



CDD-880

**Advanced VSAT Series Multi Receiver Router
Installation and Operation Manual
For Firmware Version 1.6.2.X or Higher**

Part Number MN-CDD880 / CD-CDD880
Revision 2

TABLE OF CONTENTS

TABLE OF CONTENTS	III
TABLES	X
FIGURES.....	XI
PREFACE.....	XV
About this Manual	xv
Related Documents.....	xv
Conventions and References	xvi
Patents and Trademarks	xvi
Warnings, Cautions, and Notes.....	xvi
Examples of Multi-Hazard Notices.....	xvi
Recommended Standard Designations.....	xvi
Safety and Compliance.....	xvii
Electrical Safety and Compliance.....	xvii
Electrical Installation.....	xvii
Operating Environment	xvii
European Union Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive (1999/5/EC) and EN 301 489-1	xviii
European Union Electromagnetic Compatibility (EMC) Directive (2004/108/EC)	xviii
European Union Low Voltage Directive (LVD) (2006/95/EC).....	xviii
European Union RoHS Directive (2002/95/EC).....	xix
European Union Telecommunications Terminal Equipment Directive (91/263/EEC).....	xix
CE Mark.....	xix
Product Support.....	xix
Comtech EF Data Headquarters.....	xix
Warranty Policy	xx
Limitations of Warranty	xx
Exclusive Remedies	xxi
CHAPTER 1. INTRODUCTION.....	1-1
1.1 Overview.....	1-1
1.2 Functional Description	1-2

1.3	Features	1-3
1.3.1	Physical Description.....	1-3
1.3.1.1	Standard Assemblies.....	1-3
1.3.1.2	Optional Assemblies.....	1-3
1.3.2	Dimensional Envelope	1-4
1.3.3	Physical Features	1-5
1.3.3.1	Front Panel Features.....	1-5
1.3.3.2	Rear Panel Features	1-6
1.3.3.2.1	Rear Panel Standard Features.....	1-6
1.3.3.2.2	Rear Panel Optional Features	1-7
1.3.4	On-site Firmware Updates.....	1-7
1.3.5	On-site Operational Upgrades	1-7
1.3.6	Monitor and Control Interfaces.....	1-7
1.4	CDD-880 Specifications	1-8
1.4.1	Product Features	1-8
1.4.2	Physical, Power, and Environmental	1-8
1.4.3	Demodulator.....	1-9
1.4.3.1	Receive	1-10
1.4.3.2	Low Noise Block Down Converter (LNB) Support	1-10
1.4.4	BER (Bit Error Rate).....	1-11
1.4.4.1	BER Monitor Functions	1-11
1.4.5	Regulatory Compliance.....	1-11
CHAPTER 2.	INSTALLATION.....	2-1
2.1	Unpack and Inspect the Shipment	2-1
CHAPTER 3.	REAR PANEL CONNECTIONS.....	3-1
3.1	Overview – Cabling Connection Types	3-1
3.1.1	Coaxial Cable Connections.....	3-2
3.1.1.1	Type ‘BNC’	3-3
3.1.1.2	Type ‘TNC’	3-3
3.1.1.3	Type ‘N’	3-3
3.1.1.4	Type ‘F’	3-3
3.1.1.5	Type ‘SMA’ (Subminiature Version ‘A’).....	3-3
3.1.2	D-Subminiature Cable Connections.....	3-4
3.1.3	RJ-45, RJ-48 Cable Connections	3-4
3.2	CDD-880 Advanced VSAT Network Hub Site Cabling Example	3-5
3.3	CDD-880 Cabling Connections.....	3-6
3.3.1	IF Connector – L-BAND Rx (Type ‘N’ Female)	3-7
3.3.2	Utility Connector Group	3-7
3.3.2.1	‘REDUNDANCY’ Connector (DB-9F) (FUTURE)	3-7
3.3.2.2	‘CONSOLE’ Connector (DB-9M).....	3-8

3.3.2.3	'MONITOR' Connector (DB-15M).....	3-9
3.3.2.4	'ETHERNET TRAFFIC/MANAGEMENT GE' Gigabit Ethernet Connector (RJ-45F)	3-10
3.3.3	Terrestrial Traffic – 'ETHERNET TRAFFIC GE' Gigabit Ethernet Connector (RJ-45F)	3-10
3.4	Ground and Power Connections	3-11
3.4.1	Chassis Ground Interface.....	3-11
3.4.2	115V/230V Alternating Current (AC) Power Interface (Standard)	3-12
3.4.2.1	AC Operation – Apply Power	3-12
3.4.2.2	AC Operation – Replace the Fuses	3-13
3.4.3	48V Direct Current (DC) Power Interface (Optional).....	3-14
3.4.3.1	DC Operation – Apply Power	3-14
3.4.3.2	DC Operation – Replace the Fuses.....	3-15
CHAPTER 4.	UPDATING FIRMWARE	4-1
4.1	Firmware Update Overview	4-1
4.2	Getting Started: Prepare for the Firmware Download	4-2
4.3	Download and Extract the Firmware Update	4-6
4.4	Perform the Ethernet FTP Upload Procedure	4-8
CHAPTER 5.	FAST ACTIVATION PROCEDURE.....	5-1
5.1	FAST Overview.....	5-1
5.2	FAST Activation via the HTTP Interface	5-2
5.2.1	FAST Configuration	5-3
5.2.2	FAST Upgrade	5-4
CHAPTER 6.	ETHERNET-BASED REMOTE PRODUCT MANAGEMENT	6-1
6.1	Overview.....	6-1
6.2	Ethernet Management Interface Protocols	6-2
6.2.1	Ethernet Management Interface Access	6-2
6.2.2	SNMP Interface.....	6-3
6.2.2.1	Management Information Base (MIB) Files	6-3
6.2.2.2	SNMP Community Strings	6-3
6.2.3	HTTP (Web Server) Interface	6-4
6.2.3.1	User Login	6-4
6.2.3.2	HTTP Interface – Operational Features.....	6-5
6.2.3.2.1	Virtual Front Panel	6-5
6.2.3.2.2	Navigation.....	6-6
6.2.3.2.3	Page Sections	6-6
6.2.3.2.4	Action Buttons	6-7

6.2.3.2.5	Drop-down Lists	6-7
6.2.3.2.6	Text or Data Entry	6-7
6.2.3.3	HTTP Interface – Menu Tree	6-8
6.3	HTTP Interface Page Descriptions	6-9
6.3.1	Home Pages	6-9
6.3.1.1	Home Home	6-9
6.3.1.2	Home Contact.....	6-10
6.3.2	Admin (Administration) Pages	6-11
6.3.2.1	Admin Access.....	6-11
6.3.2.2	Admin SNMP	6-12
6.3.2.3	Admin FAST	6-13
6.3.2.4	Admin Firmware.....	6-14
6.3.2.5	Admin Auto Logout	6-15
6.3.2.6	Admin VMS.....	6-16
6.3.3	Configuration Pages.....	6-18
6.3.3.1	Configuration Interface / Ethernet.....	6-18
6.3.3.2	Configuration WAN Pages	6-20
6.3.3.2.1	Configuration WAN Demod (Demodulator).....	6-20
6.3.3.2.2	Configuration WAN ACM (Adaptive Coding and Modulation)	6-23
6.3.3.2.3	Configuration WAN LNB (Low Noise Block Down Converter)	6-25
6.3.3.3	Configuration Network Pages	6-26
6.3.3.3.1	Configuration Network Routing	6-26
6.3.3.3.2	Configuration Network ARP	6-28
6.3.3.3.3	Configuration Network Assoc. CTOG.....	6-29
6.3.3.3.4	Configuration Network Working Mode.....	6-30
6.3.3.4	Configuration ECM (Entry Channel Mode).....	6-31
6.3.4	Status Pages.....	6-33
6.3.4.1	Status Statistics Pages	6-33
6.3.4.1.1	Status Statistics Traffic	6-33
6.3.4.1.2	Status Statistics Demod.....	6-35
6.3.4.1.3	Status Statistics Router.....	6-37
6.3.4.1.4	Status Statistics Managed Switch / Traffic page	6-38
6.3.4.2	Status Monitor Pages	6-39
6.3.4.2.1	Status Monitor Events.....	6-39
6.3.4.2.2	Status Monitor Alarms	6-41
6.3.5	Utility Pages	6-43
6.3.5.1	Utility Utility	6-43
6.3.5.2	Utility Reboot	6-46
CHAPTER 7.	SERIAL-BASED REMOTE PRODUCT MANAGEMENT	7-1
7.1	Overview	7-1
7.2	Remote Commands and Queries Overview	7-3
7.2.1	Basic Protocol	7-3
7.2.2	Packet Structure	7-4

7.2.2.1	Start of Packet.....	7-4
7.2.2.2	Target Address	7-5
7.2.2.3	Address Delimiter.....	7-5
7.2.2.4	Instruction Code.....	7-5
7.2.2.5	Instruction Code Qualifier	7-5
7.2.2.5.1	Controller-to-Target Instruction Code Qualifiers	7-5
7.2.2.5.2	Target-to-Controller Instruction Code Qualifiers	7-6
7.2.2.6	Optional Message Arguments.....	7-7
7.2.2.7	End of Packet	7-7
7.3	Remote Commands and Queries	7-8
APPENDIX A. REFERENCE DOCUMENTATION		A-1
A.1	Overview	A-1
A.2	FEC (Forward Error Correction) Options	A-2
A.3	VersaFEC ACM (Adaptive Coding and Modulation) Operation	A-3
A.4	BPM (Bridge Point-to-Multipoint) Operation	A-4
A.5	ECM (Entry Channel Mode) Operation	A-5
A.6	dMesh (VMS Dynamic Mesh) Connectivity.....	A-6
A.7	DPC (VMS Dynamic Power Control) Operation.....	A-7
APPENDIX B. FEC (FORWARD ERROR CORRECTION) OPTIONS		B-1
B.1	FEC Overview.....	B-1
B.2	VersaFEC (Short-block LDPC).....	B-1
B.3	CDD-880 Error Performance Characteristics	B-3
APPENDIX C. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION		C-1
C.1	BPM (Bridge Point-to-Multipoint) Overview	C-1
C.1.1	BPM Terminology	C-2
C.2	Supported Network Configurations	C-3
C.2.1	Flat Network	C-3
C.2.2	Flat Network with Routers.....	C-3
C.2.3	VLAN Trunking	C-4
C.3	Packet Processing	C-4
C.3.1	Traffic Network / Ethernet Switch Behavior.....	C-4

C.3.2	Management Network	C-5
C.4	IEEE 802.1Q Support	C-6
C.4.1	VLAN Trunking	C-6
C.4.2	Access Mode Support	C-6
C.4.3	Multiple VLAN Tagging Support.....	C-7
C.5	Multicast BPM Behavior.....	C-7
C.5.1	Multicast Management/Routed Behavior (No Change).....	C-8
C.6	BPM and Group QoS with Outbound ACM/VCM	C-8
C.7	Hub Network Configuration	C-9
C.8	Compatible Features and Detailed Specifications	C-13
C.9	Summary	C-14
APPENDIX D.	ECM (ENTRY CHANNEL MODE)	D-1
D.1	ECM (Entry Channel Mode) Overview	D-1
D.1.1	ECM Terminology	D-2
D.1.2	ECM Theory of Operation.....	D-3
D.1.2.1	CDD-880 ECM Message Processing.....	D-5
D.1.2.2	CDM-840 ECM Message Processing.....	D-6
D.2	ECM Operational Scenarios	D-7
D.2.1	Scenario 1 – VMS Initial Registration Process	D-7
D.2.2	Scenario 2 – Reverted or Auto-Recovered Messages.....	D-8
D.2.2.1	ECM Revert Cycle Timing	D-8
D.2.2.2	ECMv2 Backoff Algorithm	D-9
D.3	ECM Operation Using the HTTP Interfaces	D-11
D.3.1	CDD-880 HTTP Operation – Hub Channel Controller (HCC)	D-14
D.3.1.1	Tap Message	D-15
D.3.2	CDM-840 HTTP Operation – Remote Router Terminals.....	D-16
D.3.2.1	HCC Configuration.....	D-19
D.3.2.2	Hub Operation	D-19
APPENDIX E.	PORT DIVERSITY	E-1
E.1	Port Diversity Overview	E-1
E.2	Operational Examples	E-2
E.3	Configuration Examples	E-4
E.3.1	Spanning Tree (Global) Configuration – CiscoIOS.....	E-4
E.3.2	Interface Configuration – CiscoIOS.....	E-4

E.4	Port Diversity Operation	E-4
E.4.1	Port Diversity Operation – CDD-880 HTTP Interface	E-5
APPENDIX F. DMESH (VMS DYNAMIC MESH) SOLUTIONS		F-1
F.1	dMesh Overview	F-1
F.2	Operational Features	F-2
F.2.1	Vipersat Management System	F-2
F.2.2	Return Link VersaFEC ACM	F-4
F.2.2.1	VersaFEC®	F-4
F.2.2.2	Adaptive Coding and Modulation (ACM)	F-4
F.2.2.2.1	ACM and Dynamic Mesh	F-5
F.2.2.2.2	ACM and Dynamic Power Control (DPC)	F-5
F.3	Operational Example	F-6
F.3.1	Requirements for Bandwidth-on-Demand and Dynamic Mesh with Single Hop on Demand (SHOD)	F-6
F.3.2	Dynamic Mesh Operation	F-6
F.3.2.1	Create a Distribution List	F-7
F.4	Compatibility	F-11
F.5	Summary	F-11
APPENDIX G. DPC (VMS DYNAMIC POWER CONTROL)		G-1
G.1	DPC (Dynamic Power Control) Overview	G-1
G.2	Dynamic Power Control	G-2
G.2.1	About DPC	G-2
G.2.2	DPC Functionality	G-3
G.2.2.1	Entrance Link Cabling	G-3
G.2.2.2	Operational Essentials	G-4
G.2.2.2.1	Power Reference	G-5
G.2.2.2.2	Reference Calibration	G-5
G.2.2.2.3	Rated Maximum Power	G-5
G.2.2.2.4	Terminal Maximum Power	G-5
G.2.2.2.5	Target Power	G-5
G.3	DPC Operation	G-7
G.3.1	Adaptive Control Loop (ACL) Components	G-8
G.3.1.1	Closed Loop Mechanism	G-9
G.3.1.2	ACL Timers	G-10
G.3.1.3	LQRM Failure and Recovery Steps	G-10
G.3.2	DPC with ACM	G-11
G.3.2.1	Terminal Maximum Power	G-12
G.3.2.2	DPC with ACM and Hub Backoff	G-13

G.3.2.3	Hub Fade Control	G-14
G.3.2.4	Roaming with DPC.....	G-14
G.4	Using Dynamic Power Control	G-15
G.4.1.1	Configure DPC	G-18
G.4.1.2	Power Reference in DPC Operation	G-19
G.4.1.3	Set Reference	G-19
G.4.1.4	DPC Status Reporting	G-22
G.4.2	DPC – Operational Changes.....	G-23
G.5	Firmware Update.....	G-24
G.6	Considerations.....	G-24
APPENDIX H.	VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION)	
OPTION	H-1
H.1	VersaFEC ACM Overview	H-1
H.2	Background	H-2
H.3	VersaFEC ACM	H-3
H.3.1	VersaFEC ACM Latency	H-4
H.4	Managing VersaFEC ACM Operation	H-5
H.4.2	Troubleshooting.....	H-9
H.4.3	Monitoring ACM Performance	H-9
H.4.4	MODCOD Switch Points.....	H-11
H.5	ACM Congestion Control	H-11
H.6	Notes and Recommendations.....	H-12
H.7	Summary of Specifications	H-13

TABLES

Table 3-1.	CDD-880 Rear Panel Connectors.....	3-6
Table 3-2.	‘REDUNDANCY’ Connector Pinout	3-7
Table 3-3.	‘CONSOLE’ Connector Pinout	3-8
Table 3-4.	‘MONITOR’ Connector Pinout	3-9
Table B-1.	The VersaFEC MODCOD Set.....	B-2
Table F-1.	Comtech EF Data Product Compatibility Reference	F-11
Table H-1.	The VersaFEC MODCOD set	H-3
Table H-2.	Example Case – VersaFEC Implementation of ACM (100 ksymbols/sec).....	H-4

FIGURES

Figure 1-1. CDD-880 Multi Receiver Router.....	1-1
Figure 1-2. Advanced VSAT Series Network Topology Example	1-1
Figure 1-3. CDD-880 Dimensional Envelope	1-4
Figure 1-4. CDD-880 – Front Panel View.....	1-5
Figure 1-5. CDD-880 – Rear Panel View	1-6
Figure 1-6. Rx Carrier Level vs. Symbol Rate (L-Band 950 – 2150 MHz)	1-10
Figure 2-1. Unpack and Inspect the Shipment.....	2-1
Figure 2-2. Install the Unit Into a Rack Enclosure	2-3
Figure 2-3. Install the Optional Rear Support Brackets Kit	2-4
Figure 3-1. Coaxial Connector Examples.....	3-2
Figure 3-2. D-Subminiature Connector Examples.....	3-4
Figure 3-3. CDD-880 in an Advanced VSAT Network	3-5
Figure 3-4. CDD-880 Cabling Connections	3-6
Figure 3-5. Chassis Ground Interface	3-11
Figure 3-6. AC Power Interface	3-12
Figure 3-7. Apply AC Power to the Unit.....	3-12
Figure 3-8. Replace the AC Fuses	3-13
Figure 3-9. DC Power Interface	3-14
Figure 3-10. Apply DC Power to the Unit.....	3-14
Figure 3-11. Replace the DC Fuses.....	3-15
Figure 5-1. CDD-880 HTTP Interface – ‘Admin FAST’ page	5-2
Figure 6-1. CDD-880 Serial Interface.....	6-2
Figure 6-2. CDD-880 HTTP Interface – Menu Tree (FW Ver. 1.6.2.4)	6-8
Figure 6-3. Home Home Page	6-9
Figure 6-4. Home Contact Page.....	6-10
Figure 6-5. Admin Access Page.....	6-11
Figure 6-6. Admin SNMP Page	6-12
Figure 6-7. Admin FAST Page	6-13
Figure 6-8. Admin Firmware Page.....	6-14
Figure 6-9. Admin Auto Logout Page	6-15
Figure 6-10. Admin VMS Page.....	6-16
Figure 6-11. Configuration Interface Ethernet Page	6-18
Figure 6-12. Configuration Demod Page.....	6-20
Figure 6-13. Configuration ACM Page.....	6-23
Figure 6-14. Configuration WAN LNB Page	6-25
Figure 6-15. Configuration Routing Routes Page	6-26
Figure 6-16. Configuration ARP Page	6-28
Figure 6-17. Configuration Network Assoc. CTOG Page.....	6-29
Figure 6-18. Configuration Network Working Mode Page.....	6-30
Figure 6-19. Configuration ECM Page	6-31
Figure 6-21. Status Statistics Traffic Page.....	6-33
Figure 6-22. Status Statistics Demod Page	6-35
Figure 6-23. Status Statistics Router Page.....	6-37
Figure 6-24. Status Statistics Managed Switch Traffic Page	6-38

Figure 6-25. Status Monitor Events Page	6-39
Figure 6-26. Status Monitor Alarms Page.....	6-41
Figure 6-27. Utility Utility Page	6-43
Figure 6-28. Utility Reboot Page	6-46
Figure 7-1. CDD-880 Serial Interface Example	7-2
Figure A-1. Advanced VSAT Series Hub and Remote Site Products.....	A-1
Figure B-1. The VersaFEC Codes versus Shannon Capacity	B-2
Figure B-2. VersaFEC Codec – BPSK, Rate 0.488	B-3
Figure B-3. VersaFEC Codec – QPSK, Rate 0.533, 0.631, 0.706 and 0.803.....	B-4
Figure B-4. VersaFEC Codec – 8-QAM, Rate 0.642, 0.711, and 0.780.....	B-5
Figure B-5. VersaFEC Codec – 16-QAM, Rate 0.731, 0.780, 0.829 and 0.853.....	B-6
Figure E-1. Advanced VSAT BPM “Sky Ethernet Switch”	C-1
Figure E-2. Flat Network	C-3
Figure E-3. Flat Network with Routers.....	C-3
Figure E-4. BPM with VLANs	C-4
Figure E-5. Management Network in BPM Mode.....	C-5
Figure E-6. Multicast Behavior in BPM Mode.....	C-7
Figure E-7. Configuring VLAN to QoS Group Mapping (CTOG-250 shown)	C-8
Figure E-8. Hub Configuration – Standalone CTOG-250, No Redundancy.....	C-10
Figure E-9. Hub Network Configuration.....	C-11
Figure E-10. Multiple CTOG-250 Outbounds in Redundant Mode	C-12
Figure D-1. ECM – Message Processing Diagram.....	D-1
Figure D-2. ECM Message Processing – CDD-880 Multi Receiver Router.....	D-5
Figure D-3. ECM Message Processing – CDM-840 Remote Router	D-6
Figure D-4. CDD-880 HTTP Interface – Splash Page and ECM Operation Menu Tree (FW Ver. 1.6.2.X)	D-12
.....	D-12
Figure D-5. CDM-840 HTTP Interface – Splash Page and ECM Operation Menu Tree (FW Ver. 1.6.2.X)	D-13
.....	D-13
Figure D-6. CDD-880 HTTP Interface – Configuration ECM Page.....	D-14
Figure D-7. CDM-840 HTTP Interface – Configuration ECM Page.....	D-16
Figure E-1. Port Diversity Example #1.....	E-2
Figure E-2. Port Diversity Example #2 – Three-Switch Setup	E-3
Figure E-3. Port Diversity Example #3 – Two-Switch Setup	E-3
Figure E-4. CDD-880 HTTP Interface – Splash Page and Port Diversity Operation Menu Tree (FW Ver. 1.6.2.X)	E-5
.....	E-5
Figure E-5. Configuration Interface Ethernet Page – Diversity Port Disabled.....	E-6
Figure E-6. Configuration Interface Ethernet Page – Diversity Port Enabled.....	E-6
Figure F-1. Vipersat Management System – Graphical User Interface (GUI)	F-2
Figure F-2. VMS-configured Advanced VSAT Network	F-3
Figure F-3. CDD-880 HTTP Interface – Configuration Network Routing Page.....	F-9
Figure G-1. DPC Power Scale.....	G-4
Figure G-2. ACM – MODCOD Switch-Point	G-6
Figure G-3. Closed Loop Mechanism	G-9
Figure G-4. LQRM / Power Management Flow Diagram	G-11
Figure G-5. DPC with ACM at Rate Max Power.....	G-12
Figure G-6. Hub Rain Fade	G-13
Figure G-7. DPC w/ACM with Hub Backoff	G-13

Figure G-8. Roaming DPC G-15
Figure G-9. HTTP Interfaces – Splash Pages and DPC Operation Menu Trees (FW Ver. 1.6.2.X) G-17
Figure H-1. VersaFEC Codes vs. Constrained Capacity.....H-4
Figure H-2. CDD-880 HTTP Interface and Menu Tree – Route Creation, BERT Operations (FW Ver. 1.6.2.X)
.....H-6
Figure H-3. CDM-840 HTTP Interface and Menu Tree – VersaFEC ACM, BERT Operations (FW Ver. 1.6.2.X)
.....H-7
Figure H-4. CDD-880 HTTP Interface – Configuration | Network | Assoc. CTOG and Configuration |
Network | Routing PagesH-8
Figure H-5. CDM-840 HTTP Interface – Configuration | WAN | Mod | ACM PageH-9
Figure H-6. HTTP Interface – Utility | Utility Page (CDD-880 Shown)..... H-10
Figure H-7. CDM-840 – ACM MODCOD Switch Points..... H-11

BLANK PAGE

PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data CDD-880 Multi Receiver Router. This is an informational document intended for the persons responsible for the operation and maintenance of the CDD-880.

Related Documents

- **Comtech EF Data CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)**
- **Comtech EF Data CDM-840 Remote Router Installation and Operation Manual(CEFD P/N MN-CDM840)**
- **Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual(CEFD P/N MN-ODM840)**

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's Patents and Patents Pending at <http://patents.comtechefdata.com>.

Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes



A **WARNING** GIVES INFORMATION ABOUT A POSSIBLE HAZARD THAT MAY CAUSE DEATH OR SERIOUS INJURY.



A **CAUTION** gives information about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

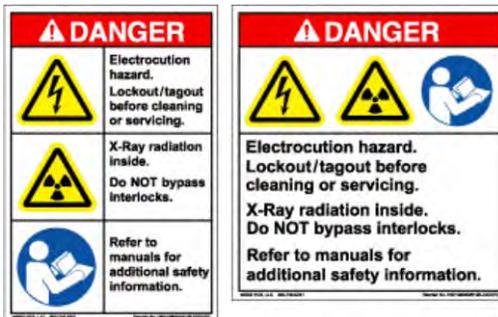


A **NOTE** gives important information about a task or the equipment.



A **REFERENCE** directs the user to additional information about a task or the equipment.

Examples of Multi-Hazard Notices



Recommended Standard Designations

The new designation of the Electronic Industries Association (EIA) supersedes Recommended Standard (RS) designations. References to the old RS designations may be shown when depicting actual text (e.g., RS-232) as displayed on the unit's Web Server Interface pages or the rear panel connections. All other references in the manual will be shown with the EIA designations



You should carefully review the following information:

Safety and Compliance

Electrical Safety and Compliance

The unit complies with the **EN 60950 Safety of Information Technology Equipment (Including Electrical Business Machines)** safety standard.



