MHz	20 mA	3.25		1.3/3.3	9/23	3.75/9.5	.95/.43

Table 5-2 is a battery charger reference table that shows the various available chargers for the PRM 660.

Table 5-2. Battery Adapters and Chargers Reference Table

Location	Type	PRM 660 Access. No.	PRM 660 Option No.
U.S./Canada	Battery Chgr./ Cond.	FLN2325A	
U.S./Canada	Wall Adptr/ Charger	FLN6794A	V466
Europe	Battery Chgr./ Cond.	FLN2326	
Europe	Wall Adptr/ Charger	FLN6795A	V327
United Kingdom	Battery Chgr./ Cond.	FLN2327	
United Kingdom	Wall Adptr/ Charger	FLN8479A	V349
US/Canada	Desk Charger	HTN9026 R	
US/Canada	Multi-Unit Charger	HTN9295	

Chapter 6
Service Information

This chapter contains three separate sections to support servicing the products in this document. The first section provides a listing by product of service documentation and service aids. The second section provides interconnect charts with cable installation information. The third section is a chart of test equipment by product.

6.1 Software, Documentation, and Accessories

This section provides a listing by product of service documentation and service aids. Part numbers listed are as shown in the documents. The removal of the *P* (no space or hyphen) places the document number in both COF and AAD formats.

System Documents

Document	Equipment Model Number	Document Number/ Part Number
Private Radio Data Systems Network Configuration and Optimization Guide	System	68P81099E55

Motorola Wireless Communication Software (MWCS II)

Document	Equipment Model Number	Document Number/ Part Number
MWCS II Software Developer's Manual	System	68P80800E35

QUANTAR® Data Base Station (DBS)

Document	Equipment Model Number	Document Number/ Part Number
Service Manual for QUANTAR and QUANTRO Station Products and ASTRO-TAC™ Comparator	C99ED-001D	68P81088E90
Radio Service Software and QUANTAR and QUANTRO Stations Radio Service Software User's Guide	C99ED-001D	RVN5002
QUANTAR and QUANTRO Stations Radio Service Software User's Guide	C99ED-001D	68P81085E35
Cable, four-foot, IBM® PC DB9 M-F	C99ED-001D	3080369E31

Vehicular Radio Modem 500 (VRM-500)

Document	Equipment Model Number	Document Number/ Part Number
Cable, 6-foot DB9 M-F (PC running RSS)	F2054	0180358A25
Radio Service Software and VRM 500 Vehicular Radio Modem Radio Service Software User's Guide	F2054	RVN4133
MCS 2000 Mobile Radio Service Instructions	F2054	68P81080C43
VRM 500 Vehicular Radio Modem Radio Service Software User's Guide	F2054	68P02946C95

Vehicular Radio Modem 650 (VRM 650)

Document	Equipment Model Number	Document Number/ Part Number
Cable, 6-foot DB9 M-F (PC running RSS)	F3454 F3455	0180358A25
VRM 500/650 Vehicular Radio Modem Radio Service Software User's Guide	F3454 F3455	68P02946C95
Radio Service Software and VRM 500 Vehicular Radio Modem Radio Service Software User's Guide	F3454 F3455	RVN4133

Vehicular Radio Modem 660 (VRM 660)

Document	Equipment Model Number	Document Number/ Part Number
Cable, 6-foot DB9 M-F (PC running RSS)	F2168	0180358A25
Radio Service Software and VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2168	RVN4146
VRM 660 Vehicular Radio Modem Radio Service Software User's Guide	F2168	68P02951C15

Mobile Workstation 300 (MW 300)/Mobile Workstation 350 (MW 350)

Document	Equipment Model Number	Document Number/ Part Number
Cable, 6-foot DB9 M-F (PC running RSS)	F2168	0180358A25
Radio Service Software and VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2168	RVN4146
VRM 660 Vehicular Radio Modem Radio Service Software User's Guide	F2168	68P02951C15

Mobile Workstation 520 (MW-520)

Document	Equipment Model Number	Document Number/ Part Number
Radio Service Software and VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F5201/ F5200	RVN4146
Mobile Workstation 520™ Service Manual Board Level	F5201/ F5200	68P02950C65
Radio Service Software Manual	F5201/ F5200	68P02938C95
VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F5201/ F5200	68P02945C40

Portable Radio Modem (PRM 660)

Document	Equipment Model Number	Document Number/ Part Number
Radio Service Software and VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2274	RVN4146
VRM 660 Vehicular Radio Modem, PRM 660 Portable Radio Modem, Mobile Workstation 520, RPM 500 Radio Packet Modem, Radio Service Software User's Guide	F2274	68P02945C40

Global Positioning System (GPS)

Document	Equipment Model Number	Document Number/ Part Number
Private DataTAC 1.0 GPS Install Supplement	L3027 L3028	68P81129E91
Placer™ GPS 400 Installation and Operator's Manual	L3027 L3028	CDN6279
GPS Software for 9100-WS Installation Instructions	L3027 L3028	68P02948C322

The documents referenced in this manual can be obtained from the following source:

Accessories and Aftermarket Division
Motorola Centralized Customer Service
1313 E. Algonquin Road
Schaumburg, IL 60196

1-800-422-4210 FAX 1-847-538-8198

6.2 Cable Installation Information

This section describes the cabling information for the products described in this document.

6.2.1 Radio Network Controller 3000

This section covers the cabling and accessories for the RNC3000.

Radio Network Controller 3000 (RNC3000)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
MVME712A/AM CPU Processor Module					
Serial Port 1 Console	DB25-F D-Conn.	—	CKN1032 DB25 M-M CKN1033 DB25 M-M	DB25-F	Console TDN1088
Serial Port 2 TTY01	DB25-F D-Conn.	—	CKN1034 DB25 M-M	DB25-F	COMSPHERE® Modem (remote service)
Serial Port 3	DB25-F D-Conn.	—	—	—	A/B Switch
Serial Port 4 Async Host Link = < 9600 Baud)	DB25-F D-Conn.	—	CKN1034 DB25 M-M	DB25-F	COMSPHERE Modem Async (Host Link)
Input B/Power Cable	3 Conn	E642, etc.		Power Conn.	Power Main
MVME712B Transition Module					
Ethernet Port (AUI) 10BaseT	RJ-45	—	TDN1087, TDN1112, TDN1113, TDN114, CDN6330, CDN6331	—	10BaseT Cabling
SDP12-01 Transition Module					
Channels 0-3 Async Port)	HD62	—	TDN1082	—	COMSPHERE Modem (Base Station Link)
Channels 4-7 Async Port)	HD62	—	TDN1082	—	COMSPHERE Modem (Base Station Link)
SDP12-01 Transition Module					
Channels 8-11 Async Port)	HD62	—	TDN1082	—	COMSPHERE Modem (Base Station Link)
Channels 12-15 Async Port)	HD62	—	TDN1082	—	COMSPHERE Modem (Base Station Link)

6.2.2 Wireless Network Gateway™

This section covers the cabling and accessories for the WNG.

Wireless Network Gateway (WNG)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
10/100BaseT Port (RJ-45)	RJ-45	-	CDN6330, CDN6331, TDN1111, TDN1112, TDN1113, TDN1114	RJ-45	Hub, etc.
XR 712-121, Port 1	DB25-F	-	CKN1032 (M-M) CKN1033 (M-M)	DB25-F	Console TDN1088
FX Chassis, Port 1 (Fault Tolerant only)	25HD-F		CDN1041	DB25-F	Console TDN1088
10/100BaseT Port (RJ-45)	RJ-45	-	CDN6330, CDN6331, TDN1111, TDN1112, TDN1113, TDN1114	RJ-45	Hub, etc.
10/100BaseT Port (RJ-45) (FX Model only)	RJ-45		CDN6330, CDN6331, TDN1111, TDN1112, TDN1113, TDN1114	RJ-45	Hub
Input B/Power Cable	3 Conn	E909	TDN1092	3 Conn	Main Power

6.2.3 FullVision® Integrated Network Manager

This section covers the cabling and accessories for FullVision INM.

FullVision Integrated Network Manager

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
Ethernet Port, AUI	DB25-F	-	TDN1087 10BaseT Transceiver CDN6330, CDN6331, TDN1111, TDN1112, TDN1113, TDN1114	RJ-45	Hub
Ethernet Port, RJ-45	RJ-45	-	CDN6330, CDN6331, TDN1111, TDN1112, TDN1113, TDN1114	RJ-45	Hub, etc.
Serial Port 2	DB9-M	-	TKN9113, TKN9114, TKN9115	DB25-F	COMSPHERE Modem Service Modem
Printer Port	Centronics®	-			Deskjet® Printer
Input B/Power Cable	3 Conn.	E909	TDN1092	3 Conn.	Main Power
Ethernet Port, RJ-45	RJ-45	-	CVN6142 CDN6330, CDN6331, TDN1111. TDN1112, TDN1113, TDN1114 (SNMP trap frdng software*)	RJ-45	Hub
Serial Port 1	DB9-M		TKN9113, TKN9114, TKN9115 (Paging software*)	DB25-F	COMSPHERE Modem
*For further information, contact your local Business Manager.					