CAUTION – IF THE UNIT IS OPERATED IN A VEHICLE OR MOVABLE INSTALLATION, MAKE SURE THE UNIT IS STABLE. OTHERWISE, EN 60950 SAFETY IS NOT GUARANTEED.

Electrical Installation



CAUTION – CONNECT THE UNIT TO A POWER SYSTEM THAT HAS SEPARATE GROUND, LINE AND NEUTRAL CONDUCTORS. DO NOT CONNECT THE UNIT WITHOUT A DIRECT CONNECTION TO GROUND.



Sect 3.4 Ground and Power Connections

Operating Environment



CAUTION – DO NOT OPERATE THE UNIT IN ANY OF THESE EXTREME OPERATING CONDITIONS:

- **AMBIENT TEMPERATURES LESS THAN 0° C (32° F) OR MORE THAN 50° C (122° F).**
- **PRECIPITATION, CONDENSATION, OR HUMID ATMOSPHERES OF MORE THAN 95% RELATIVE HUMIDITY.**
- **UNPRESSURIZED ALTITUDES OF MORE THAN 2000 METRES (6561.7 FEET).**
- **EXCESSIVE DUST.**
- **FLAMMABLE GASES.**
- **CORROSIVE OR EXPLOSIVE ATMOSPHERES.**

European Union Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive (1999/5/EC) and EN 301 489-1

Independent testing verifies that the unit complies with the European Union R&TTE Directive, its reference to EN 301 489-1 (*Electromagnetic compatibility and Radio spectrum Matters [ERM]; ElectroMagnetic Compatibility [EMC] standard for radio equipment and services, Part 1: Common technical requirements*), and the Declarations of Conformity for the applicable directives, standards, and practices that follow:

European Union Electromagnetic Compatibility (EMC) Directive (2004/108/EC)

- **Emissions: EN 55022 Class B** – Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.
- **Immunity: EN 55024** – Information Technology Equipment: Immunity Characteristics, Limits, and Methods of Measurement.
- **EN 61000-3-2** – Harmonic Currents Emission
- **EN 61000-3-3** – Voltage Fluctuations and Flicker.
- **Federal Communications Commission Federal Code of Regulation FCC Part 15, Subpart B.**



CAUTION – TO ENSURE THAT THE UNIT COMPLIES WITH THESE STANDARDS, OBEY THESE INSTRUCTIONS:

- **Use coaxial cable that is of good quality for connections to the L-Band Type ‘N’ Rx (receive) female connector.**
- **Use Type ‘D’ connectors that have back-shells with continuous metallic shielding.**

Type ‘D’ cabling must have a continuous outer shield (either foil or braid, or both). The shield must be bonded to the back-shell.

- **Operate the unit with its cover on at all times.**

European Union Low Voltage Directive (LVD) (2006/95/EC)

Symbol	Description
<HAR>	Type of power cord required for use in the European Community.
	CAUTION: Double-pole/Neutral Fusing ACHTUNG: Zweipolige bzw. Neutraleiter-Sicherung

International Symbols			
Symbol	Definition	Symbol	Definition
	Alternating Current		Protective Earth
	Fuse		Chassis Ground



For additional symbols, refer to Warnings, Cautions and Notes listed earlier in this Preface.

European Union RoHS Directive (2002/95/EC)

This unit satisfies (with exemptions) the requirements specified in the European Union Directive on the Restriction of Hazardous Substances in Electrical and Electronic Equipment (EU RoHS, Directive 2002/95/EC).

European Union Telecommunications Terminal Equipment Directive (91/263/EEC)

In accordance with the European Union Telecommunications Terminal Equipment Directive 91/263/EEC, the unit should not be directly connected to the Public Telecommunications Network.

CE Mark

Comtech EF Data declares that the unit meets the necessary requirements for the CE Mark.

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

Comtech EF Data Headquarters

<http://www.comtechefdata.com>

Comtech EF Data Corp.

2114 West 7th Street

Tempe, Arizona USA 85281

+1.480.333.2200

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product. The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

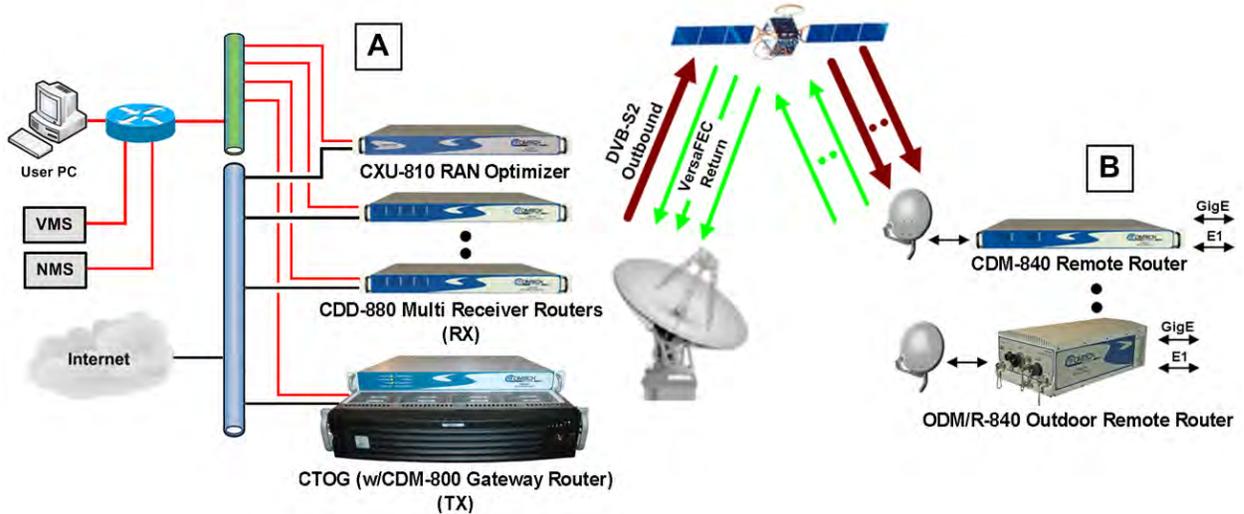
Chapter 1. INTRODUCTION

1.1 Overview



Figure 1-1. CDD-880 Multi Receiver Router

The CDM-880 Multi Receiver Router (**Figure 1-1**) serves as the hub expansion utility component of Comtech EF Data’s Advanced VSAT Series group of products.



Feature	Description
A	Hub Site
B	Typical Remote Site Cluster

Figure 1-2. Advanced VSAT Series Network Topology Example

Comtech’s Advanced VSAT Series group of products (**Figure 1-2**) are designed to support latency-sensitive applications such as cellular backhaul over satellite, Universal Service Obligation (USO) networks, corporate networks, Internet Service Providers, and other similar hub-and-spoke

network environments that require high-performance, high-quality IP transport with “always-on” availability.

The CDD-880 supports from two through 12 independent demodulators (expandable, by pairs, on a single card) in a single 1RU chassis. It features two 10/100/1000 Gigabit Ethernet (GigE) interfaces, and provides Comtech EF Data VersaFEC Forward Error Correction and an integrated IP Packet Processor with Streamline Encapsulation (SLE) and Payload and Header Compression.

The Advanced VSAT Series product group can also be optionally managed by the Vipersat Management System, specifically for situations where bandwidth requirements can dynamically change.



- **Sect. 1.3 CDD-880 Features**
- **Sect. 1.4 CDD-880 Specifications**
- **VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)**

1.2 Functional Description

The CDD-880 Multi Receiver Router:

- Receives VersaFEC interoperable with Comtech EF Data’s CDM-840 / ODM-840 / ODMR-840 Remote Routers.
- Features a high performance processor and a real-time operating system (RTOS) combined with multiple Field Programmable Gate Arrays (FPGAs).
- Runs on an embedded operating system in non-volatile Flash memory. It does not have moving parts for media storage.
- Features six plug-in card slots, each of which supports a VersaFEC/Streamline dual demodulator card. This allows for six deployed configurations: 2, 4, 6, 8, 10 and 12 demodulators.
- Supports reception and transmission of IP data over satellite links via two fundamentally different types of interface – **IF** and **data**:
 - The **IF** interface provides downlink connectivity with the satellite.
 - The **data** interface is a bidirectional path that connects the customer’s equipment (assumed to be the **Data Terminal Equipment**, or DTE) to the unit (assumed to be the **Data Communications Equipment**, or DCE). All terrestrial data is connected using the available 10/100/1000 Gigabit Ethernet interface.

Rx Features: Overall, the receive path allows IP packets to be Streamline decapsulated, K4 decompressed if required, and then sent to the processor. IP packets are sent out the appropriate Ethernet interface. Optimized E1 packets are received with IP/UDP headers and routed to the appropriate CXU-810 RAN Optimizer on the hub network.

Note that, as IP/UDP packets, the CDD-880 is completely agnostic/ignorant to the RAN Optimization feature, which offers significant network feature simplicity advantages.



- **Sect. 1.3 Features**
- **Sect. 1.4 CDD-880 Specifications**
- **Appendix B. FEC (ORWARD ERROR CORRECTION) OPTIONS**

1.3 Features

1.3.1 Physical Description

The CDD-880 Multi Receiver Router is constructed as a 1RU-high rack-mounting chassis. Handles at the front facilitate removal from and placement into a rack. The unit can be free-standing if desired.



- **Sect. 1.4 CDD-880 Specifications**
- **Sect. 2.2 Installation into a Rack Enclosure**

1.3.1.1 Standard Assemblies

Assembly	Description	Where Installed
PL-0000772	CDD-880 Base Chassis Assembly (AC)	–
PL-0000763	CDD-880 Main PCB	CDD-880 chassis
PL-0000764	CDD-880 Dual Demodulator Board	CDD-880 chassis
FS-0000030	Cartridge Fuse, 2.5A 250VAC 5x20mm Slow-blow fuse, 213 series	CDD-880 chassis

1.3.1.2 Optional Assemblies

Assembly	Description	Where Installed
PL-0000866	CDD-880 Base Chassis Assembly (DC)	–
KT-0000168	4" Rear-Mounting Support Bracket	Sides of CDD-880 chassis / rear of user-provided mounting rack – See Sect. 2.2.1
KT-0000195	10" Rear-Mounting Support Bracket	

1.3.2 Dimensional Envelope

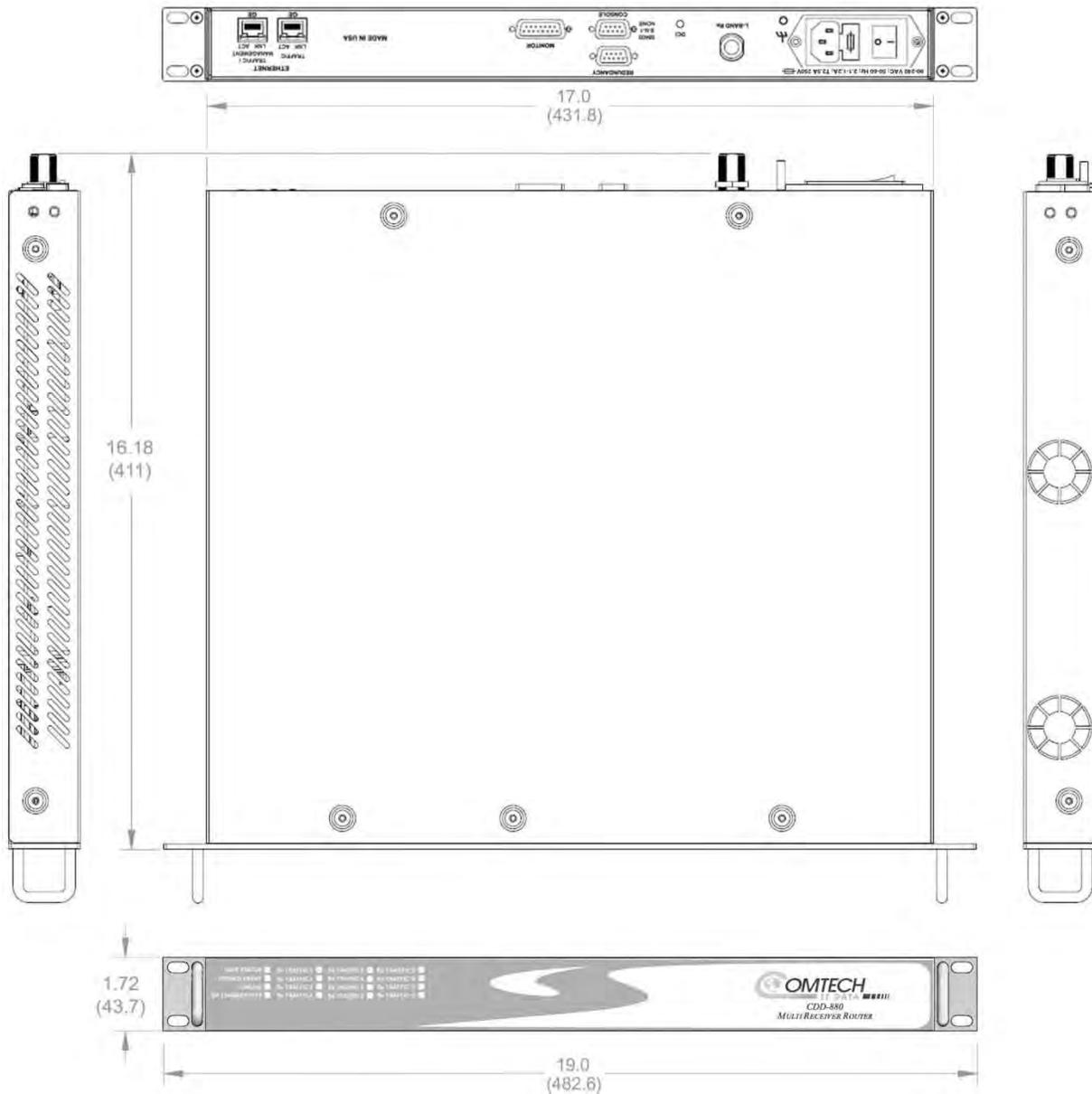


Figure 1-3. CDD-880 Dimensional Envelope

1.3.3 Physical Features

1.3.3.1 Front Panel Features



- Chapter 2. INSTALLATION
- Chapter 7. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

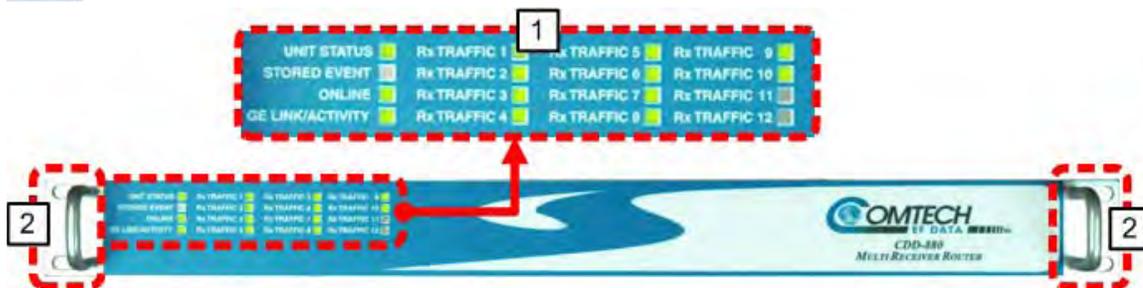


Figure 1-4. CDD-880 – Front Panel View

The CDD-880 front panel (**Figure 1-4**) provides these features:

1 LED Indicators

The front panel features 16 Light-Emitting Diode (LED) indicators. These LEDs convey operational states as follows:

LED	State	Condition
UNIT STATUS	Green	No Unit Faults or Alarms.
	Amber	No Unit Faults, but an Alarm exists.
	Red	A Unit Fault exists (Example: PSU fault).
STORED EVENT	Amber	There is a Stored Event in the log, which can be viewed from the Web Server Interface or retrieved via the remote control interface.
	Off	There are no Stored Events.
ONLINE	Green	The Unit is On Line, and carrying traffic.
	Off	The Unit is Off Line (standby) – forced by externally connected 1:1 or 1:N redundancy system.
GE LINK/ACTIVITY	Green (solid)	Traffic Ethernet is connected, but no traffic exists.
	Green (blinking)	Ethernet activity detected.
	Off	GE Ethernet port is not connected.
Rx TRAFFIC 1 through 12	Green (solid)	No Rx Traffic Faults (demod and decoder are locked, everything is OK).
	Green (blinking)	No Rx Traffic Faults, blinks when a packet is being received from the satellite link to this unit.
	Amber	Rx Traffic has an Alarm.
	Red	Rx Traffic has a Fault.
	Off	Demod Card is not installed.

2 Rack Handles

In a rack enclosure, these handles help you install and remove the unit.

1.3.3.2 Rear Panel Features



- Sect. 3.2 CDD-880 Cabling Connections
- Sect. 3.3 CDD-880 Grounding and Power Connections



CAUTION – PROPER GROUNDING PROTECTION IS REQUIRED. The equipment must be connected to the protective earth connection at all times. It is therefore imperative that the unit is properly grounded, using the ground stud provided on the unit rear panel, during installation, configuration, and operation.

External cables are attached to connectors provided on the rear panel of the unit (**Figure 1-5**).



(TOP) Standard AC Unit
(BOTTOM) Optional 48V DC Unit

Figure 1-5. CDD-880 – Rear Panel View

1.3.3.2.1 Rear Panel Standard Features

As per **Figure 1-5**, from left to right:

Power Interface:

- 115/230 VAC Primary Input Power Supply with Press-fit Fuse Holder

IF Interface:

- (1X) Type 'N' female **L-BAND Rx** connector for 50Ω L-Band (950 to 2150 MHz)

Utility and Traffic Data Interfaces:

- (1X) DB-9F EIA-232 **REMOTE** connector for serial remote control.
- (1X) DB-15M EIA-232 **MONITOR** connector for I&Q Constellation/Rx AGC Monitor Output.
- (1X) 10/100/1000 BaseT Gigabit Ethernet RJ-45 Interface **ETHERNET | TRAFFIC | GE** port for Ethernet traffic.
- (1X) 10/100/1000 BaseT Gigabit Ethernet RJ-45 Interface **ETHERNET | MANAGEMENT | FE** port for Ethernet-based management and control purposes (HTTP and SNMP).

1.3.3.2.2 Rear Panel Optional Features

As per **Figure 1-5**, from left to right:

Optional Power Interface:

- 48 VDC Primary Input Power Supply with Screw-in Fuse Holders

Optional hardware operation:

- (1X) DB-9M EIA-232 **REDUNDANCY** connector.

Rear Panel Rack Support Brackets Kits are available from Comtech EF Data:

- KT-0000168 4" Rear-Mounting Support Brackets Kit
- KT-0000195 10" Rear-Mounting Support Brackets Kit



Sect. 2.2.1 Install the Optional Rear-Mounting Support Brackets Kit

1.3.4 On-site Firmware Updates



Chapter 4. UPDATING FIRMWARE

Field update of the operating system firmware is possible through file upload via satellite or the Ethernet port.

1.3.5 On-site Operational Upgrades



Chapter 5. FAST ACTIVATION PROCEDURE

Field activation of software-based options is possible through Comtech EF Data's FAST (Fully Accessible System Topology) Feature upgrade process.

1.3.6 Monitor and Control Interfaces



- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT**
- **Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**

The unit is managed through multiple interfaces providing options for both in-band (over satellite) and out-of-band monitor and control.

1.4 CDD-880 Specifications

1.4.1 Product Features

Item	Description																								
Front Panel	16 Light-Emitting Diodes (LEDs): UNIT STATUS (Green/Amber/Red) GE LINK/ACTIVITY (Green) STORED EVENT (Amber) Rx TRAFFIC 1 through 12 (Green/Amber/Red) ONLINE (Green)																								
Rear Panel IF Connector / Impedance	1X Type 'N' female connector, 50Ω																								
Rear Panel Data Interface Connectors	<ul style="list-style-type: none"> • 1X RJ-45 female port for 10/100/1000 BaseT Gigabit Ethernet data traffic • 1X RJ-45 female port for 10/100/1000 BaseT Gigabit Ethernet data traffic or HTTP and SNMP product management • 1X DB-9M EIA-232 connector for serial remote monitor and control • 1X DB-9F EIA-232 connector for 1:1 or 1:N redundancy switch operation • 1X DB-15M connector for Form C unit alarms 																								
Packet Processor Supported Protocols	<table> <tbody> <tr> <td>RFC 768 – UDP</td> <td>RFC 959 – FTP</td> <td>RFC 2597 – AF PHB</td> </tr> <tr> <td>RFC 791 – IP</td> <td>RFC 1112 – IP Multicast</td> <td>RFC 2598 – Expedite Forwarding</td> </tr> <tr> <td>RFC 792 – ICMP</td> <td>RFC 1213 – SNMP MIB II</td> <td>RFC 2616 – HTTP</td> </tr> <tr> <td>RFC 793 – TCP</td> <td>RFC 1812 – IPv4 Routers</td> <td>RFC 3412 – SNMP</td> </tr> <tr> <td>RFC 826 – ARP</td> <td>RFC 2045 – MIME</td> <td>RFC 3416 – SNMPv2</td> </tr> <tr> <td>RFC 856 – Telnet</td> <td>RFC 2474 – DiffServ</td> <td>RFC 3418 – SNMP MIB</td> </tr> <tr> <td>RFC 862 – Ping</td> <td>RFC 2475 – DiffServ</td> <td></td> </tr> <tr> <td>RFC 894 – IP</td> <td>RFC 2578 – SMI</td> <td></td> </tr> </tbody> </table>	RFC 768 – UDP	RFC 959 – FTP	RFC 2597 – AF PHB	RFC 791 – IP	RFC 1112 – IP Multicast	RFC 2598 – Expedite Forwarding	RFC 792 – ICMP	RFC 1213 – SNMP MIB II	RFC 2616 – HTTP	RFC 793 – TCP	RFC 1812 – IPv4 Routers	RFC 3412 – SNMP	RFC 826 – ARP	RFC 2045 – MIME	RFC 3416 – SNMPv2	RFC 856 – Telnet	RFC 2474 – DiffServ	RFC 3418 – SNMP MIB	RFC 862 – Ping	RFC 2475 – DiffServ		RFC 894 – IP	RFC 2578 – SMI	
RFC 768 – UDP	RFC 959 – FTP	RFC 2597 – AF PHB																							
RFC 791 – IP	RFC 1112 – IP Multicast	RFC 2598 – Expedite Forwarding																							
RFC 792 – ICMP	RFC 1213 – SNMP MIB II	RFC 2616 – HTTP																							
RFC 793 – TCP	RFC 1812 – IPv4 Routers	RFC 3412 – SNMP																							
RFC 826 – ARP	RFC 2045 – MIME	RFC 3416 – SNMPv2																							
RFC 856 – Telnet	RFC 2474 – DiffServ	RFC 3418 – SNMP MIB																							
RFC 862 – Ping	RFC 2475 – DiffServ																								
RFC 894 – IP	RFC 2578 – SMI																								
Packet Processor Statistics	Detailed packet and throughput statistics																								

1.4.2 Physical, Power, and Environmental

Parameter	Specifications	
Physical Dimensions	1RU high x 19.0 inches wide x 17.7 inches deep (4.4 cm h x 48 cm w x 44.8 cm d) approximate	
Weight	3.2 kg (7 lbs)	
Power Supply	AC	100V to 240V AC, 47 to 63 Hz, IEC 320 input
	DC (HW Option)	-48V (36V to 60V) DC
Power Consumption	60 W typical	
Fuse	AC	120/230 VAC: T3.15A, slow-blow 20 mm
	DC (HW Option)	-48VDC (38 to 60 VDC): T8.0A, slow-blow 20 mm
Temperature	Operating	0° to 50°C (32° to 122°F)
	Storage	-20° to 70°C (-4° to 158°F)
Humidity	95% maximum, non-condensing	

1.4.3 Demodulator

Parameter	Specifications
Receivers / Demodulators (per 1RU Chassis)	2, 4, 6, 8, 10, or 12 (2 demods per card)
Operating Frequency	950 to 2150 MHz L-Band, 100 Hz frequency resolution
Operating Bandwidth	All carriers must be within 70 MHz
Input Connector / Impedance	Type 'N' female, 50Ω, 17 dB minimum return loss
Return Loss	18 dB, minimum (typical 20 dB)
Input Power Range, Desired Carrier	-130 + 10 _{log} (symbol rate) to -80 + 10 _{log} (symbol rate) dB
Maximum Composite Operating Level	Lesser of +10 dBm or 105-10 _{log} (symbol rate, desired carrier) dBc, uniformly spread across 950 to 2150 MHz less desired carrier occupied bandwidth. This spec allows the entire 950 to 2150 MHz L-Band to be filled with an average uniform spectral density that is 14 dB greater than the desired carrier spectral density
Absolute Maximum, No Damage	+20 dBm
Adaptive Equalizer	5-tap design, selectable on/off
Receive Filter Rolloff (Alpha)	20%, 25%, 35%
Acquisition Range	Programmable in 1kHz increments, and subject to the following: <ul style="list-style-type: none"> Below 64 ksymbols/sec: ±1 to ±(Rs/2) kHz, where Rs = symbol rate in ksymbols/sec Between 64 and 389 ksymbols/sec: ±1 up to a maximum of ±32kHz Above 389 ksymbols/sec: ±1 to ±(0.1Rs) kHz, up to a maximum of ±200 kHz
Clock Tracking Range	±100 ppm min
Spectral Inversion	Normal or Inverted
Return Loss	Min 18 dB (typical 20 dB)
Decapsulation	Streamline
Descrambling	V.35
I&Q Constellation	Via HTTP (Web Server) Interface
Monitor Functions	Es/No estimate, Receive Signal Strength Indicator (RSSI), frequency offset

1.4.3.1 Receive

Parameter	Specifications
Data Rate (each Demodulator)	16 kbps to 15.35 Mbps, in 1 bps step (CCM Mode) (Modulation and FEC dependent)
Maximum Aggregate Data Rate	50 Mbps
Symbol Rate (Each Demodulator)	16 ksp/s to 4.5 Msp/s (CCM Mode)
FEC Mode	VersaFEC Decoder (Return Link ACM and VCM modes)
Modulation and Code Rates, Data Rate Ranges	<ul style="list-style-type: none"> • BPSK 0.488 16 kbps – 2.19 Mbps • QPSK 0.533 18 kbps – 4.8 Mbps • QPSK 0.631 21 kbps – 5.56 Mbps • QPSK 0.706 23 kbps – 4.8 Mbps • QPSK 0.803 26 kbps – 7.22 Mbps • 8-QAM 0.642 31 kbps – 8.67 Mbps • 8-QAM 0.711 35 kbps – 9.6 Mbps • 8-QAM 0.780 38 kbps – 10.53 Mbps • 16-QAM 0.731 47 kbps – 13.16 Mbps • 16-QAM 0.780 50 kbps – 14.04 Mbps • 16-QAM 0.829 54 kbps – 14.91 Mbps • 16-QAM 0.853 55 kbps – 15.35 Mbps

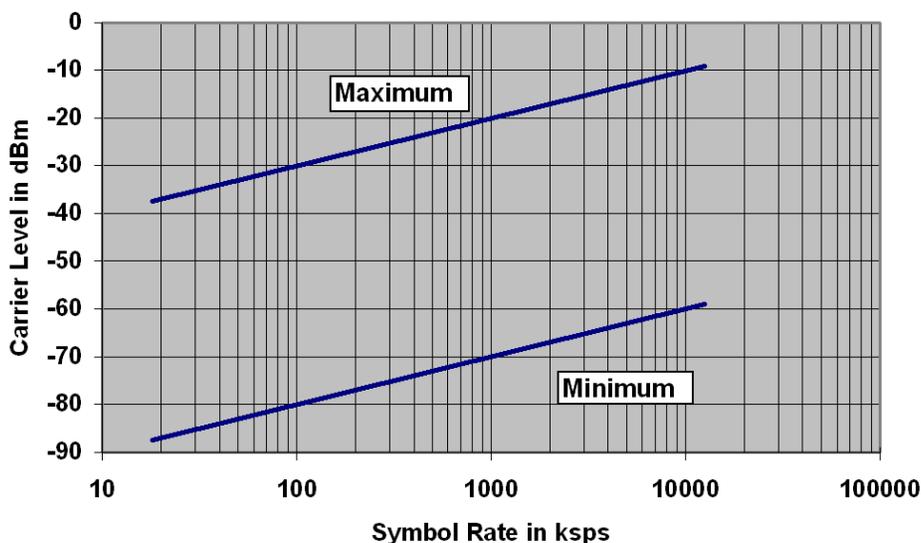


Figure 1-6. Rx Carrier Level vs. Symbol Rate (L-Band 950 – 2150 MHz)

1.4.3.2 Low Noise Block Down Converter (LNB) Support

Parameter	Specifications
Reference (10 MHz)	Supplied through Rx IF center conductor, 10.0 MHz \pm 0.06 ppm, selectable ON/OFF, -3.0 dBm \pm 3 dB
Voltage	Supplied through Rx IF center conductor, selectable ON/OFF, 13V DC, 18V DC, 24V DC
Current	500 mA, maximum
Current Alarm	Programmable MIN and MAX current alarms

1.4.4 BER (Bit Error Rate)

VersaFEC CODEC BER BPSK (With two adjacent carriers, each 7 dB higher than the desired carrier)	For BER=10 ^{-x}	Rate – Guaranteed Eb/No (typical value in parentheses)			
	BER=10 ⁻⁵ BER=10 ⁻⁸	Rate 0.488 2.4 dB (2.1 dB) 2.7 dB (2.4 dB)			
VersaFEC CODEC BER QPSK (With two adjacent carriers, each 7 dB higher than the desired carrier)	BER=10 ⁻⁵ BER=10 ⁻⁸	Rate 0.533 QPSK 2.3 dB (2.0 dB) 2.5 dB (2.2 dB)	Rate 0.631 QPSK 2.8 dB (2.5 dB) 3.0 dB (2.7 dB)	Rate 0.706 QPSK 3.3 dB (3.0 dB) 3.7 dB (3.4 dB)	Rate 0.803 QPSK 3.8 dB (3.5 dB) 4.1 dB (3.8 dB)
VersaFEC CODEC BER 8QAM (With two adjacent carriers, each 7 dB higher than the desired carrier)	BER=10 ⁻⁵ BER=10 ⁻⁸	Rate 0.642 8QAM 4.6 dB (4.3 dB) 4.9 dB (4.6 dB)	Rate 0.711 8QAM 5.2 dB (4.9 dB) 5.5 dB (5.2 dB)	Rate 0.780 8QAM 5.6 dB (5.3 dB) 6.0 dB (5.7 dB)	
VersaFEC CODEC BER 16QAM (With two adjacent carriers, each 7 dB higher than the desired carrier)	BER=10 ⁻⁵ BER=10 ⁻⁸	Rate 0.731 16QAM 6.4 dB (6.1 dB) 6.6 dB (6.3 dB)	Rate 0.780 16QAM 7.0 dB (6.7 dB) 7.3 dB (7.0 dB)	Rate 0.829 16QAM 7.5 dB (7.2 dB) 7.8 dB (7.5 dB)	Rate 0.853 16QAM 8.0 dB (7.7 dB) 8.3 dB (8.0 dB)

1.4.4.1 BER Monitor Functions

Parameter	Specifications
Eb/No Estimate	3 to 12 dB with ± 0.5 dB accuracy
Corrected Bit Error Rate	1E-3 to 1E-9
Frequency Offset	±32 kHz range, 100 Hz resolution
Signal Strength Indicator	0 to 60 dB range relative to maximum gain

1.4.5 Regulatory Compliance

Entity	Description
“CE” as follows:	<ul style="list-style-type: none"> • EN 30489-1 • EN 55022 Class B (Emissions) • EN 55024 (Immunity) • EN 60950 (Safety)
FCC	FCC Part 15 Subpart B
RoHS Compliance	Yes

Chapter 2. INSTALLATION

2.1 Unpack and Inspect the Shipment

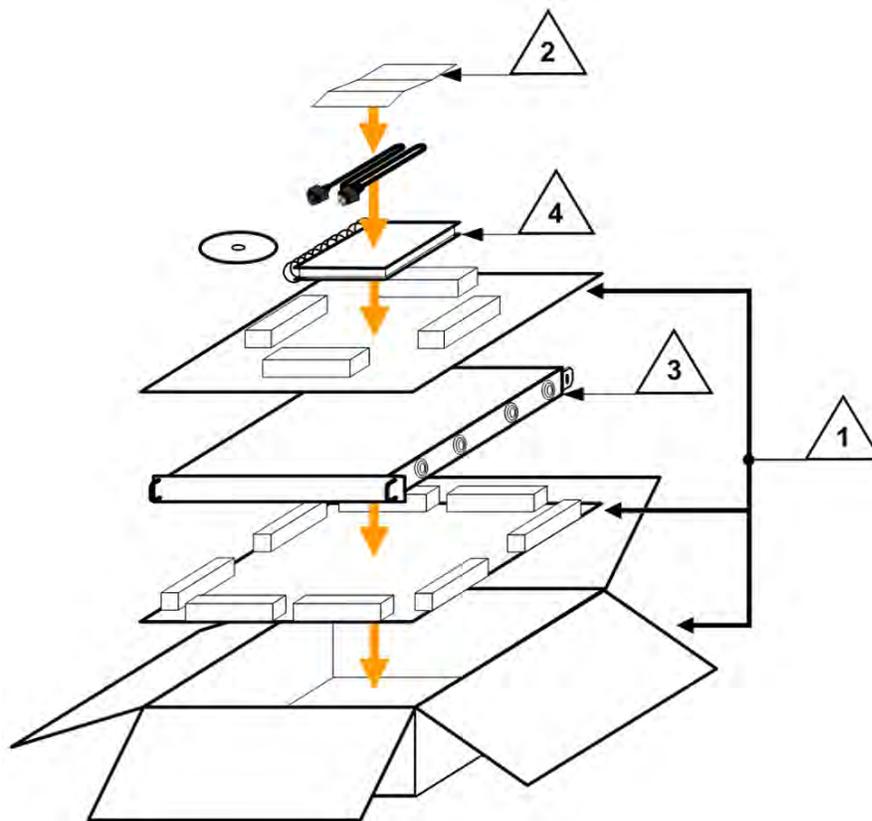


Figure 2-1. Unpack and Inspect the Shipment

The CDD-880 Multi Receiver Router, its optional Installation and Operation Manual (otherwise available online at <http://www.comtechefdata.com>), and its power cord were packaged and shipped in a reusable cardboard carton containing protective foam spacing.



CAUTION – THIS EQUIPMENT CONTAINS PARTS AND ASSEMBLIES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN HANDLING THE EQUIPMENT.



Once opened, inspect the shipment:

Step	Task
1	Keep all shipping materials.
2	Check the packing list to make sure the shipment is complete.
3	Inspect the equipment for damage. If damage exists, immediately contact the carrier and Comtech EF Data to submit a damage report.
4	Read the manual.

2.2 Install the Unit Into a Rack Enclosure

Install the CDD-880 in its assigned position in the rack enclosure (**Figure 2-2**). Use, as required:

- A standard rack-mounted shelf;
- User-supplied screws to secure the front panel to the rack enclosure threaded front mounting rails;
- Comtech EF Data's optional KT-0000168 (4") or KT-0000195 (10") Rear Support Brackets Kit (**Figure 2-3**).

For information about custom rack enclosures, contact Comtech EF Data Product Support.



CAUTION – CORRECT GROUNDING PROTECTION IS REQUIRED TO PREVENT PERSONAL INJURY AND EQUIPMENT DAMAGE.

You must make sure the ground stud on the rear panel of the unit is always connected to the protective earth.

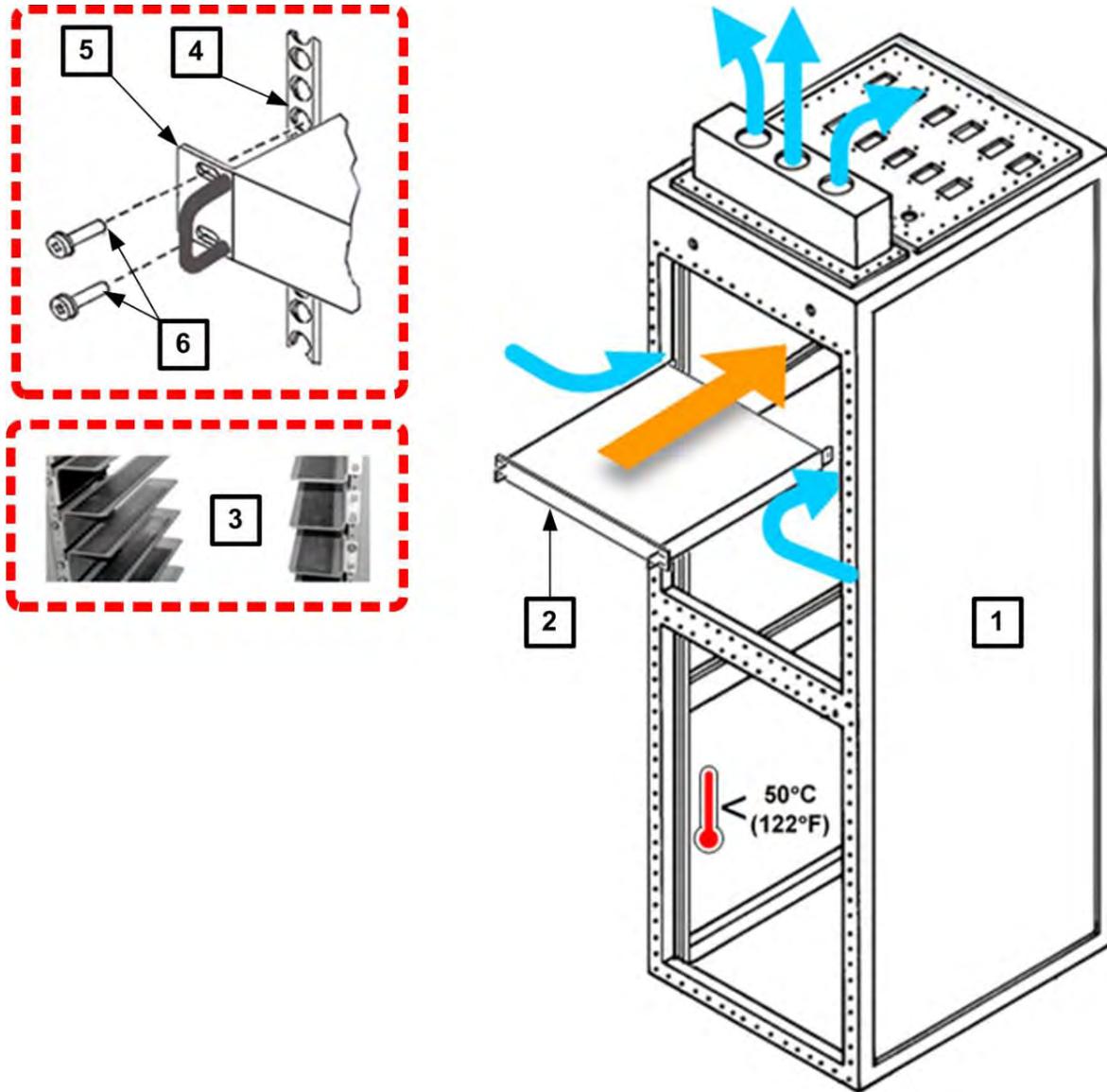
SUFFICIENT AIR VENTILATION IS REQUIRED.

Make sure there is adequate air ventilation clearance inside the enclosure, especially at the side. In a rack system where there is high heat discharge, provide forced-air cooling with top- or bottom-mounted fans or blowers.

The CDD-880 CANNOT have rack slides mounted to the sides of the chassis. Cooling fans and exhaust vents are provided here – air flow must not be impeded. Comtech EF Data recommends that an alternate method of support is provided within the rack, such as standard rack shelves or the optional Rear-Mounting Support Brackets Kit. If there is any doubt, contact Comtech EF Data Customer Support during normal business hours.

MAXIMUM AIR TEMPERATURE.

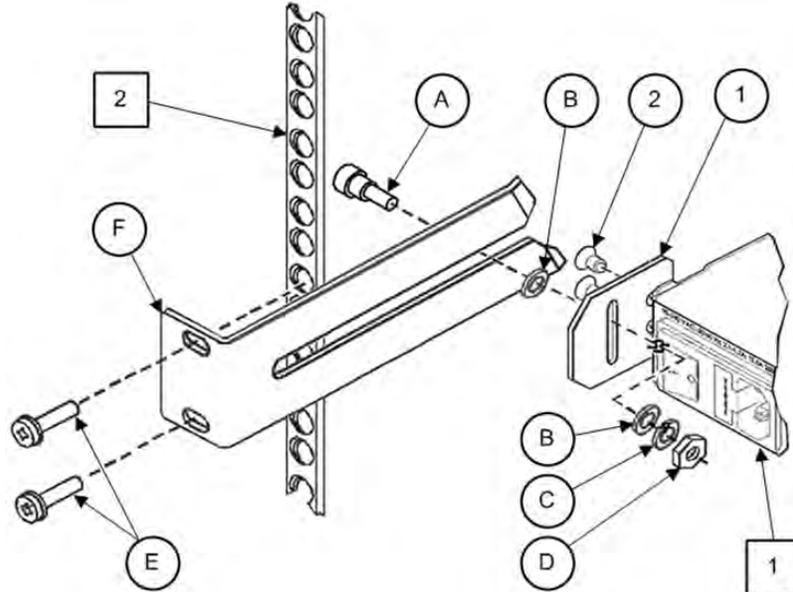
Make sure the air temperature inside the enclosure never exceeds 50°C (122°F).



Feature	Description
1	Custom Rack Enclosure
2	CDD-880 Unit
3	Standard Rack Shelving
4	Rack Enclosure Threaded Front Rail (typical)
5	Unit Front Panel
6	User-supplied Screws

Figure 2-2. Install the Unit Into a Rack Enclosure

2.2.1 Install the Optional Rear Support Brackets Kit



Feature	Description
1	Back of Unit
2	Rack Enclosure Threaded Rear Mounting Rail (typical)

KT-0000XXX Primary Rear Support Brackets Kit				
Item	Quantity		CEFD Part Number	Description
	KT-0000168	KT-0000195		
1	2	2	FP-0000913	Plate, Adapter
2	4	4	HW/10-32X3/8FLT	Screw, #10 Flat Head
3	1	–	KT/6228-2	4" Rear Support Bracket Kit
	–	1	KT/6228-3	10" Rear Support Bracket Kit

KT/6228-X Rear Support Bracket Kit				
Item	Quantity		CEFD Part Number	Description
	KT/6228-2	KT/6228-3		
A	2	2	HW/10-32SHLDR	Screw, #10 Shoulder
B	4	4	HW/10-32FLT	Washer, #10 Flat
C	2	2	HW/10-32SPLIT	Washer, #10 Split
D	2	2	HW/10-32HEXNUT	Nut, #10 Hex
E	4	4	HW/10-32x1/2RK	Bolt, #10 Rack Bracket
F	2	–	FP/6138-2	Bracket, Rear Support – 4"
	–	2	FP/6138-3	Bracket, Rear Support – 10"

Figure 2-3. Install the Optional Rear Support Brackets Kit

Tools needed to install the optional KT-0000168 (4") or KT-0000195 (10") Brackets Kit:

- A medium Phillips™ screwdriver
- A 5/32-inch SAE Allen™ Wrench
- An adjustable Crescent™ wrench.

Do these steps to install the brackets kit (**Figure 2-3**):

Step	Description
1	Assemble the Adapter Plates to the back sides of the CDD-880 chassis using the #10 Flat Head Screws.
2	Assemble the #10 Shoulder Screws through the Adapter Plate mounting slots using the #10 Flat Washers, #10 Split Washers, and #10 Hex Nuts.
3	Mount the Rear Support Brackets to the rack enclosure threaded rear mounting rails using the #10 Rack Bracket Bolts.
4	Slide the CDD-880 into the front of the rack enclosure. Make sure that the #10 Shoulder Screws properly engage into the slots of the Rear Support Brackets.

Chapter 3. REAR PANEL CONNECTIONS

3.1 Overview – Cabling Connection Types

Comtech EF Data's Advanced VSAT Series group of products, including the CDD-880 Multi Receiver Router, use a number of different cables. Each cable type is typically dedicated to a specific mode of operation.



- 1) **Not all of these operational interface types may be available.**
- 2) **The European EMC Directive (EN55022, EN50082-1) requires using properly shielded cables for DATA I/O. These cables must be double-shielded from end-to-end, ensuring a continuous ground shield.**

3.1.1 Coaxial Cable Connections

Coupling Type	Connector Type	
	Plug	Jack
Bayonet (Type 'BNC' shown)		
Threaded (Type 'N' shown)		

Figure 3-1. Coaxial Connector Examples

The types of coaxial cables used by Comtech EF Data are 'BNC', 'TNC', 'N', 'F', and 'SMA'. Coaxial cables (plugs) and their mating connectors (jacks/sockets) are available in two coupling styles: **Bayonet** or **Threaded**:

- **Bayonet Coupling Style:** The jack has a pair of guide posts that accommodate the plug's lockdown slots. This lockdown design provides secure assembly without over-tightening the connection.
- **Threaded Coupling Style:** The jack features external threads. The plug shell features internal threads, and has either a knurled outer surface to permit hand-tightening of the connection, or hex flats to accommodate torqued installation.

Connection Instructions:

- **Bayonet Coupling Connections:** Use the plug slots to guide, then slide the plug onto the jack posts. Then, turn the plug clockwise until the jack posts are fully seated within the plug slot.
- **Threaded Coupling Connections:** Engage the plug onto the jack threads, and then turn the plug clockwise until it is fully threaded onto the jack. Do not over-tighten the connection.

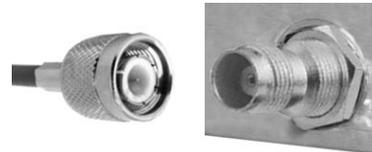
3.1.1.1 Type 'BNC'

BNC plugs and jacks feature a **Bayonet Coupling** design.



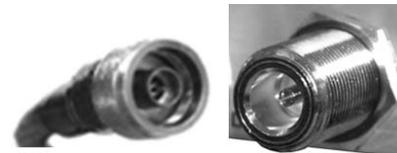
3.1.1.2 Type 'TNC'

TNC plugs and jacks feature a **Threaded Coupling** design similar to Type 'N', Type 'F', and Type 'SMA' connectors.



3.1.1.3 Type 'N'

Type 'N' connectors feature a **Threaded Coupling** design similar to Type 'TNC', Type 'F', and Type 'SMA' connectors.



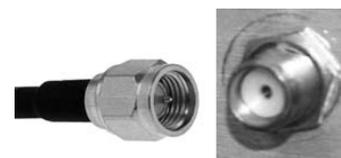
3.1.1.4 Type 'F'

Type 'F' connectors feature a **Threaded Coupling** design similar to Type 'TNC', Type 'N', and Type 'SMA' connectors.



3.1.1.5 Type 'SMA' (Subminiature Version 'A')

Type 'SMA' connectors feature a **Threaded Coupling** design similar to Type 'TNC', Type 'N', and Type 'F' connectors.



3.1.2 D-Subminiature Cable Connections

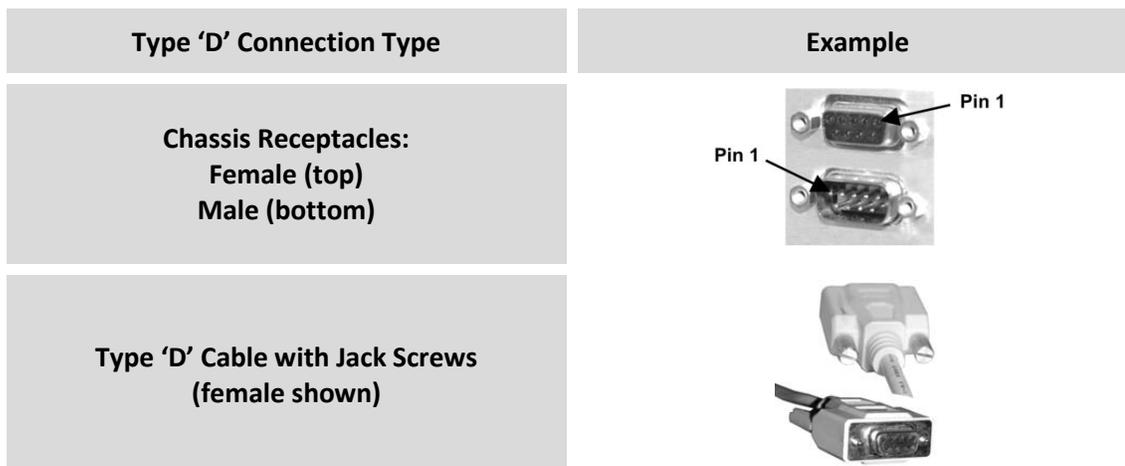


Figure 3-2. D-Subminiature Connector Examples

D-Subminiature connectors are also called **Type 'D'** or '**D-Sub**' connectors. The connector pair features multiple rows of pins (male side) coupled to mating sockets (female side). The cable plug and chassis receptacle each feature a D-shaped profile that interlock to ensure proper pin orientation and connector seating.

Either chassis receptacle gender features two jack nuts for secure assembly of the cable plug to the chassis receptacle.

Whether its gender is male or female, the cable plug features two jack screws for secure connection to the jack nuts provided on the mating chassis receptacle. The jack screws may be hand tightened or tightened with a standard flat-blade screwdriver.

Connection Instructions: Orient the plug to the receptacle in the proper position. Press firmly into place. Use the jack screws to secure the plug to the receptacle jack nuts. Do not over-tighten.

About connector pinout tables: Figure 3-2 identifies the Pin 1 location for either gender connector. Unless noted otherwise, the connector pinout tables provided in this manual arrange/order information (i.e., the Pin # column/row) based on this orientation.

3.1.3 RJ-45, RJ-48 Cable Connections

The plug for an RJ-45 or RJ-48 cable features a flexible tab. The RJ-45 or RJ-48 jack features a mating slot. This design configuration assures proper installation and pin orientation.

Connection Instructions: Press down the tab on the cable plug, and then insert the plug into the RJ-4x jack. The connection is complete when the tab 'clicks' into position inside the jack.