6.2.4 QUANTAR® Data Base Station

This section covers the cabling and accessories for the QUANTAR DBS.

QUANTAR Data Base Station

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
RSS Port (SCM Front Panel)	DB9-F D-Conn.	—	3080369E31 DB9 (M-F)	DB9(M) D-Conn.	PC
C (Conn. #15) Modem	DB25-F D-Conn.	—	3083273X01 DB25 (M-M), four-foot	DTE DB25-F	COMSPHERE Modem
F (Conn. #24) (Battery Temperature Sensor)	3-Pin Conn.	—	TKN8732A/Cable TKN8786A/Battery Temp Sensor	2-Pin Conn.	Storage Battery
E (Conn. #25) (Battery Charger Output)	4-Pin Conn.	— — —	TPN6185/Battery Charge 625 watts TPN6187/Battery Charge 265 watts TRN5155A/Battery Cable Ext. 10Ft.	4-Pin Conn.	Storage Battery
H (Conn. #30) 5 MHz Input	BNC	—	—	BNC	Ext. Freq. Std.
I (Conn. #31) ‘ Modem Power	10-Pin Conn.	—	3083277X01, 4-foot, 2-wire	Screw Terminals on Power Strip	COMSPHERE Modem

6.2.5 Vehicular Radio Modem 500

This section covers cabling and accessories for the VRM-500.

Vehicular Radio Modem 500 (VRM-500)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
DTE	DB9-F D-Conn.	— — —	FKN4520/14IN. (M-F) FKN4369/10FT. (M-F) FKN4367/20FT. (M-F)	COM1/ DB9(M) D-Conn. COM2/ DB9(M) D-Conn	MW-520
		— — —	FKN4368/10FT. (M-M) FKN4376/20FT. (M-M) FKN4174/20FT. (M-F)	(Use AMP #745255-2 or 745779-2 connectors only.)	Terminal Interface Cable
AUX	DB9-M D-Conn.	—	FKN4548 (F-M)	DB9(F) D-Conn.	GPS
RADIO	13-Pin DIN Jack	J455	FKN4482	Data and Voice	MCS 2000®

6.2.6 Vehicular Radio Modem 650

This section covers the cabling and accessories for the VRM 650.

Vehicular Radio Modem 650 (VRM 650)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
DTE		—	FKN4520/14IN. (M-F)	COM1/ DB9(M) D-Conn.	MW-520
		—	FKN4367/20FT. (M-F)	COM2/ DB9(M)	
		—	01-80358A25 6 FT. DB9 (M-F)	D-Conn	
		—	FKN4174/20FT. (M-F)	(Use AMP #745255-2 or 745779-2 connectors only.)	Terminal
		—	FKN4368/10FT. (M-M)		
		—	FKN4376/20FT. (M-M)		
AUX	DB9-M D-Conn.	—	FKN4548 (F-M)	DB9(F) D-Conn.	GPS
Rear Panel Connectors					
Antenna	Mini-UHF-F	—	Antenna and cable sold separately	—	Antenna
		—			
		—			
DC Connector	2-pin Conn.	—	HKN4192/20FT.	2-pin Conn.	Vehicle Battery
			FKN4752		Modem

6.2.7 Vehicular Radio Modem 660

This section covers the cabling and accessories for the VRM 660.

Vehicular Radio Modem 660 (VRM 660)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
DTE		—	FKN4520/14IN. (M-F)	COM1/ DB9(M) D-Conn.	MW-520
		—	FKN4367/20FT. (M-F)	COM2/ DB9(M)	
		—	FKN4369/10FT. (M-F)	D-Conn	
		—	FKN4174/20FT. (M-F)	(Use AMP #745255-2 or 745779-2 connectors only.)	Terminal
		—	FKN4368/10FT. (M-M)	On Terminal	
		—	FKN4376/20FT. (M-M)		
Rear Panel Connectors					
Antenna	Mini-UHF-F	—	Antenna and cabling are customer specific	—	Antenna
DC Connector	2-pin Conn.	—	HKN4192/20FT. (supplied standard)	2-pin Conn.	Vehicle Battery
Remote Control	4-pin				

6.2.8 Mobile Workstation 520

This section covers the cabling and accessories for the MW-520.