3.2 CDD-880 Advanced VSAT Network Hub Site Cabling Example

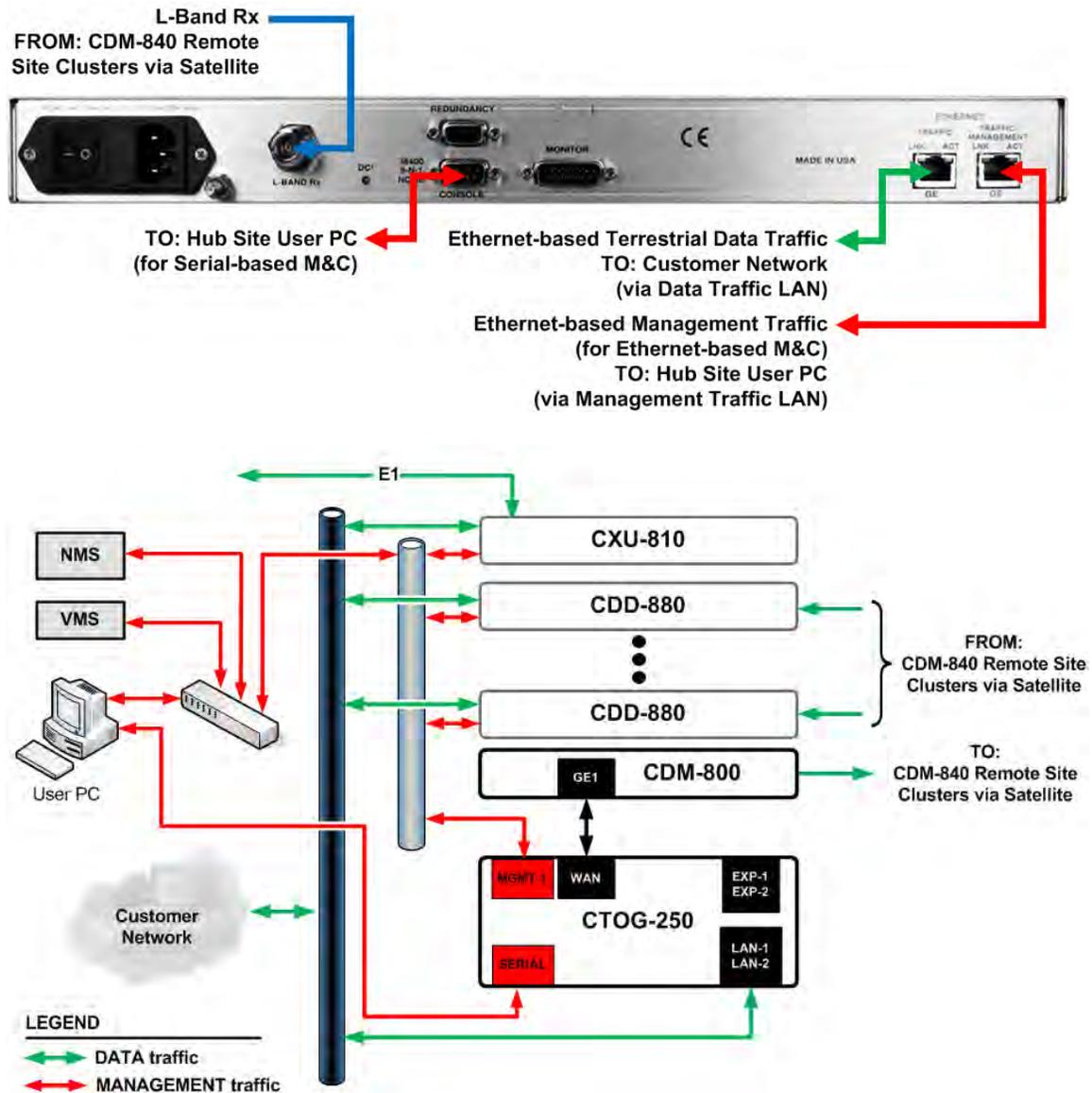
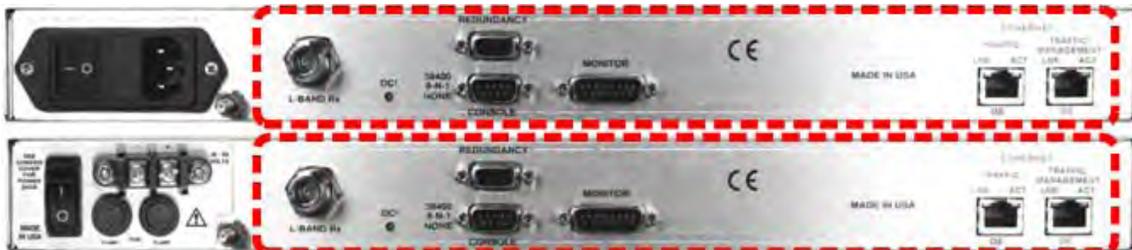


Figure 3-3. CDD-880 in an Advanced VSAT Network

Figure 3-3 illustrates the CDD-880's use in an Advanced VSAT Network. At top, the primary cabling connections are shown for a typical CDD-880 rear panel. At bottom, the diagram shows the CDD-880's operational role within the hub site of an Advanced VSAT Network hub-and-spoke configuration.

3.3 CDD-880 Cabling Connections

The CDD-880 rear panel connectors (**Figure 3-4**) provide all necessary external connections between the unit and other equipment.



(TOP) Standard AC Unit
(BOTTOM) Optional 48V DC Unit

Figure 3-4. CDD-880 Cabling Connections

Table 3-1 summarizes the available connectors, grouped according to service function.

Table 3-1. CDD-880 Rear Panel Connectors

Service Type (Ch. Sect.)	Name	Connector Type	Connector Function
IF Connector (3.3.1)	L-BAND Rx	50Ω Type 'N' female	L-Band Rx Input
Utility Connector Group (3.3.2)	REDUNDANCY	D-sub 9-pin female	(FUTURE) For connection to an optional 1:1 or 1”N CEFD Redundancy Switch
	CONSOLE	D-sub 9-pin male	Serial Remote Interface (EIA-232)
	MONITOR	D-sub 15-pin male	I&Q Constellation/Rx AGC Monitor Output
	ETHERNET TRAFFIC/MANAGEMENT GE	RJ-45 female	10/100/1000 BaseT Gigabit Ethernet Traffic OR Management data interface (IEEE 802.ab)
Terrestrial Data Connector (3.3.3)	ETHERNET TRAFFIC GE	RJ-45 female	10/100/1000 BaseT Gigabit Ethernet traffic data interface (IEEE 802.3ab)

3.3.1 IF Connector – L-BAND Rx (Type ‘N’ Female)



CAUTION – THERE MAY BE DC VOLTAGES PRESENT ON THE TYPE ‘N’ RX IF CONNECTOR, UP TO A MAXIMUM OF 48 VOLTS. THE LED LABELED ‘DC!’ WILL LIGHT TO INDICATE THIS CONDITION.



The return loss on this port is typically better than 17 dB. If you prefer to connect to a 75Ω system, an optional Type ‘N’ to Type ‘F’ adapter is available. While there will be a reduction in return loss when doing this, the effect in most systems will be negligible.



Connector Type	Name	Description	Direction
50Ω Type ‘N’ Female	L-BAND Rx	Rx IF Signal, L-Band	In

3.3.2 Utility Connector Group

3.3.2.1 ‘REDUNDANCY’ Connector (DB-9F) (FUTURE)



This interface is intended for future use for connection to an optional CEFD CRS-170A 1:1 L-Band Redundancy Switch.



Connector Type	Name	Direction
D-sub 9-pin female	REDUNDANCY	In/Out

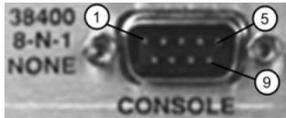
Table 3-2. ‘REDUNDANCY’ Connector Pinout

Pin #	Description	Direction
5	Ground	–
9	Fused +12 volt	Out
4	Redundancy In 2	In
8	Redundancy Out 2	Out
3	Redundancy In 1	In
7	Redundancy Out 1	Out
2	Receive Serial Data – auxiliary channel	In
6	Transmit Serial Data – auxiliary channel	Out
1	Ground	–

3.3.2.2 'CONSOLE' Connector (DB-9M)



Use this interface for EIA-232 communications. It is intended for connection to a user-provided M&C computer or VT (Video Terminal) device. The standard configuration settings for the serial interface are provided here.



Connector Type	Name	Direction
D-sub 9-pin male	REMOTE	In/Out

Table 3-3. 'CONSOLE' Connector Pinout

Pin #	Description	Direction
1	Ground	–
6	Reserved - do not connect to this pin	–
2	EIA-232 Transmit Data	Out
7	Reserved - do not connect to this pin	–
3	EIA-232 Receive Data	In
8	Reserved - do not connect to this pin	–
4	Reserved - do not connect to this pin	–
9	Reserved - do not connect to this pin	–
5	Ground	–

3.3.2.3 'MONITOR' Connector (DB-15M)



This interface provides the Rx constellation and analog AGC level of the selected demod.



Connector Type	Name	Direction
D-sub 15-pin male	MONITOR	Out

Table 3-4. 'MONITOR' Connector Pinout

Pin #	Description	Direction
1	Ground	–
9	Reserved - do not connect to this pin	–
2	Reserved - do not connect to this pin	–
10	Reserved - do not connect to this pin	–
3	Constellation 'Q' channel	Out
11	Constellation 'I' channel	Out
4	Reserved - do not connect to this pin	–
12	Reserved - do not connect to this pin	–
5	Reserved - do not connect to this pin	–
13	Rx AGC (0-3V)	Out
6	Reserved - do not connect to this pin	–
14	Reserved - do not connect to this pin	–
7	Reserved - do not connect to this pin	–
15	Reserved - do not connect to this pin	–
8	Reserved - do not connect to this pin	–

3.3.2.4 'ETHERNET | TRAFFIC/MANAGEMENT | GE' Gigabit Ethernet Connector (RJ-45F)



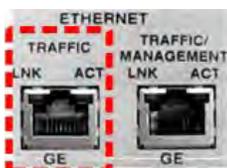
Connector Type	Name	Direction
RJ-45 female modular jack	ETHERNET TRAFFIC/MANAGEMENT GE	In/Out



Use this port either for remote management and control (M&C) of CDD-880 functions via SNMP/HTTP, OR for Gigabit Ethernet terrestrial data traffic.

- Port operates at 10/100/1000 Mbps, half and full duplex, auto-negotiating.
- The maximum Ethernet packet size is 2026 bytes in Router Mode and 2014 bytes in BPM (Bridge Point-to-Multipoint) Mode (including Ethernet headers and 2 VLANs)
- This port features two operational LED indicators:
 - LNK – Comms Link detected (glows amber)
 - ACT – Activity detected (flashes green)

3.3.3 Terrestrial Traffic – 'ETHERNET | TRAFFIC | GE' Gigabit Ethernet Connector (RJ-45F)



Connector Type	Name	Direction
RJ-45 female modular jack	ETHERNET TRAFFIC GE	In/Out

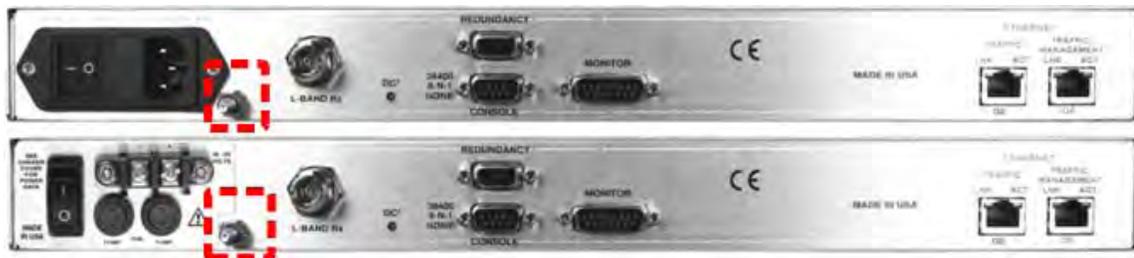


Use this port for Gigabit Ethernet terrestrial data traffic.

- Port operates at 10/100/1000 Mbps, half and full duplex, auto-negotiating.
- The maximum Ethernet packet size is 2026 bytes in Router Mode and 2014 bytes in BPM (Bridge Point-to-Multipoint) Mode (including Ethernet headers and 2 VLANs)
- This port features two operational LED indicators:
 - LNK – Comms Link detected (glows amber)
 - ACT – Activity detected (flashes green)

3.4 Ground and Power Connections

3.4.1 Chassis Ground Interface



(TOP) Standard AC Unit
(BOTTOM) Optional 48V DC Unit

Figure 3-5. Chassis Ground Interface

Use the #10-32 stud, located adjacent to the power interface (**Figure 3-5**), for connecting a common chassis ground among equipment.



CAUTION – CORRECT GROUNDING PROTECTION IS REQUIRED TO PREVENT PERSONAL INJURY AND EQUIPMENT DAMAGE. YOU MUST MAKE SURE THE GROUND STUD ON THE REAR PANEL OF THE UNIT IS ALWAYS CONNECTED TO PROTECTIVE EARTH.



The AC power interface provides the safety ground.

3.4.2 115V/230V Alternating Current (AC) Power Interface (Standard)



Feature	Description
1	On / Off Switch
2	Press-fit Fuse Holder
3	IEC Three-prong Connector

AC Power Specifications	
Input Power	40W maximum, 20W typical
Input Voltage	100V to 240V AC, +6%/-10%, autosensing (total absolute max. range is 90 to 254VAC)
Connector Type	IEC-60320 Type C13/C14
Fuse Protection	Line and neutral fusing (2X) T3.15A 20mm Slow-blow type fuses

Figure 3-6. AC Power Interface

3.4.2.1 AC Operation – Apply Power



Figure 3-7. Apply AC Power to the Unit

Do these steps to apply AC power to the unit (Figure 3-7):

Step	Task
1	Plug the provided AC power cord female end into the unit.
2	Plug the AC power cord male end into the user-supplied power source.
3	Switch the unit ON.

3.4.2.2 AC Operation – Replace the Fuses

For AC operation, the unit uses two common 5mm x 20mm Slow-blow fuses – one each for line and neutral connections. The fuses are contained on the rear panel in a fuse holder that is press-fit into the body of the IEC power module (Figure 3-8).



Figure 3-8. Replace the AC Fuses



WARNING – DEATH OR PERSONAL INJURY IS POSSIBLE! DISCONNECT THE POWER SUPPLY BEFORE PROCEEDING!

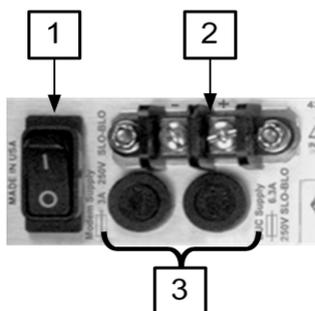


CAUTION – ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING. SEE FIGURE 3-6 FOR THE AC FUSE SPECIFICATIONS.

Do these steps to replace the AC fuses (Figure 3-8):

Step	Task
1	Disconnect the power supply.
2	Unseat the fuse holder from the IEC power module: <ul style="list-style-type: none"> Use the slot to pry the holder outward from the IEC power module. Pull the holder straight out, and then swing the holder away from the module.
3	Remove and replace the fuses as necessary.
4	Re-seat the fuse holder in the IEC power module.

3.4.3 48V Direct Current (DC) Power Interface (Optional)



Feature	Description
1	On / Off Switch
2	Power Terminal Block
3	Screw-in Fuse Holders / Receptacles

DC Power Specifications	
Input Power	25W (typical) 245W (maximum with BUC)
Input Voltage	48V DC, nominal (36V to 60V)
Connector Type	Terminal Block
Fuse Protection	(2X) 20mm Slow-blow type fuses: (1X) T3.15A (3.15 Amp) (1X) T5A (5.0 Amp)

Figure 3-9. DC Power Interface

3.4.3.1 DC Operation – Apply Power



Figure 3-10. Apply DC Power to the Unit

Do these steps to apply DC power to the unit (Figure 3-10):

Step	Task
1	Connect the user-supplied (+) and (-) DC power leads to their respective terminals. Number 18 AWG minimum wires are recommended.
2	Connect the user-supplied DC power leads to the user power source.
3	Switch the unit ON.

3.4.3.2 DC Operation – Replace the Fuses

For DC operation, the unit requires two different fuses. The fuses are located on the rear panel in the individual screw-in receptacles found below the terminal block (**Figure 3-11**).

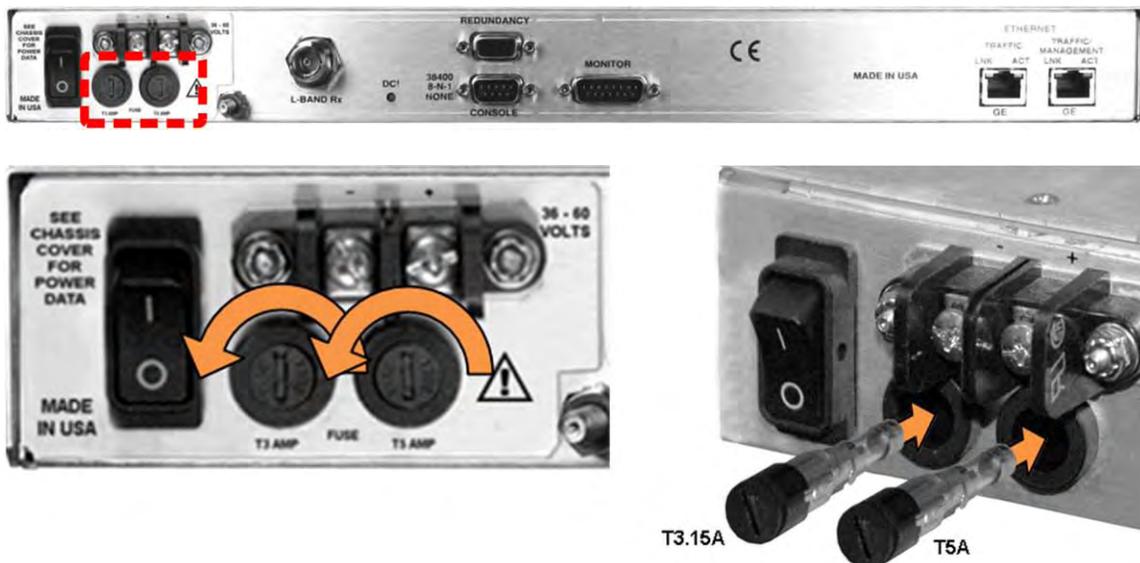


Figure 3-11. Replace the DC Fuses



WARNING – DEATH OR PERSONAL INJURY POSSIBLE! DISCONNECT THE POWER SUPPLY BEFORE PROCEEDING!



CAUTION – ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING. SEE FIGURE 3-9 FOR THE DC FUSE SPECIFICATIONS.

Do these steps to replace the DC fuses (**Figure 3-11**):

Step	Task
1	Disconnect the power supply.
2	Unscrew either fuse holder from its receptacle.
3	Remove and replace the fuse(s): <ul style="list-style-type: none"> Use one each T3.15A (3.15 Amp) and T5A (5.0 Amp) fuse in the locations shown.
4	Screw either fuse holder into its receptacle

Chapter 4. UPDATING FIRMWARE

4.1 Firmware Update Overview



Make sure to operate the CDD-880 with its latest available firmware.

The CDD-880 Multi Receiver Router is factory-shipped with the latest version of operating firmware. If you require a firmware update, you must contact Comtech EF Data Product Support.

Firmware updates may be applied to an in-service CDD-880 without having to remove the covers of the unit chassis. Use the CDD-880 to update the firmware:

- Obtain the firmware update archive file from Comtech EF Data Product Support.
- Establish the proper communications link for acquiring the firmware update archive files by directly connecting a user-supplied Microsoft Windows-based PC to the **'ETHERNET | TRAFFIC/MANAGEMENT | GE'** 10/100/1000 BaseT Gigabit Ethernet port and the 9-pin serial **'CONSOLE'** port located on the CDD-880 rear panel.
- Use Windows Command-line to transfer, via File Transfer Protocol (FTP), the extracted firmware files from the User PC to the CDD-880 standby firmware image.
- Use the CDD-880 HTTP (Web Server) Interface to configure the modem to operate using the updated firmware image.

4.2 Getting Started: Prepare for the Firmware Download

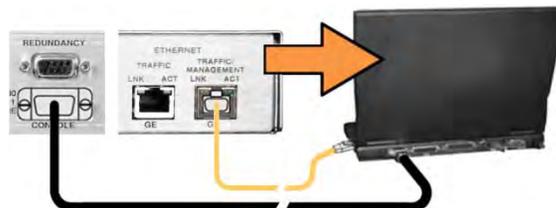
Do these steps:

1. **Identify the firmware number/revision letter/version number and the assigned Ethernet Management IP Address.**

User-supplied items needed:

- A Microsoft Windows-based PC, equipped with available serial and Ethernet ports, a compatible Web browser (e.g., Internet Explorer), and a terminal emulator program (e.g., Tera Term or HyperTerminal).
- A CAT5 Ethernet cable to connect the PC Ethernet port to the CDD-880.
- A 9-pin serial cable to connect the PC serial port to the CDD-880.

- a) Use an Ethernet hub, switch, or direct cable connection to connect the CDD-880 rear panel **'ETHERNET | TRAFFIC/MANAGEMENT | GE'** 10/100/1000 Gigabit Ethernet port to an Ethernet port on the User PC.



- b) Use the 9-pin serial cable to connect the CDD-880 rear panel **'CONSOLE'** port to a serial port on the User PC.
- c) **On the PC** – Open the terminal emulator program. Configure the program serial port communication and terminal display settings.



Refer to your terminal emulator program HELP feature or user guide for operating and configuration instructions.

Configure the utility program serial port communication and terminal display operation:

- **38400 bps (Baud Rate)**
- **8 Data Bits**
- **1 Stop Bit**
- **Parity = NO**
- **Port Flow Control = NONE**
- **Display New line Rx/Tx: CR**
- **Local Echo = ON**

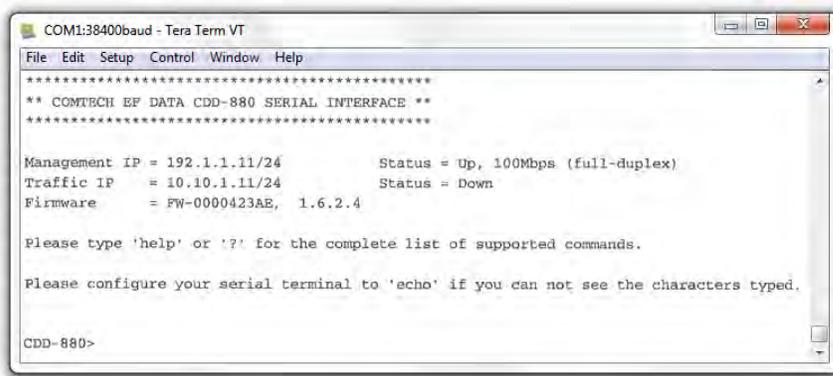
- d) **On the CDD-880: Turn on the power.**



**(LEFT) Standard 115V/230V AC Unit
(RIGHT) Optional 48V DC Unit**

e) On the PC – Make note of the information displayed on the CDD-880 Serial Interface:

- Management IP Address (default is 192.168.1.11/24)
- Firmware Number and Revision Letter (e.g., FW-0000423AE)
- Firmware Release Version (e.g., 1.6.2.4)



The serial and HTTP interface figures as featured throughout this chapter are intended for user reference only and are subject to change. The firmware information (i.e., revision letters, version numbers, etc.) as displayed may differ from your setup.



See Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for information and instructions on using the CDD-880 Serial Interface.

f) Alternately, use the CDD-880 HTTP Interface to obtain the firmware information.

- On the PC – Use a Web browser (e.g., Internet Explorer) to log in to the CDD-880 HTTP Interface and open the Admin | Firmware page. Then, make note of the Slot #1 and Slot #2 firmware loads:

Firmware Information					
Slot #	Running	Name	Version	Date	Size
1	Yes	FW-0000423AE	1.6.2.4		
2	No	FW-0000423AE	1.6.2.4		



See Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT for information and instructions on using the CDD-880 HTTP Interface.

2. Create a temporary folder (subdirectory) on the User PC for the firmware archive download.

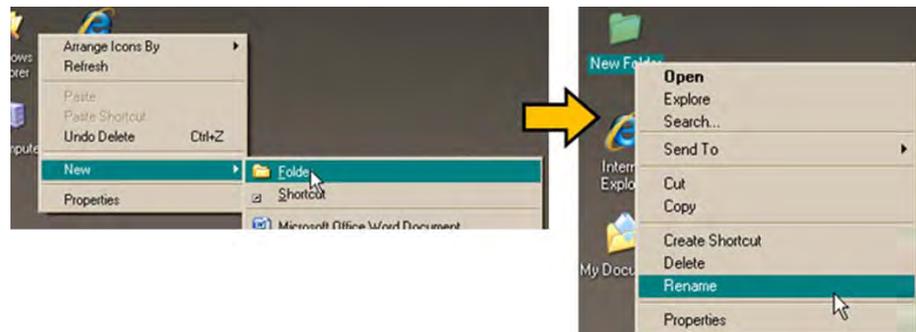


- Drive letter “c:” is used in these examples. Any valid, writable drive letter can be used.
- Typical for all tasks: Type the command without quotes, and then press Enter to execute.

There are several ways you may use create a temporary folder on a Windows-based PC:

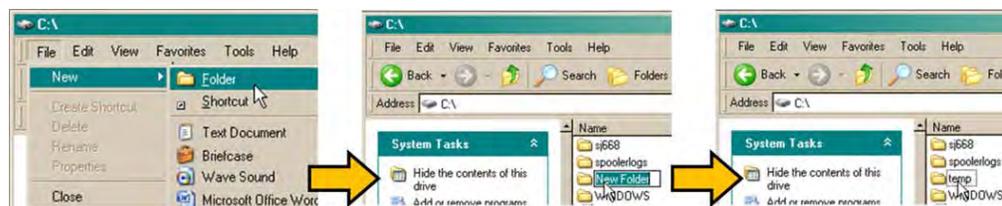
a) Use the Windows Desktop to create and rename the temporary folder.