Mobile Workstation 520 (MW-520)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
Parallel	J1-DB25-F Conn	—			Printer
Power Connector	2-Pin Conn.	—	HKN4192/20FT.		Vehicle Battery
Audio In	Miniphone	—			Microphone
Audio Out	Miniphone	—			8 ohm 5 watt Speaker
Display	J2-DB44-F	—	30-02132C45	J3-DB44-M	FLN2435 Display
Keyboard	J3-DB9-F Conn	—	FLN8825 (DB9-M) Permanently attached keyboard	—	Keyboard
COM1	J5-DB9-M RS-232	— —	FKN4367/20FT. (F-M) FKN4369/10FT. (M-F)	DTE-DB9-F	VRM
COM2	J6 - DB9-M RS-232	— —	FKN4367/20FT. (F-M) FKN4369/10FT. (M-F)	PORT2-DB9-F	GPS
Aux.	J4-DB9-F Conn	—	Cable comes hard-wired with monitor	—	VGA Analog
Antenna Jack on Docking Station	RF/Mini UHF	— —	Antenna and cabling are customer specific FKN4594	— RF/Mini UHF	Antenna FLN2424 Power Amp.
RF POWER AMPLIFIER, 800 MHz (FLN2424)					
Antenna Jack	RF/Mini UHF	—	Antenna and cabling are customer specific	—	Antenna
DC Connector or Amplifier	2-pin	—	HKN4192/20FT.	—	Vehicle Battery

6.2.9 Portable Radio Modem 660

This section covers the cabling and accessories for the VRM 660.

Portable Radio Modem 660 (PRM 660)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
Ext. Antenna Conn.	J1	SMB	FKN4399/ 2880376E84 Mini UHF Conn		Antenna
Ext. Power Connector		V327	Battery Charger & Cond. (FLN6795A)		Wall Outlet 110V AC
		V349	Battery Charger & Cond. (FLN8479A)		Wall Outlet 220V AC
		V466	Battery Charger & Cond. (FLN6794A)		Wall Outlet 220V AC
		—	FLN2325A		Wall Outlet 110V AC
		—	FLN2326		Wall Outlet 220V AC
		—	FLN2327		Wall Outlet 220V AC
Serial Port Connector	RJ-45	—	FKN4092	DIN8	Terminal Strip
		—	FKN4088A/3FT.	DB9-F	DTE

6.2.10 Global Positioning System

This section covers the cabling and accessories for the GPS.

Global Positioning System (GPS)

Extension Connector Listings	Jack Number & Equipment Style	Cable Option	Cable Accessories	Jack Number and Style	Type of Equipment Used
ANT	SMB Push-On Conn.-M	—	CDN6277 (M-F)	SMA Conn.-F	Antenna
PORT 1	DB-F	—	FKN4369/10FT. (M-F) FKN4367/20FT. (M-F) FKN4548/20FT. (M-F)	DB9-M	PC for programming
PORT 2	DB9-F	—	FKN4369/10FT. (M-F) FKN4367/20FT. (M-F) FKN4548/20FT. (M-F)	DB9-M	VRM-500, VRM 650, MW-520,
DC Connector	2-pin	—		—	Vehicle Battery

6.3 Test Equipment Information

You need to contact the Mobile Data Customer Solutions Engineering in the section, “page -xxv,”Using This Manual,” for assistance. The equipment listed below is required to service each product in the column headers.

Test Equipment Chart

Test Equip.	Model No. or Equiv.	MW-520	GPS*	VRM-500*	VRM 650 VRM 660 PRM 660	QUAN-TAR	RNC 3000	WNG*	Full-Vision INM
Available from Accessories and Aftermarket Division									
100 MHz Digital Oscillo scope	Motorola R-1362	•	•	•	•	•	•	•	•
100 MHz Analog Oscillo scope	Motorola R-1369	•	•	•	•	•	•	•	•
Fre-quency Counter	Motorola R-1068 (1 GHz) Motorola R-1112 (175 MHz)	•	•		•	•	•	•	•
AC Volt-meter	Motorola S-1053	•	•	•	•	•	•	•	•
RF Volt-meter	Motorola S-1339 Motorola R-1076	•	•		•	•			
RF Watt-meter	Motorola S-1350 & Element	•			•	•			
Dummy Load	Motorola T-1013	•			•	•			
RF Signal Gener-ator	Motorola R-1335	•	•		•	•			

Test Equipment Chart

Test Equip.	Model No. or Equiv.	MW-520	GPS*	VRM-500*	VRM 650 VRM 660 PRM 660	QUAN-TAR	RNC 3000	WNG*	Full-Vision INM
Digital Multi-meter	Motorola R-1072 Motorola R-1074	•	•	•	•	•	•	•	•
Lumi–nance Meter	Minolta® T-1M	•							
Audio Analyzer	Motorola R-1350	•		•		•	•		
Power Supply 0-40 VDC @ 30 Amps	Motorola R-1011	•	•	•	•	•	•	•	
Radio Test Set	Motorola R-1033	•			•	•			
Not Available from Accessories and Aftermarket Division									
RS-232C Monitor	Hazel-tine® 1500	•	•	•	•		•	•	•
Service Monitor	Motorola R-2600	•	•		•	•			
Test Terminal Pro-cessor Analyzer	DEC® VT131 Fluke® 9010A						•	•	
Modem Test Set	Electro-data® CTS-2						•	•	•
Data Stream Analyzer	Interview 48 Comstate R	•	•	•	•		•	•	•
* Only—Not Field Repairable									

Numerics

10BaseT: A variant of ethernet which allows stations to be attached via twisted-pair cable.

A

A/B Switch: A hardware switch used to switch the modem lines from the Data Base Stations to the master RNC. In a warm standby configuration, two RNCs (master and standby) are connected via ethernet, and in parallel to the DBSs through an A/B Switch.

algorithm: A mathematics rule for procedure for solving a problem.

American National Standards Institute: (ANSI) A U.S. organization chartered to accredit standards developed by a wide variety of industry groups without improper influence from any one company or organization. Does not develop standards, but reviews and implements those developed by other organizations.

Application Programming Interface: (API) The interface, or set of functions, between application programs and the network software.

asynchronous: A data transmission method that sends one character at a time. Contrasted with the synchronous methods, which send a packet of data and then resynchronize their clocks. Asynchronous also refers to commands, such as in a windowing environment, that may be sent without waiting for a response to the previous command.

Attachment Unit Interface: (AUI) The 15-pin D connector and cable between the transceiver (mounted on the backbone ethernet cable) and the network interface card in a PC or other network node.

Automatic List Builder: (ALB) The ALB can be used to prompt for the customer specifics in building the complete system equipment list.

Automatic Vehicle Location: (AVL) An application for tracking vehicles.

Auxiliary: (AUX) Abbreviation for Auxiliary serial port.

B

Base Station: (BS) See Data Base Station.

Base Station Controller: (BSC) Hardware and software logic that controls the communication functions of the radio portion of a base station. (The DBS product integrates a BSC within the QUANTAR® base station platform.)

C

Carrier Sense Multiple Access/Collision Detection: (CSMA / CD) A method for handling contention on shared media. Carrier Sense indicates that a station on the network will listen to the wire before trying to send, to prevent a collision with another station that is currently transmitting. Multiple Access indicates that many stations may be connected to the same wire as peers.

Central Processing Unit: (CPU) The computer in charge of fetching, processing, instruction decoding, performing arithmetic and logical operations, and storing data. Generally used to refer to the entire microprocessor chip.

Communication Ports: (COM Ports) The physical socket on the back of a PC (generally RS-232) into which you plug your modem. Also, a data channel inside your computer that handles serial I / O.

Compact Disk-Read Only Memory: (CD-ROM) A format for storing different types of information digitally, which can be played on a CD-ROM drive, connected to a personal computer.

Complementary Metal-Oxide Semiconductor: (CMOS) Integrated circuit technology.

Computer Aided Dispatch: (CAD) A common host application function. It involves prioritizing, formatting, and delivering information required by field personnel to perform a specific task.

Consultative Committee for International Telephony and Telegraphy: (CCITT) An advisory body headquartered in Geneva, Switzerland, under the International Telecommunications Union (ITU), which issues recommended communication standards.

Customer Acquisition Process: (CAP) A Motorola process that defines the acquisition of new customer business.

Customer Order Fulfillment: (COF) Motorola's computer electronic ordering system that allows for entry of extensive customer and equipment information direct from sales and engineering field personnel, and leads to fast, high-quality customer orders. The system allows you to place orders, check on orders, shipping dates, etc.

D

Data Base Station: (DBS) A fixed radio frequency transceiver used in wireless data communications.