- Right-click anywhere on the desktop to open the popup submenu, and then select **New > Folder** to create the temporary folder. The new folder will be created on the desktop.
- Right-click on the new folder and then select **"Rename"** from the popup submenu. Rename this folder to **"temp"** or some other convenient, unused name.



b) Use Windows Explorer to create and rename the temporary folder.

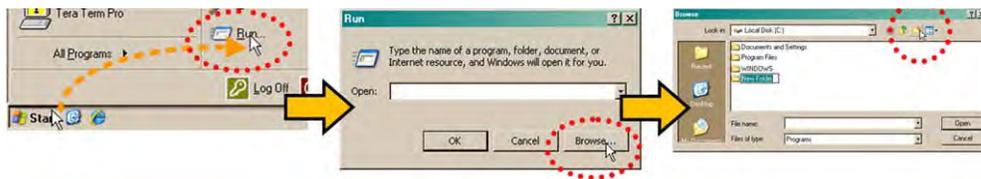
- Select **File > New > Folder** to create the temporary folder. The new folder will be created in the active folder.
- Right-click the **"New Folder"** folder name, and then rename this folder to **"temp"** or some other convenient, unused name.



c) Use the 'Run' and 'Browse' windows to create and rename the temporary folder.

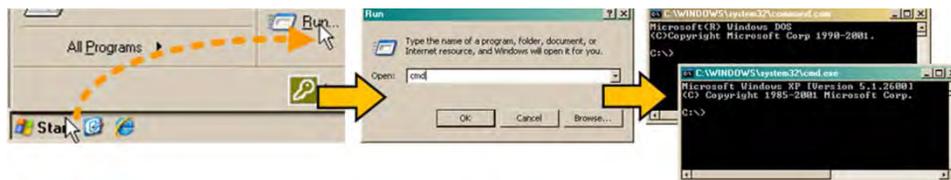
- Select **[Start]** on the Windows taskbar, and then click the **Run...** icon. The **'Run'** window will open.
- Click **[Browse]** in the **'Run'** window. The **'Browse'** window will open.
- Click the **Create New Folder** icon in the **'Browse'** window. The new folder will be created.

- Right-click the **“New Folder”** folder name, and then rename this folder to **“temp”** or some other convenient, unused name.

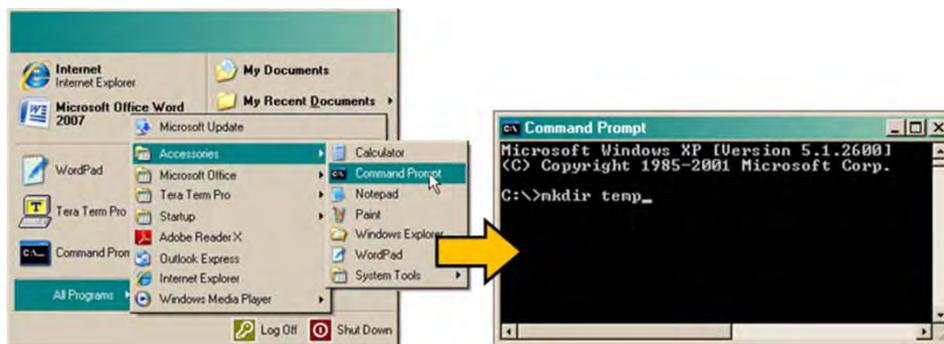


d) Use Windows Command-line to create the temporary folder.

- **First**, click **[Start]** on the Windows taskbar, and then click the **‘Run...’** icon (or, depending on Windows OS versions *prior* to Windows 95, click the **‘MS-DOS Prompt’** icon from the Main Menu).
- **Next**, open a **Command-line** window...
 - For Windows 95 or Windows 98 – Type **“command”**.
 - For any Windows OS versions later than Windows 98 – Type **“cmd”** or **“command”**.



- Alternately, from **[Start]**, select **All Programs > Accessories > Command Prompt**.
- **Finally**, from the Command-line **‘c:\>’** prompt, type **“mkdir temp”** or **“md temp”** (*mkdir* and *md* stand for *make directory*), and then click **[OK]**.



There should now be a “temp” folder created and available for placement of the firmware file download.

4.3 Download and Extract the Firmware Update

Do these steps:

1. Acquire the firmware update archive file from Comtech EF Data Product Support.



- **About Firmware Numbers, File Versions, and Formats:** The Comtech EF Data Web site catalogues its firmware update files by product type (e.g., router, modem, etc.), the specific model, and optional hardware configurations.
- **About File Archive Formats:** Comtech EF Data provides its downloadable files in two compressed archive formats: ***.exe** (self-extracting) and ***.zip** (compressed).

The ***.exe** file does not require a file archiver and compression utility program such as *PKZIP for Windows*, *WinZip*, *ZipCentral*, etc. (*PKZIP for DOS* is not supported due to file naming conventions). **Comtech EF Data does not provide this utility program.**

Some firewalls do not allow the download of ***.exe** files. Download the ***.zip** file instead, and extract the firmware files from the archive download with a user-supplied utility program. For detailed information on handling archived files, refer to the utility program Help documentation.

2. Transfer the archive file to the temporary folder.

- Once the **EXE** or **ZIP** hyperlink is selected the **'File Download'** window opens and prompts selection of **[Open]** or **[Save]**:
 - Click **[Open]** to turn over file extraction to the user-supplied utility program. Be sure to extract the firmware files to the **"temp"** folder created earlier.
 - Click **[Save]** to open the **'Save As'** window. Be sure to select and **[Save]** the archive ***.exe** or ***.zip** file to the **"temp"** folder created earlier.
 - Otherwise, click **[Cancel]** to quit and exit the file download process.



3. Extract the firmware files from the archive file.

- (If not already done with **File Download > [Open]**) Extract the firmware files from the downloaded ***.exe** or ***.zip** archive file with the user-supplied utility program:

- Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program. Extract, at a minimum, two files:
 - **FW0000423x_CDD880.bin** – the Firmware Bulk image file (where ‘x’ denotes the revision letter), and
 - **CDD-880ReleaseNotes_v#-#-#.pdf** – the Firmware Release Notes PDF file (where ‘#-#-#’ denotes the firmware version number).

4. Confirm availability of the firmware files in the temporary folder.

There are several ways you may view the contents of the temporary folder on a Windows-based PC:

a) From the Windows Desktop:

- Double-left-click the “**temp**” folder saved to the Windows Desktop.
- Use **Windows Explorer** to locate, and then double-left-click the “**temp**” folder.
- Use the ‘**Browse**’ window ([**Start**] > ...**Run** > [**Browse**]) to locate, and then double-click the “**c:\temp**” folder.

b) Using Command-line:

- Type “**cd c:\temp**” at the Command-line prompt to change to the temporary directory created earlier using Command-line.
- Type “**dir**” to list the files extracted to the temporary directory from the downloaded archive file.

The firmware files have been successfully downloaded and are now available for transfer to the CDD-880.

4.4 Perform the Ethernet FTP Upload Procedure



YOU MAY PROCEED WITH THE FIRMWARE UPDATE PROCEDURE, ASSUMING THAT:

- YOUR CDD-880 IS CONNECTED TO A USER-SUPPLIED, WINDOWS-BASED PC, AS FOLLOWS:
 - THE PC SERIAL PORT IS CONNECTED TO THE CDD-880 'CONSOLE' PORT.
 - THE PC ETHERNET PORT IS CONNECTED TO THE CDD-880 'ETHERNET | TRAFFIC / MANAGEMENT | GE' 10/100/1000 BASET GIGABIT ETHERNET PORT WITH A USER-SUPPLIED HUB, SWITCH, OR DIRECT ETHERNET CABLE CONNECTION.
 - THE PC IS RUNNING A TERMINAL EMULATION PROGRAM (FOR OPERATION OF THE CDD-880 SERIAL INTERFACE) AND A COMPATIBLE WEB BROWSER (FOR OPERATION OF THE CDD-880 HTTP INTERFACE).
- THE CDD-880 MANAGEMENT IP ADDRESS HAS BEEN NOTED USING THE CDD-880 SERIAL INTERFACE, AND THE FIRMWARE HAS BEEN IDENTIFIED USING EITHER THE CDD-880 SERIAL INTERFACE OR THE CDD-880 HTTP INTERFACE 'ADMIN | FIRMWARE' PAGE.
- YOU HAVE DOWNLOADED, OR OTHERWISE RECEIVED FROM COMTECH EF DATA, THE LATEST FIRMWARE UPDATE AND THE EXTRACTED FILES ARE AVAILABLE ON THE USER PC IN AN ACCESSIBLE TEMPORARY FOLDER.

Do these steps:

1. Use Command-Line to send a 'PING' command to confirm proper connection and communication between the User PC and the CDD-880:
 - If the Management IP Address of the unit is still not known, type "info" at the CDD-880 Serial Interface 'CDD-880>' command prompt and record the displayed information. Alternately, use Serial Remote Control or the HTTP Interface:
 - **Serial Remote Control** – Type the "<0/IPA?" remote query (without quotes) at the CDD-880 Serial Interface **CDD-880>** command prompt. The unit returns the configured Management IP Address:

>0000/IPA=192.168.1.11/24 (default)
 - **CDD-880 HTTP Interface** – View the *IP Address/CIDR Mask* entry on the 'Configuration | Interface | Ethernet' page:



- **Once the Management IP Address is known, use Command-line to PING** – Type “**ping xxx.xxx.xxx.xxx**” at the Command-line prompt (where ‘xxx.xxx.xxx.xxx’ is the unit Management IP Address).

The response should confirm whether or not the unit is properly connected and communicating.

2. Use Command-line to transfer (FTP) the files from the User PC to the CDD-880:

- Type “**ftp xxx.xxx.xxx.xxx**” (where ‘xxx.xxx.xxx.xxx’ denotes the unit Management IP Address).
- Enter the username and password assigned to the unit. The default username and password is “**comtech**”.
- Type “**bin**” to set the binary transfer mode.
- Type “**prompt**” and then type “**hash**” to facilitate the file transfers.
- Type “**put FW-0000423xx_CDD880.bin**” (where ‘xx’ denotes the revision letter) at the Command-line prompt, without quotes, to begin the file transfer. The process sequences through several blocks – this may take several minutes for the transfer to occur. Once the upgrade file is received, the image is written to Flash memory and the unit transmits the message “**UPLOAD COMPLETE.**”



In the event you receive the “Connection closed by remote host.” message, wait another minute before continuing. The CDD-880 update sometimes takes longer than the FTP client allows.

- Type “**bye**” to terminate the FTP session, and then close the Command-line window.

3. Use the CDD-880 Serial Interface or the CDD-880 HTTP Interface ‘Admin | Firmware’ page to verify that the PC-to-Unit FTP file transfer was successful.

4. Use the CDD-880 HTTP Interface to select the firmware and reboot the unit:

a) Select the desired Boot Slot (Image):

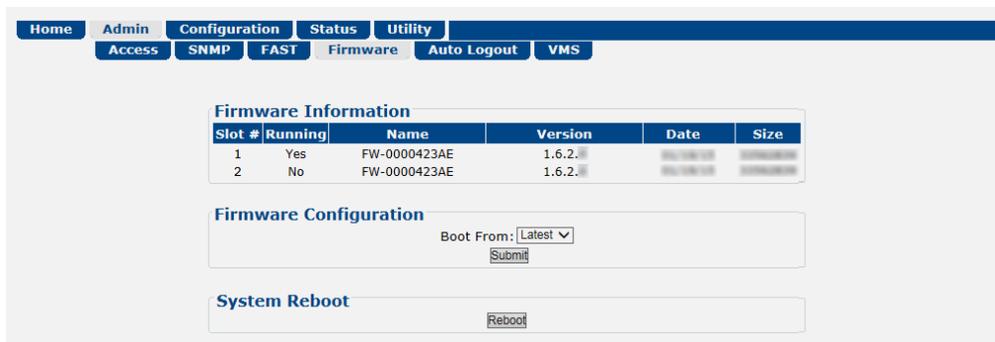
- Go to the CDD-880 HTTP Interface ‘**Admin | Firmware**’ page.
- Use the ‘**Boot From:**’ drop-down menu to select **Latest, Slot 1**, or **Slot 2** (in the *Firmware Configuration* section).

By default, the unit will boot from the Slot that stores the firmware version having the *latest date* (**Boot From: Latest**). ‘**Boot From:**’ may also be set to force the unit to boot up using either firmware image loaded in **Slot 1** or **Slot 2**.

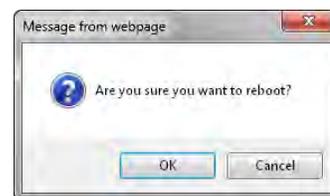
- Click [**Submit**] to save the setting.

b) Reboot the CDD-880:

- Go to either the CDD-880 HTTP Interface 'Admin | Firmware' page or the 'Utility | Reboot' page:



- Click **[Reboot]** to reboot the unit. A dialogue box appears to prompt continuation or cancellation of the reboot process:



Click **[OK]** to continue the reboot process, or **[Cancel]** to abort the process and return to the **Utility | Reboot** page.

Once the reboot process resumes, the **Utility | Reboot** page is replaced with the dynamic message "Please wait... CDD-880 is rebooting. Login will be required in **XX seconds**" – the time count decrements to 0 seconds before the unit reboots. After the reboot, login is required once again to resume use of the HTTP Interface.

The CDD-880 is now operating with its latest firmware. The firmware update process is now complete.

Chapter 5. FAST ACTIVATION PROCEDURE

5.1 FAST Overview

The CDD-880 Multi Receiver Router incorporates a number of optional features. In order to permit a lower initial cost, you may purchase the unit with only the desired features enabled.

If you wish to upgrade the functionality of a unit at a later date, Comtech EF Data provides **Fully Accessible System Topology (FAST)**, which permits the purchase and activation of options through special authorization codes. You may contact Comtech EF Data Product Support to purchase these unique, register-specific **Fast Access Codes**, and then load these codes into the unit using the HTTP (Web Server) Interface (accessible by connecting your PC Ethernet port to the CDD-880 rear panel 'ETHERNET | TRAFFIC/MANAGEMENT | GE' port).

FAST System Theory: FAST facilitates on-site upgrade of the operating feature set without removing a unit from the setup. FAST technology allows you to order a unit precisely tailored for the initial application. When your service requirements change, you can upgrade the topology of the unit to meet these requirements within minutes. This accelerated upgrade is possible because of FAST's extensive use of the programmable logic devices incorporated into Comtech EF Data products.

FAST Implementation: Comtech EF Data implements the FAST system in the modem at the factory. All **FAST Features** are available through the basic platform unit at the time of order – FAST allows immediate activation of available options, after confirmation by Comtech EF Data, through the HTTP Interface.

FAST Accessible Options: You may order hardware options for installation either at the factory, or you can install and activate them on-site. The FAST Access Code that you purchase from Comtech EF Data enables configuration of the available hardware.

5.2 FAST Activation via the HTTP Interface



See Sect. 6.4.4.2.3 Admin | FAST for complete information on using the CDD-880 HTTP Interface to activate FAST Features.

Use the HTTP Interface 'Admin | FAST' page to manage CDD-880 FAST Features. This page provides scrollable list boxes that display the availability and activation status for all FAST Features. FAST code entry/option activation control is also provided.

CDD-880 (CDD-880): Comtech EF Data Multi Receiver Router Active

UNIT STATUS ● Rx TRAFFIC 1 ● Rx TRAFFIC 5 ● Rx TRAFFIC 9 ●
 STORED EVENT ● Rx TRAFFIC 2 ● Rx TRAFFIC 6 ● Rx TRAFFIC 10 ●
 ONLINE ● Working Mode: Router Rx TRAFFIC 3 ● Rx TRAFFIC 7 ● Rx TRAFFIC 11 ●
 GE LINK/ACTIVITY ● FW Version: 1.6.2.4 Rx TRAFFIC 4 ● Rx TRAFFIC 8 ● Rx TRAFFIC 12 ●

Home Admin Configuration Status Utility
 Access SNMP FAST Firmware Auto Logout VMS

FAST Configuration

Option	Status
Demod Card Slot1:	VersaFEC Installed
Demod Card Slot2:	VersaFEC Installed
Demod Card Slot3:	VersaFEC Installed
Demod Card Slot4:	VersaFEC Installed
Demod Card Slot5:	VersaFEC Installed
Demod Card Slot6:	Not Installed
Rx Data and Symbol Rate:	CCM: Up to Max/ACM: Up to Max
Rx Header Decompression:	Enabled
Rx Payload Decompression:	Enabled
Precision Time Protocol	Disabled (No Hdwre)

FAST Upgrade

Serial Number: 11111111
 FAST Code:

Figure 5-1. CDD-880 HTTP Interface – 'Admin | FAST' page

5.2.1 FAST Configuration

The **read-only** table in this section displays the CDD-880 available FAST Features and the operational status for each option:

Column	Description
Option	This column lists each available FAST Feature.
Status	This column identifies each FAST Feature operational parameter(s). If an option is not enabled, the column displays this information.

The complete roster of FAST Accessible Options is as follows:

Option	
Demod Card / VersaFEC	Up to six (6) dual demodulator cards installable.
Aggregate Rx Data Rate (CCM) and Symbol Rate (ACM)	Up to 10 Mbps (CCM) or 4 Msps (ACM)
	Up to 25 Mbps (CCM) or 10 Msps (ACM)
	Up to 50 Mbps (CCM) or 20 Msps (ACM)
	Max Data Rate (CCM) or Symbol Rate (ACM) for use with dSCPC only
PTP (Precision Time Protocol)	NOT AVAILABLE IN THE FW VER. 1.6.2.X RELEASE



- 1) **Rx Header and Payload Compression are standard (non-FAST) operational features for Comtech EF Data's Advanced VSAT Series group of products. If these features are listed in the FAST Configuration table, they are always indicated as Enabled.**
- 2) **PTP is not available in this firmware release. Once operable, this protocol will be used to synchronize clocks throughout a computer network. When the hardware required for this option is not installed in the CDD-880, this page displays the message "Disabled (No Hdware)".**

5.2.2 FAST Upgrade

Do these steps to perform the CDD-880 FAST Feature upgrade:

Step	Task
1	Use the FAST Configuration table to view the currently installed features. Any options that appear as Disabled or Not Installed in the table's <i>Status</i> column may be purchased as a FAST upgrade.
2	<p>The serial number of the CDM-800 is required by Comtech EF Data when ordering FAST option upgrades.</p>  <p>Take note of this number, provided here in the FAST Upgrade section, before contacting Comtech EF Data:</p> <p>Serial Number: _____</p>
3	<p>Contact Comtech EF Data Product Support:</p> <ul style="list-style-type: none"> • Provide the CDD-880 Serial Number to the representative. • Identify and purchase the desired FAST option(s). • Obtain the invoice, the 20-digit FAST Access Code, and the FAST option activation instructions.
4	Carefully enter the FAST Access Code into the FAST Code register text box.
5	Click [Submit] to execute the FAST Upgrade.
6	<p>The unit either accepts or rejects the code, and the FAST Configuration table refreshes to reflect any upgrades in operation.</p> <p>If the unit rejects the code entry, repeat the FAST Access Code entry procedure. Should the code entry error persist, contact Comtech EF Data Product Support for further assistance.</p> 

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

6.1 Overview

Ethernet-based Remote Product Management of the CDD-880 Multi Receiver Router is available using the rear panel 'ETHERNET | TRAFFIC | GE' (traffic) and 'ETHERNET | TRAFFIC/MANAGEMENT | GE' (M&C) RJ-45 10/100/1000 BaseT Gigabit Ethernet ports.



- 1) **YOU MAY PROCEED WITH ETHERNET-BASED REMOTE PRODUCT MANAGEMENT (SNMP OR WEB SERVER), ASSUMING THAT:**
 - **YOU ARE OPERATING THE CDD-880 WITH THE LATEST VERSION FIRMWARE FILES.**
 - **YOU HAVE CONNECTED THE CDD-880 TO A USER-SUPPLIED, WINDOWS-BASED PC AS FOLLOWS:**
 - **THE PC SERIAL PORT IS CONNECTED TO THE CDD-880 REAR PANEL 'CONSOLE' PORT WITH A USER-SUPPLIED SERIAL CABLE.**
 - **THE PC ETHERNET PORT IS CONNECTED TO THE CDD-880 REAR PANEL 'ETHERNET | TRAFFIC/MANAGEMENT | GE' 10/100/1000 BASE-T GIGABIT ETHERNET M&C PORT WITH A USER-SUPPLIED HUB, SWITCH, OR DIRECT ETHERNET CABLE CONNECTION.**
 - **THE USER PC IS RUNNING A TERMINAL EMULATION PROGRAM (FOR OPERATION OF THE CDD-880 SERIAL INTERFACE) AND A COMPATIBLE WEB BROWSER (FOR OPERATION OF THE CDD-880 HTTP (WEB SERVER) INTERFACE).**
 - **YOU HAVE NOTED THE CDD-880 MANAGEMENT IP ADDRESS USING THE CDD-880 SERIAL INTERFACE.**
- 2) **COMTECH EF DATA RECOMMENDS USE OF THE SERIAL REMOTE INTERFACE AND ETHERNET-BASED SNMP INTERFACE ONLY FOR ADVANCED USERS. ALL OTHER USERS ARE STRONGLY ENCOURAGED TO USE THE CDD-880 HTTP INTERFACE FOR MONITOR AND CONTROL (M&C) OF THE CDD-880.**
- 3) **THE SERIAL AND HTTP INTERFACE FIGURES FEATURED THROUGHOUT THIS CHAPTER ARE INTENDED FOR USER REFERENCE ONLY AND ARE SUBJECT TO**

CHANGE. THE FIRMWARE INFORMATION (I.E., REVISION LETTERS, VERSION NUMBERS, ETC.) AS DISPLAYED MAY DIFFER FROM YOUR SETUP.

6.2 Ethernet Management Interface Protocols

The User PC affords access to Ethernet-based remote monitor and control (M&C) of the CDD-880 through two separately-operated protocols:

- **Simple Network Management Protocol (SNMP).** This non-secure interface requires a user-supplied Network Management System (NMS) and a user-supplied Management Information Base (MIB) File Browser.
- **The CDD-880 HTTP (Web Server) Interface.** This non-secure interface requires a compatible user-supplied Web browser such as Internet Explorer.

6.2.1 Ethernet Management Interface Access

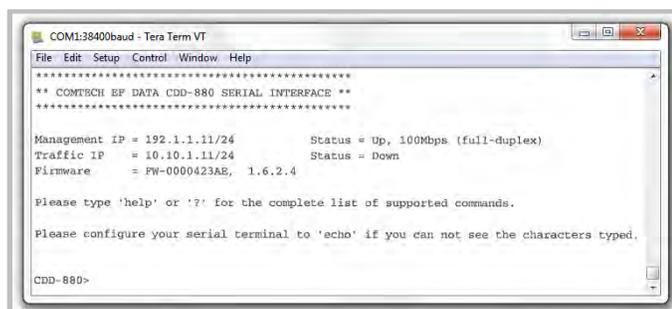


Figure 6-1. CDD-880 Serial Interface

Access to the CDD-880 Ethernet Management Interfaces requires you to specify the unit Management IP Address. You may obtain this information via use of a terminal emulator connected to the CDD-880 rear panel, 9-pin serial '**CONSOLE**' port. As shown, a number of operational parameters (including the unit factory-default IP Addresses) are displayed on the CDD-880 Serial Interface upon power-up of the unit.

The factory-assigned default IP Addresses are provided in the table that follows (if otherwise assigned, use the last column to write down the IP Addresses for future reference):

Description	Default Address	User-assigned Address
TRAFFIC / MANAGEMENT GE IP Address	192.168.1.11	_____
'TRAFFIC / GE' (GigE Traffic) IP Address	10.10.1.11	_____



Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

6.2.2 SNMP Interface

The Simple Network Management Protocol (SNMP) is an Internet-standard non-secure protocol for managing devices on IP networks. An SNMP-managed network consists of three key components:

- **The managed device.** This includes the CDD-880 Multi Receiver Router.
- **The SNMP Agent.** The software that runs on the CDD-880. The CDD-880 SNMP Agent supports both **SNMPv1** and **SNMPv2c**.
- **The user-supplied Network Management System (NMS).** The software that runs on the manager.

6.2.2.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management of a unique device. A MIB file consists of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function. These MIB files should be compiled in a user-supplied MIB Browser or SNMP Network Monitoring System server. The following MIB files are associated with operation of the CDD-880:

MIB File/Name (where 'x' is revision letter)	Description
FW10874-2x.mib ComtechEFData Root MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID: Name: comtechEFData Type: MODULE-IDENTITY OID: 1.3.6.1.4.1.6247 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData
FW-0000423x_CDD880.mib CDD-880 MIB file	MIB file consists of all of the OIDs for CDD-880 M&C.

6.2.2.2 SNMP Community Strings



In SNMP v1/v2c, the SNMP Community String is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern.

The CDD-880 uses Community Strings as a password scheme that provides authentication before gaining access to the CDD-880 Agent MIBs. They are used to authenticate users and determine access privileges to the SNMP agent.

Type the SNMP Community String into the user-supplied MIB Browser or Network Node Management software. Two Community Strings are defined for SNMP access:

- Read Community default = public
- Write Community default = private



For proper SNMP operation, make sure to use the CDD-880 MIB files with the associated version of the CDD-880 M&C. Refer to the CDD-880 FW Release Notes for information on the required FW/SW compatibility.