Data Communications Equipment: (DCE) Equipment that provides the functions required to establish, maintain, and terminate a connection, the signal conversion, and coding required for communications between data terminal equipment and the data circuit. The data communication equipment may or may not be an integral part of a computer (e.g., a modem).

Data Terminal Equipment: (DTE) User terminal equipment which creates information for transmission. Also refers to the interface to users' equipment as opposed to the DCE interface to the network.

DB-15: A standard 15-pin connection specified for the AUI interface.

DB-25: A twenty-five pin connection for V.24 or RS-232 C interfaces.

DB-9: A standard 9-pin connector used for serial interfaces.

decibel: (dB)A unit for measuring relative power ratios and transmission gains or losses.

decibel milliwatt: (dBm) A measure of power, referencing one milliwatt, that logarithmically measures the change in power intensity.

Digital Audio Tape: (DAT) A type of storage media used for the backup of computing data.

Disk Operating System: (DOS) A disc-oriented computer where programs and data utilize memory discs as the main operating feature.

E

EIA-232: Electronic Industries Association defines electrical characteristics such as required voltage, resistance and current values of an interface circuit.

Electronics Industries Association: (EIA) A U.S. national standards organization composed of members from the electronics industry. In the context of data and computer communications, it has produced a range of interface standards for connecting peripherals to a computer. It is a member of American National Standards Institute and, through them, the International Organization for Standardization.

end-to-end: An operation such as a measurement of performance, or protocol processing such as Layer 4 error detection, which is performed only between the endpoints in a communication circuit.

ethernet: The name of the local area network originally invented by the Xerox Corporation Palo Alto Research Center. It operates using the CSMA / CD medium access control method. The early specification was refined by a joint team from Digital Equipment Corporation, Intel Corporation and Xerox Corporation and this in turn has been superseded by the IEEE 802.3-ISO 8802.3-international standard.

F

fault tolerance: The ability of a system to sustain a fault condition and still provide the expected outcome, typically through additional mechanisms.

fault tolerant: A description of computer and networking hardware and software products which are resistant to failures.

flash: In computer memory, a device that behaves like ROM, but can be modified or overwritten using special procedures. Usually used in hardware devices (such as a modem) to upgrade or update the feature set of the device.

Formatted Logical Messaging: (FLM) A Motorola proprietary protocol that defines logical messages for Private DataTAC™ network host communications.

FullVision® Integrated Network Manager: (FullVision INM) A Motorola software application that provides a view of the status and health of a communication system.

G

GigaHertz: (GHz) A unit of frequency equal to one billion cycles per second (Hz).

Global Positioning System: (GPS) The GPS system is a constellation of high orbit U.S. Government satellites which make approximately two passes a day around the world, at 11K miles per hour.

Graphical User Interface: (GUI) A computer interface that permits users to directly manipulate objects displayed on the monitor as the primary means of interaction. Using a pointing device, the screen objects can be modified and controlled.

H

High-level Data Link Control: (HDLC) A protocol used between the DBS and the RNC.

Hertz: (Hz) A unit of frequency of a periodic process equal to one cycle per second.

I

Inbound: (IB) The transmission direction from a user device to a host application.

Industry Standard Architecture: (ISA) A personal computer bus architecture. Developed by IBM® for the AT® computer.

INM: Integrated Network Manager. See FullVision INM.

Input/Output: (I/O) A device used to send or retrieve information to or from a computer. These devices include hard disk and CD-ROM drives, and printers.

Institute of Electrical and Electronics Engineers: (IEEE) An international engineering society, in over 130 countries. Members are technical and scientific professionals. This is a U.S. professional society that also takes part in the development of standards for use by the computer industry. In the context of computer communications, it has been responsible for the production of standards relating to LANs.

Inter-Exchange Carrier: (IEC) US term for any telephone operator licensed to carry traffic between LATAs interstate or intrastate.

International Electrotechnical Commission: (IEC) The Commission promotes co-operation on all questions of standardization and related matters in the fields of electrical and electronic engineering and thus to promote international understanding.

International Standards Organization: (ISO) An international union comprised of the national standards bodies from member countries. The technical committee that produces standards for the computer industry is TC97 - Information Processing Systems. ISO has been responsible for the production of the basic ISO Reference Model for OSI and the production of the standards for each layer in the reference model.

International Telecommunications Union: (ITU) Formerly known as CCITT, the primary international standards organization for wired public telecommunications networks.

International Telecommunications Union-Telecommunications Standardization Sector: (ITU-T) Formerly known as CCITT, the primary international standards organization for wired public telecommunications networks. Also called ITU-TSS.

Internet Engineering Task Force: (IETF) Part of the IAB responsible for short-term engineering needs relating to the TCP/IP protocol suite.

Internet Protocol: (IP) The network-layer protocol for the TCP/IP Protocol Suite. It is a connectionless, best-effort packet switching protocol.

K

kilo: (K,k) In a microcomputer system, one kilo equals 1,024 or 2 to the 10th power.

kilobits per second: (kbps or kb/s) A unit of transmission rate, equal to one thousand (1,000 or 1 x 10E3) bits per second.

kiloHertz: (kHz) A unit of frequency equal to one thousand (1,000 or 1 x 10E3) cycles per second (Hz).

L

Light Amplification by Stimulated Emission: (laser) A laser is a device which generates a coherent, monochromatic beam of light which is used for single-mode, fiber-optic transmissions. Laser is also used to refer to a component.laserlight amplification by stimulated emission of radiation. It is a device which generates a coherent, monochromatic beam of light which is used for single-mode, fiber-optic transmissions. Laser is also used to refer to a component.

Light Emitting Diode: (LED) An electronic device that converts an electrical signal into a light signal. In addition to their use as status indicators on most computer and communications devices, LEDs also are used as the light signal source for some multi-mode, fiber-optic transmissions.

Liquid Crystal Display: (LCD) A visual display that uses an electric current to charge a thin layer of fluid that is trapped between two glass plates.

Local Access and Transport Area: (LATA) Area of responsibility of local carrier in USA. When telephone circuits have their start and finish points within a LATA they are the sole responsibility of the local telephone company concerned. When they cross a LATA boundary, i.e., go inter-LATA, they are the responsibility of an interexchange carrier or IEC.

Local Area Network: (LAN) A privately owned and administered network for data communications. Provides a relatively high bandwidth over a limited geographical area for communication between the attached devices (typically personal computers and servers).

Logical Identifier: (LID) A four-byte address used to uniquely identify a mobile device in an RF network.

Logical Link Control: (LLC) The upper portion of the datalink layer, as defined in IEEE 802.2. The LLC sublayer presents a uniform interface to the user of the datalink service, usually the network layer. Beneath the LLC sublayer is the media access control sublayer.

M

Management Information Base: (MIB) The name of the database used to hold the management information relating to a network or internetwork.

Megabits per second: (Mb/s or Mbps) A unit of transmission rate, equal to one million bits per second.

Megabyte: (MB) 1,048,576 bytes, often used to mean one million bytes.

MegaHertz: (MHz) A unit of frequency equal to one million cycles per second (Hz).

millisecond: (ms) One thousandth of a second.

Mobile Data Terminal: (MDT) A computer type terminal that is installed in car or truck and includes or connects to a radio modem which allows the user to access information in the customer computer.

modulator-demodulator: (modem) A device providing an interface between data processing equipment (such as a terminal, concentrator or computer) and analog communications channels, applying the information signal to the carrier wave (modulation) and recovering the original information from the modulated carrier wave (demodulation).

N

Nickel Cadmium: (NiCd) A rechargeable battery chemistry.

Nickel-Metal Hydride: (NiMh) A rechargeable battery chemistry. NiMh does not have memory and lasts longer than Nickel Cadmium.

nit: A unit of illuminative brightness equal to one candle per square meter measured perpendicular to the rays of the source.

O

ohm: The unit of resistance of the International System of Units (S1). The ohm is the resistance of a conductor such that a constant current of one ampere in it produces a voltage of one volt between its ends.

Open Systems Interconnect: (OSI) A seven-layer data communication protocol model that specifies standard interfaces that all vendors can adapt to their own designs.

Outbound: (OB) The transmission direction from a host application to a user device.

P

Personal Computer: (PC) The generic term for a single-user, microprocessor based computer which has an architecture derived from the original IBM® PC.

Personal Computer Memory Card International Association: (PCMCIA) A set of standards for small, credit card sized plug-ins for portable and desktop personnel computers. Mostly referred to as PC cards. PCMCIA cards provide enhanced functions and capabilities, such as modems, networking capabilities, and extra memory. Some manufacturers are developing vertical application and customer-specific cards.

Power Amplifier: (PA) An audio or radio frequency amplifier designed to increase and deliver a larger amount of output energy.