6.2.3 HTTP (Web Server) Interface

A user-supplied Web browser allows the full monitoring and control (M&C) of the CDD-880 from its HTTP Interface. This non-secure embedded Web application is designed for, and works best with, Microsoft Internet Explorer Version 7.0 or higher.

6.2.3.1 User Login

Type the CDD-880 Management IP Address (shown here as `http://xxx.xxx.xxx.xxx`) into the **Address** area of the User PC Web browser:



The login page, similar to this example, opens.



Enter the assigned **User Name** and **Password** – the default for both is **comtech**. Click **[Log On]**.

If the User Name and Password are accepted: The CDD-880 HTTP Interface Home page, similar to this example, appears:



6.2.3.2 HTTP Interface – Operational Features

6.2.3.2.1 Virtual Front Panel



The top of every page in the CDD-880 HTTP Interface features a read-only ‘Virtual Front Panel’ (VFP). This feature emulates the CDD-880 front panel real-time LED operation. It also displays the currently running Firmware Version; the current Working Mode (Router or BPM); and the operational state of the CDD-880 – “Active” or “Inactive”:

- “Active” indicates to you that the page as displayed is “live” and up-to-date;
- “Inactive” indicates to you either that the page, as displayed, is “stale” and is not updating, or that the unit is in a transitional state (e.g., a reboot is in process).

The virtual LEDs provide ‘heads-up’ operational status indicators that react to any changes made to unit operation, and convey operational states. To ensure that your web browser correctly displays the LED feature, Comtech EF Data recommends that you do these steps (this example uses Microsoft Internet Explorer):

Step	Task
1	On the Tools menu, click Internet Options.
2	On the General tabbed page: Under Browsing history, click [Settings].
3	On the Temporary Internet Files and History Settings page: Under Check for Newer Versions of Stored Pages: click Every Time I visit the webpage.
4	Click [OK] to save the selection and close the Temporary Internet Files and History Settings page.
5	Click [OK] to close the Internet Options page.
6	Restart your browser.

The VFP reflects the active operating state of the CDD-880 and its physical front panel LEDs as follows:

LED	State	Condition
UNIT STATUS	Green	No Unit Faults or Alarms.
	Amber	No Unit Faults, but an Alarm exists.
	Red	A Unit Fault exists (Example: PSU fault).
STORED EVENT	Amber	There is a Stored Event in the log, which can be viewed from the HTTP Interface
	Off	There are no Stored Events.
ONLINE	Green	The Unit is On Line, and carrying traffic.
	Off	The Unit is Off Line (standby) – forced by externally connected 1:1 or 1:N redundancy system.
GE LINK/ACTIVITY	Green (solid)	Traffic Ethernet is connected, but no traffic exists.
	Green (blinking)	Ethernet activity detected.
	Off	Traffic Ethernet is not connected.
Rx TRAFFIC 1 through Rx TRAFFIC 12	Green (solid)	No Rx Traffic Faults (demod and decoder are locked, everything is OK).
	Green (blinking)	No Rx Traffic Faults, blinks when a packet is being received from the satellite link to this unit.
	Amber	Rx Traffic has an Alarm.
	Red	Rx Traffic has a Fault.
	Off	Demod is disabled.

6.2.3.2.2 Navigation

The HTTP Interface features navigation tabs, located just below the Virtual Front Panel, at the top of each page. Once you click a navigation tab, you may click an available primary page tab. In turn, any nested tabs appear for further selection.



This manual uses a naming format for all Web pages to indicate the depth of navigation needed to view the subject page: “**Top Level Tab | Primary Page Tab | Nested Tab**”.

For example: “**Status | Statistics | Traffic**” means “first click the top-level **Status** navigation tab; then, click the **Statistics** primary page tab; finally, click the nested **Traffic** tab.”

6.2.3.2.3 Page Sections

Each page features one or more sections. The title at the upper-left corner of each page or page section provides indicates its operational features. Each section can feature editable fields, action buttons, and read-only displays that are specific to that section.



This manual explains the purpose and operation for each Web page on a **per-page, per-section** basis.

6.2.3.2.4 Action Buttons

Action buttons are important in the HTTP Interface. Click an action button to do one of these tasks:



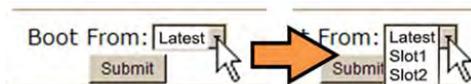
- Reset changed parameters to remove **unsaved** changes.
- Permanently save changes.
- Refresh the page with current data.



If you edit a field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

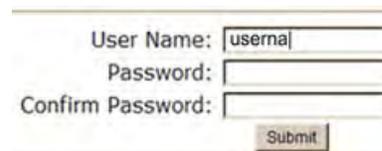
6.2.3.2.5 Drop-down Lists

A drop-down list lets you choose from a list of selections. Left-click the drop-down button to open the list. Then, left-click on an item to select that choice.



6.2.3.2.6 Text or Data Entry

Text boxes let you type data into a field. An action button may be associated with a single text box, or a group of text boxes. For any text box, left-click anywhere inside the box, type the desired information into that field, and be sure to press **[ENTER]** when done.



Click the related action button to save the data.



If you edit a field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

6.2.3.3 HTTP Interface – Menu Tree



Any diagram block that is marked with (*) denotes a page that is functional only when that optional FAST Feature has been purchased and activated. The diagram block marked with (**) denotes that this page is functional only when a LOW-NOISE BLOCK DOWN CONVERTER (LNB) is installed and is recognized as operational.

Figure 6-2 illustrates the menu hierarchy for the CDD-880 HTTP Interface. It features five navigation tabs (shown in blue) located below the VFD at the top of each page. Primary page tabs (green) and nested page tabs (yellow or grey) grant access to individual Web pages.

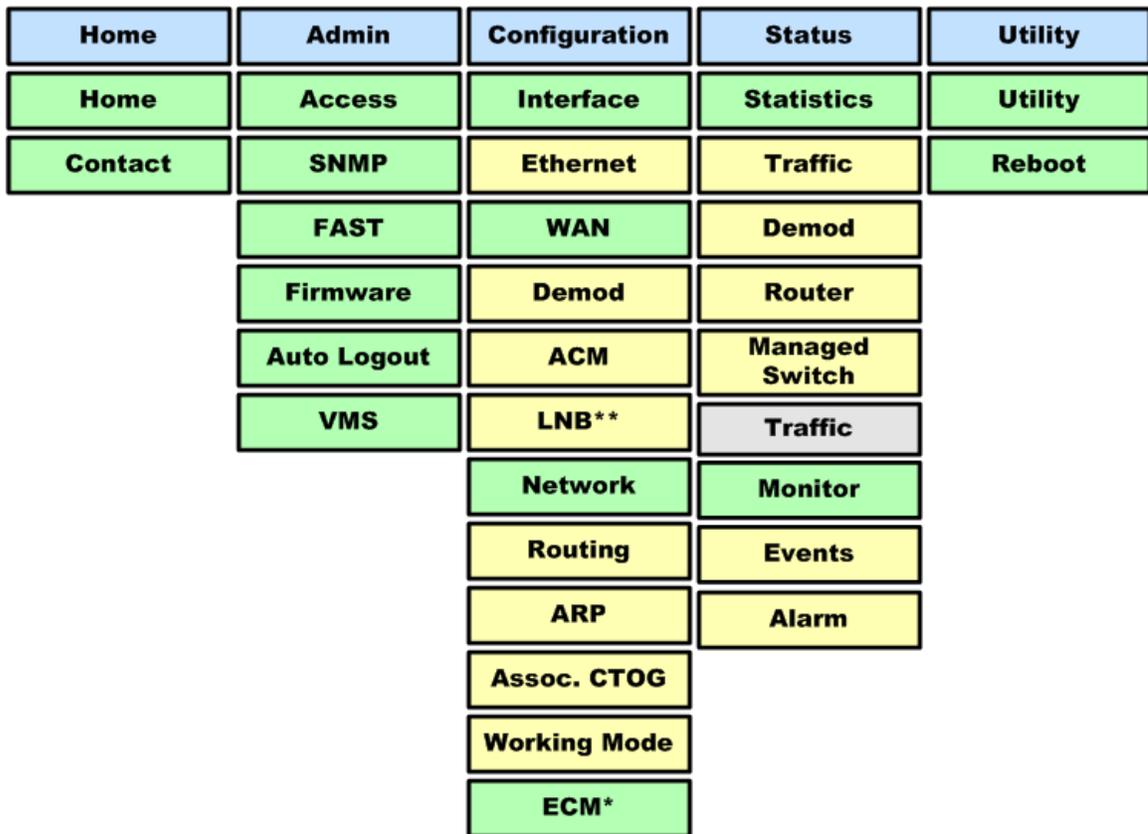


Figure 6-2. CDD-880 HTTP Interface – Menu Tree (FW Ver. 1.6.2.4)

6.3 HTTP Interface Page Descriptions



- 1) Access to and availability of certain CDD-880 HTTP Interface pages depends upon the optional FAST Features purchased for operation, and/or the detected presence of auxiliary products (e.g., VIPERSAT Management System, LNB, etc.) installed and configured for use with the CDD-880. Such operational restrictions will be noted in the subsections that follow through the end of this chapter.
- 2) The HTTP Interface pages, as depicted in the figures featured through the end of this chapter, do not show the page banner and VFP (Virtual Front Panel). These figures depict operational examples that will vary from your actual implemented network. They are provided for reference purposes only.

6.3.1 Home Pages

Click the **Home** or **Contact** tab to continue.

6.3.1.1 Home | Home

Use this page to identify the product and its current operating firmware version. Click the **Home** navigation tab and/or the nested page tab to return to this page from anywhere in the HTTP Interface.

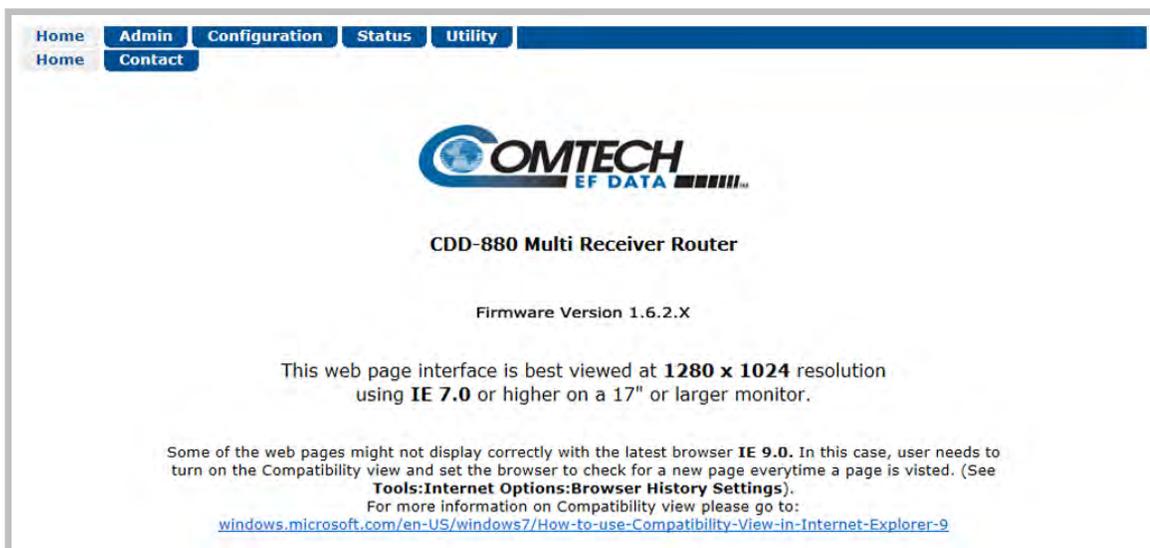


Figure 6-3. Home | Home Page

6.3.1.2 Home | Contact

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

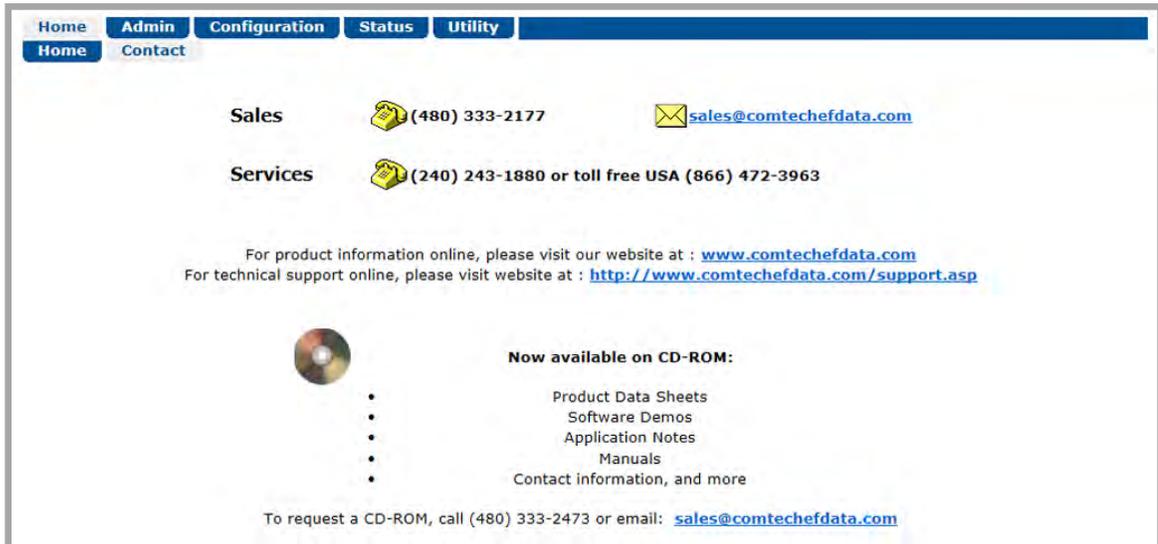


Figure 6-4. Home | Contact Page

6.3.2 Admin (Administration) Pages

Use these pages to set up user access, manage the firmware load preferences, and activate CDD-880 FAST features.



The Admin pages are available only to users who have logged in using the Administrator Name and Password.

Click the **Access**, **SNMP**, **FAST**, **Firmware**, **Auto Logout**, or **VMS** tab to continue.

6.3.2.1 Admin | Access

The Administrator must use this page to manage the CDD-880 HTTP Interface user access settings.

The screenshot shows the 'Admin | Access' page. At the top, there is a navigation bar with tabs for 'Home', 'Admin', 'Configuration', 'Status', 'Utility', 'Access', 'SNMP', 'FAST', 'Firmware', 'Auto Logout', and 'VMS'. The 'Access' tab is currently selected. Below the navigation bar, the page title is 'User Access'. The main content area contains three input fields: 'User Name' (with the value 'comtech' and a '(max length 15)' note), 'Password' (with masked characters and a '(max length 15)' note), and 'Confirm Password' (with masked characters). A 'Submit' button is located below the 'Confirm Password' field.

Figure 6-5. Admin | Access Page

User Access

- Enter a **User Name**. The **User Name** can be any alphanumeric combination with a maximum length of 15 characters. The factory default is **comtech**.
- Enter a **Password**. The **Password** can be any alphanumeric combination with a maximum length of 15 characters. The factory default is **comtech**.
- Re-enter the new **Password** in the **Confirm Password** text box.

Click **[Submit]** to save.

6.3.2.2 Admin | SNMP



Sect. 5.3 SNMP Interface

The Administrator must use this page to manage the CDD-880 SNMP (Simple Network Management Protocol) settings.

Figure 6-6. Admin | SNMP Page

SNMP Configuration



THE SNMP TRAP DESTINATION IP ADDRESS FEATURE IS A **FUTURE OFFERING**. IT IS NOT OPERATIONAL AT THIS TIME.

- Enter an **SNMP Read Community** string. The SNMP Read Community string can be any combination of characters and a length of 4 to 15 characters. The factory default SNMP Read Community string is **public**.

Click **[Submit]** to save.

- Enter an **SNMP Write Community** string. The SNMP Write Community string can be any combination of characters and a length of 4 to 15 characters. The factory default SNMP Write Community string is **private**.

Click **[Submit]** to save.

6.3.2.3 Admin | FAST

The CDD-880 has a number of optional features that you may activate after you purchase their unique authorization codes from Comtech EF Data Product Support. Use this page to enter these **Fully Accessible System Topology (FAST) Access Codes**. The example here shows the page appearance with the CDD-880 equipped with five dual demodulator cards.



See **Chapter 5. FAST ACTIVATION PROCEDURE** for the complete information on activating your FAST Features via the CDD-880 HTTP Interface.



- 1) **Header and Payload Compression** are standard (non-FAST) operational features for Comtech EF Data’s Advanced VSAT Series group of products. If these features are listed in the FAST Configuration table, they are always indicated as Enabled.
- 2) **Precision Time Protocol (PTP)** is not available in this firmware release. Once operable, this protocol will be used to synchronize clocks throughout a computer network. When the hardware required for this option is not installed in the CDD-880, this page displays the message “Disabled (No Hdwre)”.

FAST Configuration	
Option	Status
Demod Card Slot1:	VersaFEC Installed
Demod Card Slot2:	VersaFEC Installed
Demod Card Slot3:	VersaFEC Installed
Demod Card Slot4:	VersaFEC Installed
Demod Card Slot5:	VersaFEC Installed
Demod Card Slot6:	Not Installed
Rx Data and Symbol Rate:	CCM: Up to Max/ACM: Up to Max
Rx Header Decompression:	Enabled
Rx Payload Decompression:	Enabled
Precision Time Protocol	Disabled (No Hdwre)

FAST Upgrade

Serial Number: 111111111

FAST Code:

Figure 6-7. Admin | FAST Page

6.3.2.4 Admin | Firmware



Chapter 4. UPDATING FIRMWARE

The Administrator must use this page to select which image (boot Slot #) is to be designated as the active running firmware image – i.e., the version loaded for operation upon power-up or soft reboot.

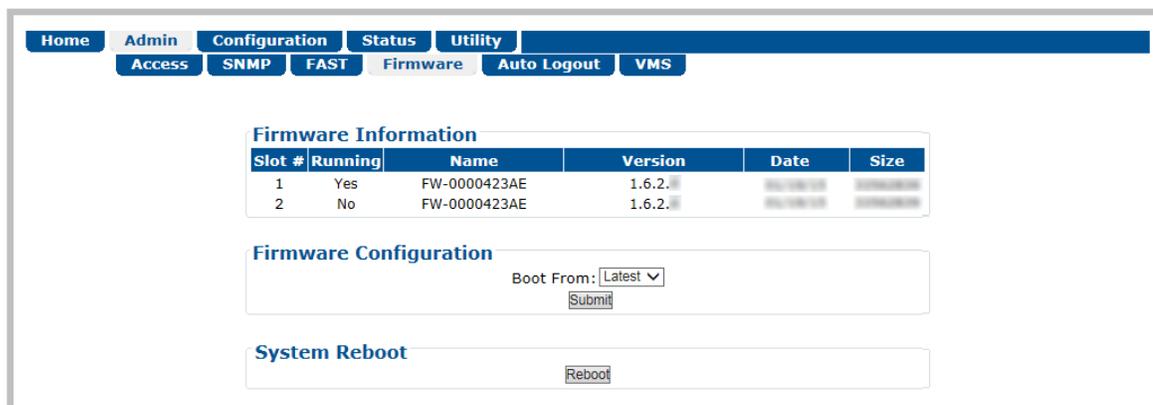


Figure 6-8. Admin | Firmware Page

Firmware Information

This read-only status section displays the operating status for the CDD-880 FW-0000423 firmware versions loaded into Slot #1 and Slot #2.

Firmware Configuration

Use the **Boot From:** drop-down list to select **Latest**, **Slot 1**, or **Slot 2**. The default selection is **Latest**, in which the unit will automatically select the image that contains the most current firmware.

Click **[Submit]** to save. Note that the Firmware Information section, which in **Figure 6-8** displays **Slot #1** as the designated active running firmware image, will not update until after the unit is rebooted.

System Reboot

Click **[Reboot]** to reboot the CDD-880. Once the unit reboots, you must log in once again to resume use of the HTTP Interface. See the **Utility | Reboot** page (**Sect. 6.3.5.2**) for full details about the reboot process.

6.3.2.5 Admin | Auto Logout

The Administrator must use this page to execute the Auto Logout security measure. When you configure Auto Logout, the active session terminates if the unit remains idle (i.e., when no user activity occurs) beyond your designated Logout Time. You must then log in with a valid user name and password to resume use of the CDD-880 HTTP Interface.



Home Admin Configuration Status Utility
Access SNMP FAST Firmware Auto Logout VMS

Auto Logout Configuration

Logout Time: Min (0-15; 0 disables the Auto Logout feature)

Figure 6-9. Admin | Auto Logout Page

Auto Logout Configuration

Set an automatic logout time to safeguard access to an already logged-in unit:

- Enter a value from **1** to **15** minutes into the **Logout Time** box to configure this feature.
- Enter a value of **0** to disable this feature.

Click **[Submit]** to save.

6.3.2.6 Admin | VMS



VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

The screenshot shows the VMS Admin interface. At the top, there is a navigation bar with tabs for Home, Admin, Configuration, Status, and Utility. Below this, there are sub-tabs for Access, SNMP, FAST, Firmware, Auto Logout, and VMS. The main content area is divided into two sections: Management System Configuration and Management System Status. The Management System Configuration section contains fields for Network ID (set to 1), Management Base Port (set to 49152), and Management Multicast IP (set to 239.1.2.3). The Management System Status section displays VMS IP Address (0.0.0.0), Registration Status (Not Registered), and VMS Version (Not yet received).

Figure 6-10. Admin | VMS Page

Management System Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Network ID** (1 to 254) – The **Network ID** designation defines to which network the Gateway Router belongs. All devices in a common network will have the same network ID. VMS uses the Network ID to identify Vipersat units within a network, and allows the VMS to manage multiple networks, each with its own unique network ID number.
- **Management Base Port**– The **Management Base Port** sets the starting IP port addressing for all VMS and ACM messages.



CAUTION – MAKE NOTE OF THE FOLLOWING:

- Use this setting **ONLY** if network port addressing is in contention. You should otherwise leave this setting at default (hex) C000 (des) 49152 to avoid unnecessary configuration changes.
- If you change this port number (i.e., enter a value and click [Submit] to save), it will affect internal management operations across the entire network. You will be required to make configuration changes to all modems.
- While this page is operational only when the optional VIPERSAT MANAGEMENT SYSTEM (VMS) is installed and operational, the Management Base Port number is essential to proper operations with or without the VMS feature.

- **Management Multicast IP** – This is the Multicast IP Address assigned to all Vipersat network units to receive management messages from the VMS. This address must match the VMS Transmit Multicast Address.

Once the CDD-880 is registered in the Vipersat network, the VMS takes full management control of the Data Rate, Symbol Rate, Frequency, and MODCOD demodulator parameters.

Management System Status

This read-only section provides available information on the VMS's IP Address, Registration Status, and Version.

6.3.3 Configuration Pages

Use the nested 'Configuration' pages to configure all unit parameters.

Click the **Interface**, **WAN**, **Network**, or **ECM** tab to continue.



MEO (Medium Earth Orbit) is not available in this firmware release. The MEO tab and its nested page, while available and selectable on this interface, are therefore NOT OPERATIONAL.

6.3.3.1 Configuration | Interface | Ethernet

Use this page to configure the rear panel **ETHERNET | TRAFFIC/MANAGEMENT | GE** and **ETHERNET | TRAFFIC | GE 10/100/1000 BaseT** Gigabit Ethernet ports.

The figure displays two screenshots of the 'Configuration | Interface | Ethernet' page. The top screenshot shows the 'Port Diversity Configuration' section with 'Port Enable/Disable' set to 'Disable'. The bottom screenshot shows the same page with 'Port Enable/Disable' set to 'Enable', and includes 'Active Ethernet Port' and 'Standby Ethernet Port' sections.

Top Screenshot (Port Diversity DISABLED):

- Port Diversity Configuration: Port Enable/Disable:
- GE Traffic / Management (Router Port):
 - MAC Address: 00:06:b0:02:9b:ed
 - IP Address/CIDR Mask:
 - Link Configuration:
 - Negotiated Link Mode: 1000 Base-T/Full Duplex
- GE Traffic (Bridge Port):
 - MAC Address: 00:06:b0:02:9b:ee
 - IP Address/CIDR Mask:
 - Link Configuration:
 - Negotiated Link Mode: Link Down

Bottom Screenshot (Port Diversity ENABLED):

- Port Diversity Configuration: Port Enable/Disable:
- Active Ethernet Port:
 - Traffic IP Address:
 - Management IP Address:
 - MAC Address: 00:06:b0:02:9b:ed
 - Link Configuration:
 - Negotiated Link Mode: 1000 Base-T/Full Duplex
 - Ethernet Port: Traffic/Management
- Standby Ethernet Port:
 - MAC Address: 00:06:b0:02:9b:ee
 - Link Configuration:
 - Negotiated Link Mode: Link Down
 - Ethernet Port: Traffic

(TOP) Page with Port Diversity DISABLED
(BOTTOM) Page with Port Diversity ENABLED

Figure 6-11. Configuration | Interface | Ethernet Page

Port Diversity Configuration



This feature must be used in a setup with multiple (i.e., two or more) switches. The switches need to be running Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP).



See Appendix E. PORT DIVERSITY for detailed information on using this feature.

Use the drop-down list to **Enable** or **Disable** this feature. Click **[Submit]** to save.

When enabled, the Port Diversity feature changes the appearance of this page to reflect the Active and Standby status of each port, as shown at bottom in **Figure 6-11**.

GE Traffic / Management (Router Port) / Active Ethernet Port

GE Traffic (Bridge Port) / Standby Ethernet Port

The acceptable/valid operating ranges for items in this section are provided in parentheses.