Private DataTAC™: Motorola's advanced wireless data systems, typically owned and operated by an agency, municipality, or private enterprise for their exclusive use.

pSOS+™: Real-time operating system provided by Integrated Systems Incorporated. Used in Private DataTAC infrastructure products such as the RNC3000 and DBS.

Q

QWERTY: Standard American keyboard format in which the Q, W, E, R, T, and Y keys are the first six alphanumeric keys on the top alphabetic row of the keyboard.

R

Radio Data-Link Access Procedure: (RD-LAP) An RF protocol used for communication between user devices and the DBSs. RD-LAP provides a raw data transfer rate of 19.2 kbps on 25 kHz radio channels and 9.6 kbps on 12.5-kHz radio channels.

Radio Frequency: (RF) Refers to the electromagnetic energy wavelengths between the audio and light range frequencies (usually somewhere between 10 kHz and 300 gHz).

Radio Interface Box: (RIB) The RIB is a hardware interface between the station and the computer's serial port.

Radio Network Controller 3000: (RNC3000 or RNC) The RNC manages the data messaging and provides the data communication interface between the RF networks and the host computer network.

Radio Service Software: (RSS) An RF diagnostic and adjustment utility.

Random Access Memory: (RAM) An integrated circuit memory chip that allows information to be stored and retrieved by a microprocessor or controller. The information can be stored or accessed in any order, and all storage locations are equally accessible.

Read-Only Memory: (ROM) Memory device, usually semiconductor, in which the contents are defined during manufacture. The stored information can be read, but not changed once it is programmed.

redundancy: The use of redundant components needed for back-up in case of failure from the main components.

RJ-11: A standard 4-wire (2 pair) telephone jack / connector. RJ-11 is used on most single-line telephones.

RJ-45: Standard 8-wire (4-pr.) jack / connector. It is used as a low-cost alternative to standard twisted-pair cabling when connecting low-speed devices. The wire may be twisted or flat though flat will only work up to 19.2 kbps. Used with 10BaseT ethernet devices.

RS-232: The most common, standard interface used to connect DTEs to modems. It uses a DB-25 connector, although the DB-9 version has become popular on PCs with limited space for connectors.

S

Simple Network Management Protocol: (SNMP) The application protocol in an IP suite used to send and retrieve management-related information across an IP network.

SMA: A sub-miniature threaded coupling interface.

Small Computer Systems Interface: (SCSI) A disk-drive to disk-controller interface standard. It is typically used on workstations, but is available for PCs. It is often pronounced scuzzy.

Statement Of Work: (SOW) Created after the equipment list is completed. This provides the customer with a complete description of what Motorola will be responsible for.

Static Random Access Memory: (SRAM) A form of semi-conductor memory.

T

telco: Shortened term for the telephone company.

ThinNet: Also called thin ethernet (10Base2 ethernet environment). Generally used for small networks.

Transmission Control Protocol: (TCP) An Internet standard transport-layer protocol. It operates over IP and is connection-oriented and stream-oriented.

Transmission Control Protocol/Internet Protocol: (TCP / IP) The term used to refer to the complex suite of protocols including IP, TCP and the associated application protocols.

Transmit: (Tx or tx) To send information.

twisted pair: A type of transmission medium consisting of two insulated wires twisted together to improve immunity to interference from other electrical signals.

Type 5: A telephone company specification for four-wire leased line circuit.

U

Ultra High Frequency: (UHF) UHF is limited to 403-512 MHz, in the context of land mobile / private mobile radios, and specific bands supported by Private DataTACs.

Uninterruptible Power Supply: (UPS) A power conditioning and backup supply unit placed between the microcomputer and the commercial power source. A UPS protects the system from power sags or loss.

V

Vehicular Radio Modem: (VRM) A VRM is used with a separate mobile radio or integrated with a mobile radio into a single unit.

VersaModule, European: (VME) A flexible open-ended bus system which makes use of the Eurocard (circuit boards). VME was introduced in 1981 by Motorola and three other companies.

W

Wide Area Network: (WAN) A computer or communications network that covers a geographic area which is larger than a city or metropolitan area.

Windows® Sockets: (WinSock) An application programming interface standard for software that provides a TCP/IP interface under Windows.

Wireless Network Gateway™: (WNG) A hardware and software platform designed to link a wireline data network to a Motorola radio frequency network. This platform manages message traffic to and from the wireless network.

wireline: A connection between the station and another unit, such as a console (phone line).

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