Typical for either page section/version:

- **MAC Address (read-only)** – The MAC Address cannot be changed.
- **IP Address / CIDR Mask (8 to 30)** – Use this box to enter the IP Address and CIDR (Classless Inter-Domain Routing) Subnet Mask.



- 1) The IP Addresses for the ETHERNET | TRAFFIC/MANAGEMENT | GE and ETHERNET | TRAFFIC | GE ports must be different and on separate subnets.
- 2) The ETHERNET | TRAFFIC/MANAGEMENT | GE and ETHERNET | TRAFFIC | GE ports are isolated; the CDD-880 can pass traffic from one subnet to the other if this is how the route table is configured.
- 3) The ETHERNET | TRAFFIC/MANAGEMENT | GE port serves as the dedicated Ethernet-based monitor and control interface between the CDD-880 and the User PC.

- **Link Configuration** – Use the drop-down list to select the line speed and duplex setting for the specified port. The available settings are **Auto***, **10 BaseT/Half Duplex**, **10 BaseT/Full Duplex**, **100 BaseT/Half Duplex**, or **100 BaseT/Full Duplex**.



* Auto is the recommended configuration selection.

- **Negotiated Link Mode** – The actual negotiated line speed and duplex setting for the specified port is displayed here. The read-only, viewable settings are **10 BaseT/Half Duplex**, **10 BaseT/Full Duplex**, **100 BaseT/Half Duplex**, **100 BaseT/Full Duplex**, or **1000 BaseT/Full Duplex**.

Click **[Submit]** to save.

6.3.3.2 Configuration | WAN Pages

Use the nested **WAN** pages to configure WAN-based operating parameters. Click the **Demod**, **ACM**, or **LNB** tab to continue.



The LNB page is functional **ONLY** when this optional product is installed.

6.3.3.2.1 Configuration | WAN | Demod (Demodulator)



The upper range of Data and Symbol Rate selection requires activation of the optional 'RECEIVE SYMBOL RATE' FAST Feature.

Use this page to configure the CDD-880 Rx demodulator operations. Figure 6-12 shows the page appearance with the CDD-880 equipped with five dual demodulator cards.

Global Demodulator Settings

Rx RF Frequency: Base 0.0000 MHz, Center 35.0000 MHz, Upper Limit 70.0000 MHz. LNB LO Mix: Low (-), 0 MHz. Rx L-Band Frequency Range: Base 1200.0000 MHz, Center 1235.0000 MHz, Upper Limit 1270.0000 MHz.

Individual Demodulator Settings

NOTE: Changing the modcod in CCM mode will change the symbol rate

Demod	Enabled	Symbol Rate (Kbps)	Data Rate (Kbps)	Frequency (950-2150MHz)	MODCOD	Spectrum Invert	Descram.	Eb/No Alarm Pt (0.1-16.0 db)	Circuit ID	Acq. Range (1-200 kHz)
# 1	<input checked="" type="checkbox"/>	4500.000	2194.072	1205.0000	BPSK 0.488	Normal	Normal	1.0	RxCircuitID1	8
# 2	<input checked="" type="checkbox"/>	4500.000	193.960	1250.0000	16-QAM 0.853	Normal	Normal	1.0	RxCircuitID2	8
# 3	<input type="checkbox"/>	1998.273	975.772	1208.0000	BPSK 0.488	Normal	Normal	5.0	RxCircuitID3	10
# 4	<input type="checkbox"/>	1000.000	2523.715	1205.0000	QPSK 0.631	Normal	Normal	5.0	RxCircuitID4	10
# 5	<input type="checkbox"/>	141.734	200.000	1225.0000	QPSK 0.706	Normal	Normal	5.0	RxCircuitID5	10
# 6	<input type="checkbox"/>	141.734	200.000	1230.0000	QPSK 0.706	Normal	Normal	5.0	RxCircuitID6	10
# 7	<input type="checkbox"/>	141.734	200.000	1235.0000	QPSK 0.706	Normal	Normal	5.0	RxCircuitID7	10
# 8	<input type="checkbox"/>	141.734	200.000	1240.0000	QPSK 0.706	Normal	Normal	5.0	RxCircuitID8	10
# 9	<input type="checkbox"/>	4500.000	4801.147	1250.0000	QPSK 0.533	Normal	Normal	5.0	RxCircuitID9	10
# 10	<input type="checkbox"/>	100.000	106.692	1260.0000	QPSK 0.533	Normal	Normal	5.0	RxCircuitID10	10

Figure 6-12. Configuration | Demod Page

Global Demodulator Settings

This Demodulator Frequency Calculator conveniently allows you to eliminate the guesswork associated between the demodulator's L-Band Frequency and the terminal's RF frequency. If the LNB LO Mix and LNB LO Frequency and either of the frequencies are known, then the other can be calculated. Use this calculator to start from either the Rx RF Frequency or Rx L-Band Frequency and calculate the "other" frequency.

The CDD-880 supports a contiguous 70 MHz of common bandwidth feeding all equipped demodulators in the chassis. The Rx Frequency Range is the starting frequency for this range – the occupied bandwidth of the carrier terminating into each demodulator must therefore fall completely within this 70 MHz of bandwidth

The valid operating range for each item in this section is noted in parentheses.

- **Rx RF Frequency** (0 to 67080 MHz) – This is the frequency at which the terminal receives from the satellite. Once you enter a non-zero Rx RF Frequency or Rx L-Band Frequency value and enter the LNB LO Mix and LNB LO Frequency, the demodulator's Rx L-Band or RF Frequency will be automatically configured.

Enter the Rx RF Frequency in MHz. Click **[Submit]**. Upon submission, if you enter the LNB LO Frequency, the resulting Rx RF Frequency displays.

If the LNB LO Frequency is left at the default configuration of zero, the Rx RF Frequency will not be calculated.



The LNB LO Mix and LNB LO Frequency entries are provided for calculation purposes only. LNB configuration is not updated as a result of configuring these parameters.

- **LNB LO Mix** – Use this drop-down list to select the LNB LO (Low Oscillator) Mix as **Upconv (SUM): RF=LO+LBand** or **DownConv (Diff): RF=LO-LBand**.



Consult your LNB adjunct product datasheet or its Installation and Operation Manual for the type of LNB (Upconverter [Sum] or Downconverter [Diff]) being used.

- **LNB LO Frequency** – Enter the known LNB Rx LO (Low Oscillator) Frequency in MHz.



Consult your LNB adjunct product datasheet or its Installation and Operation Manual for the LO Frequency.

- **Rx L-Band Frequency** (950 to 2150 MHz for L-Band, 50 to 180 MHz for IF) – Enter the L-Band or IF-Band frequency in MHz. Click [Submit].

Individual Demodulator Settings



The upper range of Data and Symbol Rate selection requires activation of the optional 'RECEIVE DATA RATE' FAST Feature.

Individual Demodulator Settings											
NOTE: Changing the modcod in CCM mode will change the symbol rate											
Demod	Enabled	Symbol Rate (Kbps)	Data Rate (Kbps)	Frequency (950-2150MHz)	MODCOD	Spectrum Invert	Descram.	Eb/No Alarm Pt (0.1 - 16.0 db)	Circuit ID	Acq. Range (1 - 200 kHz)	
#1	<input checked="" type="checkbox"/>	4500.000 Submit	2194.072 Submit	1205.0000	BPSK 0.488	Normal	Normal	1.0	RxCircuitID1	8	Submit
#2	<input checked="" type="checkbox"/>	4500.000 Submit	193.960 Submit	1250.0000	16-QAM 0.853	Normal	Normal	1.0	RxCircuitID2	8	Submit

The HTTP Interface polls current operations and populates this section with the configured demodulators (i.e., **Demod #1** through **Demod #12**). If a slot is polled as empty or otherwise unrecognizable, this page does not display the assigned row. During operation, some parameters are automatically controlled – either by the ACM algorithm or by the VMS – when executing dSCPC switches. During these times, some page functionality becomes disabled and affected features display information on a read-only basis.

For each operating demodulator, note the following selections, on a per-column basis (the acceptable/valid operating ranges for items in this section are provided in parentheses). From left to right:

Column	Description
Demod #	This is the available "FILLED" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
Demod Enable	Click this option button to enable the slot. Click [Submit] to execute this operational change.
Rx Symbol Rate	(16 kbps to 4.5 Mbps) – Enter the Rx Symbol Rate in kbps, and then click [Submit] to save.
Rx Data Rate	(16 kbps to 15.350 Mbps) – Enter the Rx Data Rate in kbps, and then click [Submit] to save. When Adaptive Coding and Modulation (ACM) is set to Enable, the Data Rate is set automatically (manual configuration of Data Rate is disabled), and the appearances of the Rx Data Rate and Rx MODCOD columns change as follows:
Frequency	(950 to 2150 MHz) – Enter the Rx frequency, in MHz.

Demod #	Demod Enable	Rx Symbol Rate (Kbps)	Rx Data Rate (Kbps)	Frequency (MHz)	Rx MODCOD	Rx Spectrum Invert	Rx Descram.	Eb/No Alarm Pt (0.1 - 16.0 db)	Circuit ID	Acquisition Range
#1	<input checked="" type="checkbox"/>	4500.000	ACM: 2194.073	1205.0000	ACM: BPSK .488 (0)	Normal	Normal	1.0	Demod1	10

Column	Description
Rx MODCOD	Use the drop-down list to select the demodulation type and VersaFEC rate (MODCOD): <ul style="list-style-type: none"> • QPSK 0.488 • QPSK 0.533 • QPSK 0.631 • QPSK 0.706 • QPSK 0.803 • 8-QAM 0.642 • 8-QAM 0.711 • 8-QAM 0.780 • 16-QAM 0.731 • 16-QAM 0.780 • 16-QAM 0.829 • 16-QAM 0.853
Rx Spectrum Invert	Use the drop-down list to select Spectrum Inversion operation as either Normal or Inverted.
Rx Descram	Use the drop-down list to select Rx Descrambling as either Off or Normal.
Eb/No Alarm Pt	(0.1 to 16.0 dB) – Enter the Eb/No Alarm Point value, in dB. This value, as calculated by the demodulator, is the energy per bit (Eb) divided by the noise spectral density (No).  When ACM is enabled, the CDD-880 will issue an alarm only if the demodulator is at the lowest available MODCOD (BPSK).
Circuit ID	(4 to 24 characters) – Enter an identification label for the demod. Click [Submit] to save.
Acquisition Range	The Acquisition Range is programmable in 1kHz increments, subject to the following: <ul style="list-style-type: none"> • Below 64 ksymbols/sec: ± 1 to $\pm(Rs/2)$ kHz, where Rs = symbol rate in ksymbols/sec. • Between 64 and 389 ksymbols/sec: ± 1 up to a maximum of ± 32kHz. • Above 389 ksymbols/sec: ± 1 to $\pm(0.1Rs)$ kHz, up to a maximum of ± 200 kHz. Use these guidelines to enter the Acquisition Range. Click [Submit] to save.

6.3.3.2.2 Configuration | WAN | ACM (Adaptive Coding and Modulation)



Appendix H. VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION)

Use this page to inspect CDD-880 ACM operations. **Figure 6-13** shows the page as it appears with the CDD-880 equipped with a single dual demodulator card.

The screenshot displays the 'ACM Demodulator Settings' page. At the top, there are navigation tabs: Home, Admin, Configuration, Status, and Utility. Under 'Configuration', there are sub-tabs: Interface, WAN, Network, ECM, MEO, Demod, ACM, and LNB. The main content area is titled 'ACM Demodulator Settings' and contains a table with the following data:

Demod #	Remote CDM-840 IP Address	Current Es/No	Current Rx MODCOD
#1	0.0.0.0	Unlocked	BPSK .488 (0)
#2	0.0.0.0	Unlocked	16-QAM .853 (11)

Below the settings table is a section titled 'Rx ACM Events' with a table showing event data:

Date	Time	Demod #	New Es/No	New Rx ModCod	New Rx Data Rate	840 IP
		0	0	0	0	0.0.0.0

At the bottom of the events table, there are two buttons: 'Clear ACM Events' and 'Show Last 15 Events'.

Figure 6-13. Configuration | ACM Page

Return Link (Inbound) ACM allows the CDM-840 Gateway Router to dynamically adjust the VersaFEC MODCODs that are sent to each CDD-880, based upon the conditions between the remote and the hub. These conditions include antenna size, look angle, satellite band, and the current environmental conditions. The CDD-880 automatically and periodically sends its Rx

Es/No, via the CTOG-250, to an associated CDM-840 that will use this information to adjust its Tx MODCOD.

ACM Demodulator Settings (Read-only)

This table is auto-populated for each operating demodulator. From left to right:

Column	Description
Demod #	This is the available "FILLED" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
Remote CDM-840 IP Address	This is the CDM-840 Remote Router IP Address, in the form XXX.XXX.XXX.XXX, This column updates automatically once the demod locks to the remote.
Current Es/No	This is the current Es/No of the demod, in 0.1 dB increments. The displayed range is from -5 dB to 35 dB.
Current Rx MODCOD	This is the current MODCOD of the demod. It is used to measure the Current Es/No.

Rx ACM Events (read-only)

Event information is logged as sequentially. From left to right:

Column	Description
Date	This is the logged date for the event in MM/DD/YY format.
Time	This is the logged time for the event in HH:MM:SS format.
Demod #	This is the available "FILLED" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
New ES/No	This is the Es/No reported by the receiving demod when the MODCOD switch occurred.
New Rx MODCOD	This is the MODCOD that the demod was switched to by the ACM algorithm.
New Rx Data Rate	This is the Rx Data Rate at the time of this event.
840 IP	This is the IP Address assigned at present.

Click **[Show Last 15 Events]** to refresh the table with the latest reported ACM statistics.

Click **[Clear ACM Events]** to clear all ACM statistics from the buffer.

6.3.3.2.3 Configuration | WAN | LNB (Low Noise Block Down Converter)



This page is operational only when an optional **LOW-NOISE BLOCK DOWN CONVERTER** is installed.

Use this page to configure Low-Noise Block Down Converter parameters, and to display the LNB status for L-Band operation.

The screenshot shows the LNB Configuration page. The navigation bar includes Home, Admin, Configuration, Status, and Utility. Under Configuration, there are sub-menus for Interface, WAN, Network, ECM, and MEO. Under WAN, there are sub-menus for Demod, ACM, and LNB. The LNB Control section has four input fields: LNB DC Power (dropdown: Off), LNB Reference Enable (dropdown: Disable), LNB Current Threshold Low (text: 0 mA (0-500)), and LNB Current Threshold High (text: 0 mA (0-500)). A Submit LNB Controls button is below. The LNB Status section shows LNB Voltage: 0 V and LNB Current: 0 mA, with a Refresh button.

Figure 6-14. Configuration | WAN | LNB Page

LNB Control

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **LNB DC Power** – Use the drop-down list to select the power as **Off**, **13V**, **18V**, or **24V**.
- **LNB Reference Enable** – Use the drop-down list to **Enable** or **Disable** the LNB Reference.
- **LNB Current Threshold Low / High (0 to 500)** – Enter a value, in mA, for either function.

Click [**Submit LNB Controls**] to save.

LNB Status

This read-only section provides the **LNB Current (mA)** and **LNB Voltage (V)** information.

Click [**Refresh**] to update this section with its latest available statistics.

6.3.3.3 Configuration | Network Pages

Use the nested **Network** pages to configure network-based operating parameters. Click the **Routing**, **ARP**, **Assoc. CTOG**, or **Working Mode** tab to continue.

6.3.3.3.1 Configuration | Network | Routing



When operating a network in Bridge Point-to-Multipoint (BPM) mode, user traffic will pass through the various traffic ports; however, you must manage the network through the routed Management Network.

Use this page to enter static routes for IP traffic over the satellite or to another device on the LAN.

Location of 880

Mesh Location:

Add New Route

Index	Route Description	Dest. Network IP/Mask	Interface	Next Hop IP
2	<input type="text"/>	<input type="text"/>	toLAN <input type="text"/>	<input type="text"/>

Delete Route

Enter Route Index to Delete:

Route Table (Edit)

Index	Description	Dest. Network IP/Mask	Interface	Next Hop IP	
1	LQRM to 840	192.168.1.0/24	toLAN <input type="text"/>	192.168.2.51	<input type="button" value="Submit Changes"/>

Filter Table (Edit)

Index	Description	Dest. Network IP/Mask	Filter Map
0			

Figure 6-15. Configuration | Routing | Routes Page

Location of 880



This setting is important for Single Hop On Demand (SHOD) operation.

Use the drop-down list to set the location of the CDD-880 as **Hub** or **Remote**. Click **[Submit]** to save.

Add New Route

Use this section to directly add a route. From left to right:

Column	Description
Index	This is the read-only internal index number for the route. This number increments or decrements automatically as you add or delete routes.
Description	This label helps to maintain the network. The name you create must be 20 characters or less, and it must be unique across all routes.
Dest. IP/Mask	Enter a Destination IP Address/Mask in the form XXX.XXX.XXX.XXX/YY.
Intfc.	Use the drop-down list to select the Interface as toWAN or toLAN.
Next Hop IP	Enter the desired Next Hop IP Address for toLAN routes. Note that no Next Hop entry is needed for toWAN routes.

Click **[Add Entry]** when done.

Delete Route

Enter Route Index to Delete. Click **[Delete Entry]** to delete the specified route entry from the route table. Upon deletion, the Route Table index number automatically decrements to the next available number.

Route Table (Edit)

Use the text boxes and drop-down lists to edit all current Route Table entries, as described previously for the **Add New Route** section. Click **[Submit Changes]** to save. The Route Table entries will update accordingly.

Filter Table (Edit)



Appendix F. dMESH (VMS DYNAMIC MESH) SOLUTIONS

In Dynamic Mesh configurations, the VMS will control adding additional "filter" routes in order to avoid duplicated packets.

These "filter" routes are added and deleted by the VMS on an as-needed basis when a Dynamic Mesh connection is added and then deleted. From left to right:

Column	Description
Index	This is the read-only sequential internal index number for the entry.
Description	This is the name of the entry, as auto-generated by the CDD-880 that is dropping the packets.
Dest. Network IP/Mask	This column identifies the IP Address and CIDR of the packet's destination.
Filter Map	This column Identifies the specific demodulator that is dropping the packets (e.g., 1-12)

6.3.3.3.2 Configuration | Network | ARP

Use this page to configure the CDD-880 ARP (Address Resolution Protocol) parameters.

Index	IP	MAC
2	<input type="text"/>	<input type="text"/>

Add Entry

Delete Static ARP

Enter Entry Index to Delete

Delete Entry

Flush Dynamic ARP

Warning! Clicking on this will flush all Dynamic ARP entries

Flush Dynamic ARP

Index	IP	MAC	Type
1	192.1.1.2	90:e2:ba:2b:a6:bb	Dynamic

Submit Changes

Figure 6-16. Configuration | ARP Page

Add Static ARP

Enter the desired **IP** and **MAC** addresses. Click **[Add Entry]** when done. The **Index** column automatically increments to the next available number when the specified static ARP entry is added to the **ARP Table**.



Comtech EF Data recommends that you do not add Static ARP entries. Dynamic ARPs should function as expected under normal operation. You should use Static ARP entries only when it has been demonstrated that a connected networking device does not respond to ARP as expected.

Delete Static ARP

Enter the Entry Index to Delete. Click **[Delete Entry]** to delete the specified entry index from the **ARP Table**. Upon deletion, the ARP Table index number automatically decrements to the next available number.

Flush Dynamic ARP

Click **[Flush Dynamic ARP]** to delete all dynamically-learned ARP entries.

ARP Table (Edit)

This section displays all current Static and Dynamic ARP entries, and allows to user to directly edit the current Static ARP entries. From left to right:

Column	Description
Index	This is the read-only internal index number for the ARP entry. This number increments or decrements automatically as you add or delete entries.
IP	Entry IP Address, format XXX.XXX.XXX.XXX.
MAC	Entry MAC Address, format YY:YY:YY:YY:YY.
Type	The read-only entry Type is listed here as Static or Dynamic and cannot be edited.

Click **[Submit Changes]** to save.

6.3.3.3 Configuration | Network | Assoc. CTOG

Use this page to configure the CTOG-250 that is associated with this CDD-880.

Figure 6-17. Configuration | Network | Assoc. CTOG Page

Associated CTOG-250

- **Static CTOG-250 IP** – Enter the desired static IP Address in the form xxx.xxx.xxx.xxx. You must specify this address when there is more than one CTOG-250 in the same hub-side network, and the system is running in BPM mode. These fields allow you to specify the CTOG-250, using its Management IP Address, which contains the same outbound remotes as the remotes being received by this CDD-880.

When you use a **Static CTOG-250 IP** of **0.0.0.0**, the CDD-880 will populate the **Dynamic CTOG-250 IP** with the **first** CTOG-250 that is encountered.

When you provide a Static CTOG-250 IP, this overrides the Dynamic CTOG-250 IP.

Click **[Submit]** to save.

6.3.3.3.4 Configuration | Network | Working Mode



See Appendix B. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION for more details on operating a network in BPM Mode.

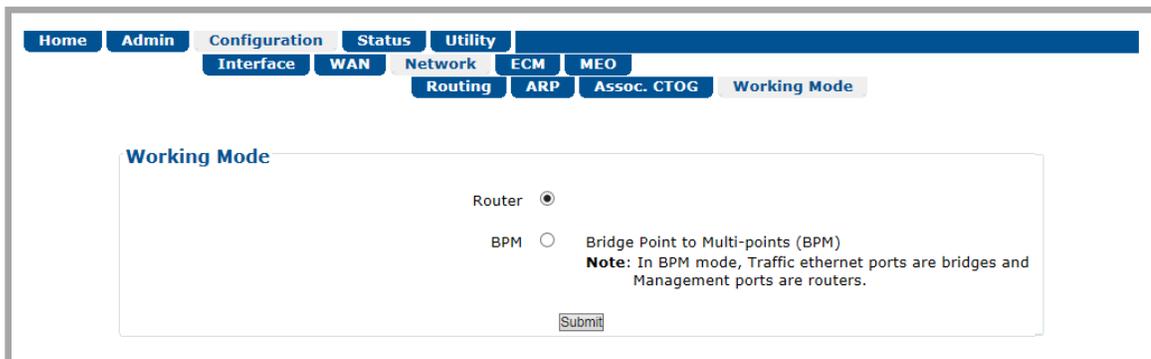


Figure 6-18. Configuration | Network | Working Mode Page

Working Mode

Select the desired working mode:

- In **Router** Mode, the traffic ports of the CTOG-250, CDD-880, and CDM-840 are configured to function as a Router.
- In **BPM** Mode, all L2/L3/L4 protocols such as VLAN, MPLS, IPv6, OSPF, and BGP will flow through the network as they would through an off-the-shelf Ethernet Switch. The Advanced VSAT BPM feature makes the Advanced VSAT equipment appear as a “Sky Ethernet Switch”. This will allow for a greatly simplified network deployment.

Click **[Submit]** to save.

6.3.3.4 Configuration | ECM (Entry Channel Mode)



1) The Configuration | ECM page is operational only when the optional VIPERSAT MANAGEMENT SYSTEM (VMS) is installed and enabled.

2) ECM uses Demod 1 as the ALOHA channel.



- Appendix D. ECM (ENTRY CHANNEL MODE)
- Appendix G. ENTRY CHANNEL MODE SWITCHING in the adjunct CEFD publication VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

ECM (Entry Channel Mode) provides a method for remotes requiring dSCPC access channels to either enter the network initially or re-enter the network after a power or service outage. Use this page to configure ECM.

ECM Hub Configuration

Enable:

Multicast IP:

Group ID:

Guard Band:

Preamble:

Data Slot Size:

Slots in Frame:

Cycle Length:

LNB LO Frequency: MHz

Satellite Frequency Conversion: MHz

ECM Hub Status

Current contention slots available: 0

Index	IP	State	Frames Transmitted	Error Frames
0	0.0.0.0		0	0

Figure 6-19. Configuration | ECM Page

ECM Hub Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Enable** – This feature activates Demod-1 (Rx TRAFFIC 1) on this unit to function as the ECM Controller for a group of CDM-840 Remote Routers. Use the drop-down list to select operation as **Enable** or **Disable**, and then click **[Submit]** to save.
- **Multicast IP** – Enter the IP Address for the Multicast of the TAP message that is sent out by this CDD-880 to all of the associated CDM-840 Remote Routers in that group.
- **Group ID** (0-255) – Assigning a unique Group ID number to this CDD-880 (i.e., the HCC) and its associated CDM-840 Remote Routers defines the group of equipment that will respond to the output of the controller. Enter the Group ID number for the CDD-880.



While “0” is an acceptable assignment, the preferred practical range is from 1 to 255.

- **Guard Band (0-1000)** – Enter the Amount of Transmit Off time, in milliseconds, between slots to prevent signal overlap.
- **Preamble** – This read-only value identifies the preamble length in VersaFEC frames.
- **Data Slot Size** – This read-only value identifies the minimum number of Versa FEC blocks in a data slot.
- **Slots in Frame** – This read-only value identifies the allowable total number of slots for each frame. When assigned slots are needed, they are taken from this pool.
- **Cycle Length** – This read-only value identifies the total cycle length, in milliseconds, of the TAP message.
- **LNB LO Frequency** – Assign the LNB LO value, used to send RF frequency values in TAP messages. Resolution = 100Hz.
- **Satellite Frequency Conversion** – Assign the correct **Satellite Frequency Conversion** value, in MHz, for this hub unit based on the RF equipment used at this site.

Click **[Submit]** to save.

ECM Hub Status (read-only)

- **Current Contention slots available** – “Contention slots” are the number of time slots in the TAP transmission cycle that are available for assignment to requesting (probing) Remotes.

From left to right:

Column	Description
Index	This is the automatically assigned internal table index number.
IP	IP Address for the identified CDM-840 Remote Router.
State	Current state of this CDM-840 – one of the following will apply: <ul style="list-style-type: none"> • Probing – The unit is requesting service (registration / switching) from the VMS. • Registered – The unit has been registered with the VMS. • Waiting to switch – the Unit is awaiting dSCPC switch command from the VMS.
Frames Transmitted	Count of frames received from this CDM-840.
Error Frames	Count of frames received with errors from this CDM-840.

6.3.4 Status Pages

The nested **Status** pages provide status, event logging, and operational statistics windows.

Click the **Statistics** or **Monitor** tab to continue.

6.3.4.1 Status | Statistics Pages



Precision Time Protocol (PTP) is not available in this firmware release. The PTP tab and page, while available and selectable here, are therefore non-functional.

Click the **Traffic**, **Demod**, **Router**, or **Managed Switch** tab to continue.

6.3.4.1.1 Status | Statistics | Traffic

Use this page to view read-only summary operational statistics for the Ethernet, Demodulator, or Router traffic.

The screenshot shows a web interface with a navigation bar containing 'Home', 'Admin', 'Configuration', 'Status', and 'Utility'. Under 'Status', there are sub-tabs for 'Statistics' and 'Monitor'. Under 'Monitor', there are further sub-tabs for 'Traffic', 'Demod', 'Router', and 'Managed Switch'. The 'Demod Statistics' table shows all values at 0. The 'Ethernet Statistics' table shows data for Traffic, Mgmt, and Total interfaces.

Packets Received	UC Packets Received	MC Packets Received	Total Rx Bytes	Total Rx Bytes Post Decomp	Current Rx Rate (pps)	Current Rx Rate (kbps)	Maximum Rx Rate (kbps)
0	0	0	0	0	0	0	0

Interface	Total Packets Transmitted	Total Packets Received	UC Packets Transmitted	UC Packets Received	MC Packets Transmitted	MC Packets Received	Current Tx Rate (kbps)	Current Rx Rate (kbps)	Maximum Tx Rate (kbps)	Maximum Rx Rate (kbps)
Traffic	0	264	0	0	0	264	0	0	1	149
Mgmt	4865	3841	4863	3699	2	142	28	9	2004	144
Total	4865	4105	4863	3699	2	406	28	9	2005	293

Buttons: Clear Demod Stats, Clear Ethernet Stats, Clear All Stats

Figure 6-20. Status | Statistics | Traffic Page

Demod Statistics

From left to right:

Column	Description
Packets Received	This is the total number of Packets received.
UC Packets Received	This is the total number of Unicast packets received.
MC Packets Received	This is the total number of Multicast packets received.
Total Rx Bytes	This is the total number of bytes received.
Total Rx Bytes Post Decomp	This is the total number of bytes received after decompression.
Current Rx Rate (pps)	This is the most recently received symbol rate (in packets per second).
Current Rx Rate (kbps)	This is the most recently received symbol rate (in kilobits per second).
Maximum Rx Rate (kbps)	This is the peak received symbol rate (in kilobits per second).

Ethernet Statistics

On a per-interface (per row) basis, From left to right:

Column	Description
Interface	This identifies the data row as the Traffic (ETHERNET TRAFFIC GE) port or the Mgmt (ETHERNET TRAFFIC/MANAGEMENT GE) port
Total Packets Transmitted	This is the total number of packets transmitted.
Total Packets Received	This is the total number of packets received.
UC Packets Transmitted	This is the total number of Unicast packets transmitted.
UC Packets Received	This is the total number of Unicast packets received.
MC Packets Transmitted	This is the total number of Multicast packets transmitted.
MC Packets Received	This is the total number of Multicast packets received.
Current Tx Rate (kbps)	This is the most recent transmitted data rate (in kilobits per second).
Current Rx Rate (kbps)	This is the most recent received data rate (in kilobits per second).
Maximum Tx Rate (kbps)	This is the most recent peak transmitted data rate (in kilobits per second).
Maximum Rx Rate (kbps)	This is the most recent peak received data rate (in kilobits per second).

- Click **[Clear Demod Stats]** to delete all existing entries from the **Demod Statistics** section.
- Click **[Clear Ethernet Stats]** to delete all existing entries from the **Ethernet Statistics** section.
- Click **[Clear All Stats]** to delete all existing entries from the Traffic Statistics page.

6.3.4.1.2 Status | Statistics | Demod

Use this page to view cumulative demodulator traffic information. The example here shows the page appearance with the CDD-880 equipped with a single dual demodulator card.

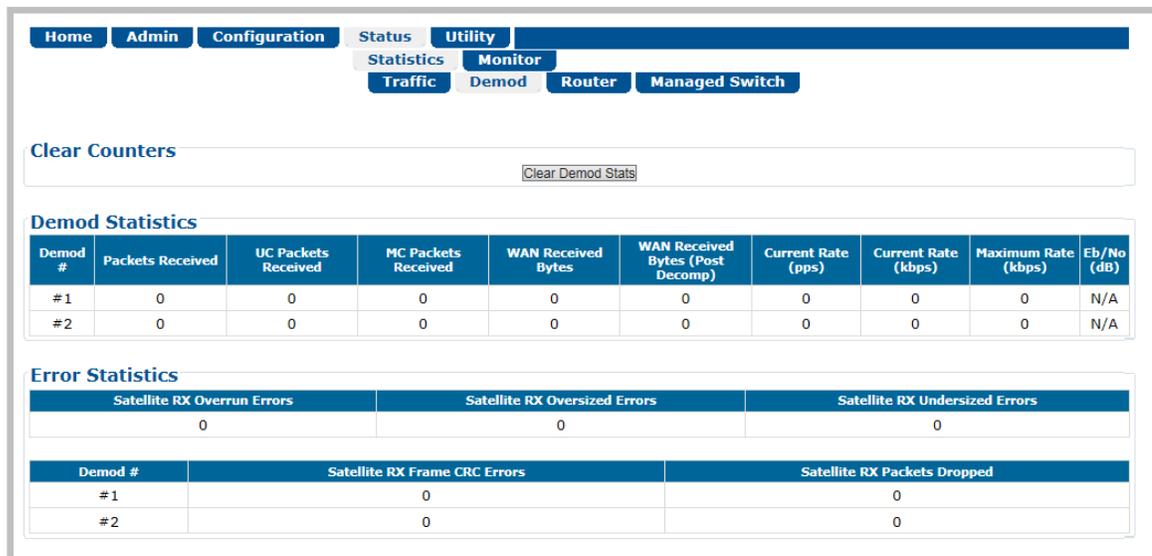


Figure 6-21. Status | Statistics | Demod Page

The HTTP Interface polls current operations and populates this section with the configured demodulators (i.e., Demod #1 and Demod #2). If a slot is polled as empty or otherwise unrecognizable, it will not display on this page.

Clear Counters

- Click **[Clear Demod Stats]** to delete all existing entries from the page.

Demod Statistics

From left to right:

Column	Description
Demod #	This is the available "filled" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
Packets Received	This is the number of packets received.
UC Packets Received	This is the number of Unicast packets received.
MC Packets Received	This is the number of Multicast packets received.
WAN Received Bytes	This is the number of bytes received from the WAN
WAN Received Bytes (Post Decomp)	This is the number of bytes received from the WAN, after decompression
Current Rate (pps)	This is the most recently received data rate (in packets per second).
Current Rate (kbps)	This is the most recently received data rate (in kilobits per second).
Maximum (kbps)	This is the most recently received peak transmitted data rate (in kilobits per second).

Error Statistics

From left to right:

Column	Description
Satellite Rx Overrun Errors	This is the number of packets dropped after being combined from all 12 demodulators (aggregate data rate too high).
Satellite Rx Oversized Errors	This is the number of packets dropped because size is greater than 2047 bytes.
Satellite Packets Rx Undersized Errors	This is the number of packets dropped because size is smaller than WAN frame (usually due to channel noise).

From left to right:

Column	Description
Demod #	This is the available "filled" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
Satellite RX Frame CRC Errors	This is the number of streamline decoder CRC errors / number of packets discarded.
Satellite RX Packets Dropped	This is the number of packets dropped before being combined into aggregate path (aggregate data rate too high).

6.3.4.1.3 Status | Statistics | Router

Use this page to view cumulative Interface, Router, and Management traffic information.

The screenshot shows a web interface with a navigation bar at the top containing tabs: Home, Admin, Configuration, Status, and Utility. Under the Status tab, there are sub-tabs: Statistics, Monitor, Traffic, Demod, Router, and Managed Switch. Below the navigation is a 'Clear Statistics' section with a 'Clear' button. The main content area contains three tables:

Interface Counters		
Description	LAN(Packets)	WAN(Packets)
Received Packets	4309	0
Transmitted Packets	5472	N/A

Router Counters	
Description	(Packets)
Received Packets	123
Routed Packets	0
IP Header Errors	0
IP Dest Errors	329
No Route Errors	0
Buffer Full Errors	0

Management Counters	
Description	(Packets)
Management Received Packets	3914
Management Transmitted Packets	5640

Figure 6-22. Status | Statistics | Router Page

Clear Statistics

Click **[Clear]** to clear all router statistics from the buffer.

Interface / Router / Management Counters

The **Description** column in each table identifies the specific packet traffic statistics compiled since the last time the buffer was cleared.

6.3.4.1.4 Status | Statistics | Managed Switch / Traffic page

Use this read-only page to view the amount of traffic processed over the Managed Switch during normal operation.

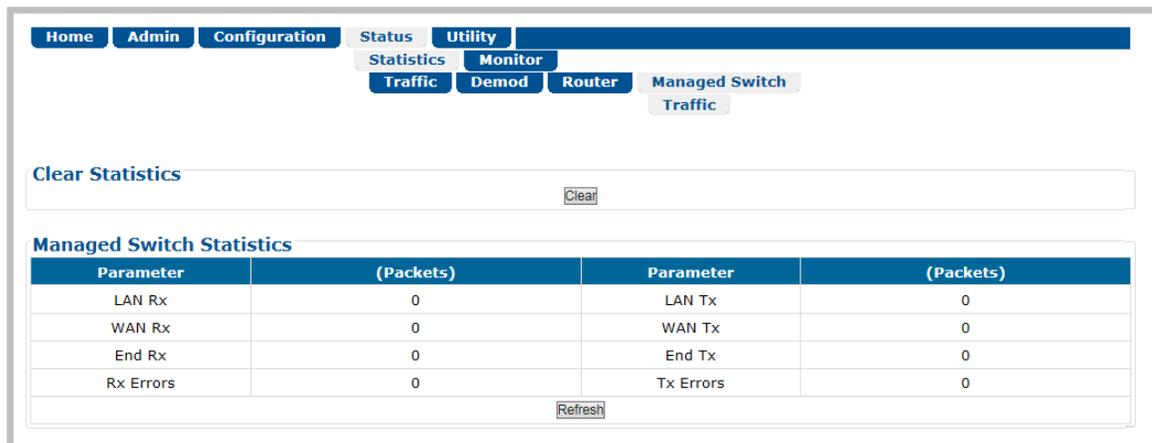


Figure 6-23. Status | Statistics | Managed Switch | Traffic Page

Clear Statistics

Click **[Clear]** to erase all data from the Managed Switch Statistics buffer.

Managed Switch Statistics

Use this table to review the number of packets transmitted and received over the Managed Switch. From left to right:

Column	Row / Description
Parameter / Packets	LAN Rx – This is the number of packets that were received from the Ethernet interface.
	WAN Rx– This is the number of packets that were received from the WAN interface.
	End Rx – This is the net number of packets that were received after losses.
	Rx Errors – This is the number of received packets that had errors.
	LAN Tx – This is the number of packets that were transmitted over the Ethernet interface.
	WAN Tx – This is the number of packets that were received over the WAN interface.
	End Tx – This is the net number of packets that were transmitted after losses.
	Tx Errors – This is the number of transmitted packets that had errors.

Click **[Refresh]** to update the table with current traffic data.

6.3.4.2 Status | Monitor Pages

The nested **Monitor** pages provide status, event logging, and operational statistics windows.

Click the **Events** or **Alarms** tab to continue.

6.3.4.2.1 Status | Monitor | Events

Use this read-only page to view the unit alarms summary, input port status, plus a scrollable window that displays any events and alarms as logged by the unit during normal operation. The example here shows the page appearance with the CDD-880 equipped with five dual demodulator cards.

The screenshot shows the 'Status | Monitor | Events' page. At the top, there are navigation tabs: Home, Admin, Configuration, Status, and Utility. Under 'Status', there are sub-tabs for Statistics, Monitor, Events, and Alarms. The 'Alarms' section is active and displays the following status:

- Unit Alarm:** Unit OK
- LNB Alarm:** LNB OK
- Traffic Alarm:** GE OK
- PTP Alarm:** PTP Ok
- Demod #1:** Traffic OK
- Demod #3:** Traffic OK
- Demod #5:** Traffic OK
- Demod #7:** Traffic OK
- Demod #9:** Traffic OK
- Rx Alarms:**
 - Demod #2:** Traffic OK
 - Demod #4:** Traffic OK
 - Demod #6:** Traffic OK
 - Demod #8:** Traffic OK
 - Demod #10:** Traffic OK

The **Input Port Status** section contains a table with the following data:

Demod #	Lock	Eb/No (dB)	Estimated Corrected BER	RSST(dB)	Rx Freq Offset (Hz)	Circuit ID
#1	Unlocked	N/A	N/A	0	0	RxCircuitID1
#2	Unlocked	N/A	N/A	0	0	RxCircuitID2
#3	Unlocked	N/A	N/A	0	0	RxCircuitID3
#4	Unlocked	N/A	N/A	0	0	RxCircuitID4
#5	Unlocked	N/A	N/A	0	0	RxCircuitID5
#6	Unlocked	N/A	N/A	0	0	RxCircuitID6
#7	Unlocked	N/A	N/A	0	0	RxCircuitID7
#8	Unlocked	N/A	N/A	0	0	RxCircuitID8
#9	Unlocked	N/A	N/A	0	0	RxCircuitID9
#10	Unlocked	N/A	N/A	0	0	RxCircuitID10

The **Events** section shows a table with one event:

Date	Time	Description
02/06/15	13:32:07	INFO - Event Log Cleared

Below the events table, there is a 'Clear Event Table' button and a 'Number of Events: 1' indicator.

Figure 6-24. Status | Monitor | Events Page

Alarms

This section summarizes the **Unit**, **LNB** (when installed), **Traffic**, and **Rx** alarms compiled since the logging buffer was last cleared.



Precision Time Protocol (PTP) is not available in this firmware release. The “PTP Alarm” entry, while visible, is non-functional at this time.

Input Port Status

This section summarizes the operating status of the demod ports. From left to right:

Column	Description
Demod #	This is the available "filled" demodulator slot (automatically assigned in pairs per each installed dual demodulator card).
Lock	This displays the status of the VersaFEC decoder as Locked, Unlocked or Disabled.
Eb/No (dB)	This is the estimated channel noise level.
Estimated Corrected BER	This is the Bit Error Rate after VersaFEC decoding.
RSSI (dB)*	This is the Relative Signal Strength Indicator (0 – 60 dB of demod operating range).
Rx Freq Offset (Hz)	This is the estimated offset from demod configured frequency (in Hz).
Circuit ID	This displays the identification label assigned to the individual demodulator.



About CDD-880 RSSI (Receive Signal Strength Indicator): The traditional method of reporting the input signal strength is the RSL (Receive Signal Level). Comtech EF Data modems are specified to meet BER requirements when the $RSL_{min} = -130 + 10_{log}(\text{Symbol Rate})$. The maximum performance (due to AGC) is $RSL_{max} = RSL_{min} + 50 \text{ dB}$.

In order to calculate the expected RSL, you must then know the current Symbol Rate and use these conversion formulae.

The CDD-880 is designed differently from most other Comtech EF Data products because it has to accommodate the energy from 12 channels at the front end. There are several analog and digital AGCs throughout the signal chain; because of this, the RSSI is a relative measure of received power, as opposed to absolute power. The CDD-880 reports a symbol rate-independent RSSI, which greatly simplifies operation.

The CDD-880 is designed to operate as per the specified BER performance for any value of RSSI greater than 0. If the RSSI is negative, then the demodulator may not perform as intended.

Due to link fading and impairment, Comtech EF Data recommends that, during Clear Sky commissioning, you configure the target RSSI as follows:

$RSSI_{clear\ sky} > \text{Max Fade Depth} + \text{Margin}$
 (where the recommended margin is ~3 to 4 dB).

For example: If the Max Fade Depth = 10 dB, then the Clear Sky RSSI should be ~14.

Note that the CDD-880 is designed to report both the RSL and RSSI.

Events



The 'STORED EVENT' LED provided on the Virtual Front Panel lights amber to indicate the presence of any stored event(s) or alarm(s).

Each logged event or alarm is **Date-** and **Time-**stamped, and a **Description** is provided.

Click **[Clear Event Table]** to delete all existing logged entries from the Events log. The log and counter then resets to a single entry: **“INFO – Event Log Cleared”**.

6.3.4.2.2 Status | Monitor | Alarms

This page indicates whether or not an event or alarm has been logged for a specific item since the logging buffer was last cleared. Use this page to view the current unit operating status and to control how the unit masks alarms (i.e., ignores alarms from their sources).

The screenshot shows a web interface with a navigation bar at the top containing 'Home', 'Admin', 'Configuration', 'Status', and 'Utility'. Under 'Status', there are sub-tabs for 'Statistics', 'Monitor', 'Events', and 'Alarms'. The 'Alarms' tab is active.

Legend:
 ● = NO ALARM ● = PREVIOUSLY ALARMED ● = CURRENTLY ALARMED

Clear Alarms:
 [Clear Previously Alarmed]

Unit Alarms

Name	Status	Mask	Name	Status	Mask
5V POWER	●	<input type="checkbox"/>	12V POWER	●	<input type="checkbox"/>
MAIN FPGA LOAD	●	<input type="checkbox"/>	DDC FPGA LOAD	●	<input type="checkbox"/>
DEMODO FPGA LOAD	●	<input type="checkbox"/>	LNB CURRENT	●	<input type="checkbox"/>
LNB VOLTAGE	●	<input type="checkbox"/>	TEMPERATURE EXCEEDED	●	<input type="checkbox"/>
GE LINK DOWN	●	<input type="checkbox"/>	HARD RESET	●	<input type="checkbox"/>

[Clear Masks] [Submit] [Mask All]

BPM Alarms

Name	Status	Mask	Name	Status	Mask
ASSIGNED CTOG IP ERROR	●	<input type="checkbox"/>			

[Clear Masks] [Submit] [Mask All]

Demodulator Alarms

Name	Status	Mask	Name	Status	Mask
DEMODO 1 RF UNLOCK	●	<input type="checkbox"/>	DEMODO 2 RF UNLOCK	●	<input type="checkbox"/>
DEMODO 1 EBNO	●	<input type="checkbox"/>	DEMODO 2 EBNO	●	<input type="checkbox"/>
DEMODO 1 DATA UNLOCK	●	<input type="checkbox"/>	DEMODO 2 DATA UNLOCK	●	<input type="checkbox"/>
DEMODO 5 RF UNLOCK	●	<input type="checkbox"/>	DEMODO 6 RF UNLOCK	●	<input type="checkbox"/>
DEMODO 5 EBNO	●	<input type="checkbox"/>	DEMODO 6 EBNO	●	<input type="checkbox"/>
DEMODO 5 DATA UNLOCK	●	<input type="checkbox"/>	DEMODO 6 DATA UNLOCK	●	<input type="checkbox"/>
DEMODO 7 RF UNLOCK	●	<input type="checkbox"/>	DEMODO 8 RF UNLOCK	●	<input type="checkbox"/>
DEMODO 7 EBNO	●	<input type="checkbox"/>	DEMODO 8 EBNO	●	<input type="checkbox"/>
DEMODO 7 DATA UNLOCK	●	<input type="checkbox"/>	DEMODO 8 DATA UNLOCK	●	<input type="checkbox"/>
DEMODO 9 RF UNLOCK	●	<input type="checkbox"/>	DEMODO 10 RF UNLOCK	●	<input type="checkbox"/>
DEMODO 9 EBNO	●	<input type="checkbox"/>	DEMODO 10 EBNO	●	<input type="checkbox"/>
DEMODO 9 DATA UNLOCK	●	<input type="checkbox"/>	DEMODO 10 DATA UNLOCK	●	<input type="checkbox"/>
DEMODO 11 RF UNLOCK	●	<input type="checkbox"/>	DEMODO 12 RF UNLOCK	●	<input type="checkbox"/>
DEMODO 11 EBNO	●	<input type="checkbox"/>	DEMODO 12 EBNO	●	<input type="checkbox"/>
DEMODO 11 DATA UNLOCK	●	<input type="checkbox"/>	DEMODO 12 DATA UNLOCK	●	<input type="checkbox"/>

[Clear Masks] [Submit] [Mask All]

Figure 6-25. Status | Monitor | Alarms Page

Legend

Operational status is color-coded for quick reference:

State	Means	Description
Green	"No Alarm"	This indicates that no event or alarm has been logged since the logging buffer was last cleared – status is OK..
Yellow	"Previously Alarmed"	This indicates that this alarm was once active, but has since been cleared.
Red	"Currently Alarmed"	This indicates that an event or alarm has been logged since the logging buffer was last cleared – status is FAULTED.

Clear Alarms

Click **[Clear Previously Alarmed]** to update this page with the latest available logged event or alarm information.

Unit / BPM / Demodulator Alarms

Typical for these remaining page sections:

Section Column	Description
Name	This is the name of the specific function.
Status	The event/alarm status "LED" for each item is displayed here – see the Legend page section.
Mask	Click the box to select alarm masking for a specific function.

- Click **[Clear Masks]** to deselect the Mask box for all listed functions.
- Click **[Mask All]** to select the Mask box for all listed functions.
- Click **[Submit]** to save.



The BPM section is visible only when you set the Working Mode as "BPM" (see Sect. 6.3.3.3.4 Configuration | Network | Working Mode).

6.3.5 Utility Pages

Click the **Utility** or **Reboot** tab to continue.

6.3.5.1 Utility | Utility

Use this page to define and access a variety of top-level system operation controls, stored unit configurations, and test utilities.

The screenshot shows the 'Utility | Utility' page with the following sections:

- Modem**: Unit Name: CDD-880; System Contact: cdmipsupport@comtech; System Location: (480) 333-4357; Set Time(hh:mm:ss): 13:33:17; Set Date(dd/mm/yy): 06/02/15; Adjustment for Internal 10 MHz Reference: -336 (-999 to 999).
- Save/Load Configuration**: Select Location: 1; Save Configuration; Select Location: 1; Load Configuration.
- Redundancy**: Current Redundancy State: Offline; Force Redundancy Switch.
- BERT**: Tuner Select: 1; Submit Changes.
- BERT Config**: Rx Bert State: Off; Rx Bert Pattern: 2*23-1; Submit.
- BERT Monitor**: Rx Bert Pattern Sync: N/A; Loss of sync since last restart: N/A; Total Errors: N/A; Total Bits: N/A; BER: N/A; Restart; Update.

Figure 6-26. Utility | Utility Page

Modem

- **Unit Name** – The product (e.g., **CDD-880**) is identified here.
- **System Contact / System Location** – E-mail and telephone contact information for Comtech EF Data Customer Support is provided here.

Click **[Submit]** to save.

- **Set Time (hh:mm:ss)** – Use the HH:MM:SS time format to set the time, where HH=hour [00-23]; MM=minutes [00-59]; and SS=seconds [00-59].
- **Set Date (dd/mm/yy)** – Use the DD/MM/YY European time format to set the date, where DD=day [01-31]; MM=month [01-12]; and YY=year [00-99].

Click **[Submit]** to save.

- **Adjustment for Internal 10 MHz Reference** – Enter a value from **-999** to **+999** to set the adjustment for the Internal 10 MHz High Stability Reference.

Click **[Submit]** to save.

Save/Load Configuration

This section allows you to save, and then load (recall) up to 10 configuration sets:

- **To save a configuration set:**
 - First, adjust all operational configuration parameters to suit.
 - Then, use the top (Save) **Select Location** dropdown to select **1** through **10**.
 - Finally, click **[Save Configuration]** to store the configuration set.
- **To load (recall) a configuration set:**
 - First, use the bottom (Load) **Select Location** dropdown to select **1** through **10**.
 - Then, click **[Load Configuration]** to recall the selected configuration set.

Redundancy



This section is reserved for future use.

BERT

(Where BERT is the acronym for Bit Error Rate Test)

- **Tuner Select** – Use the drop-down list select the active tuner (demodulator). Depending on the chassis configuration, the minimum selection is **1** or **2**; the maximum is from **1** to **12**. Click **[Submit Changes]** when done. Any further BERT configuration or operational settings will apply to the selected tuner.

BERT Config

- Configure the **Rx BERT State** as **On** or **Off**.

- Configure the **Rx BERT Pattern** as **$2^{23}-1$** or **2047**.

Click **[Submit]** to save the BERT settings and execute the test.

BERT Monitor

This section displays the ongoing BERT.

- Click **[Restart]** to restart the BERT Monitor.
- Click **[Update]** to refresh a test that is already in progress.



The CDD-880 does not accept IP traffic while a BERT is in progress.

6.3.5.2 Utility | Reboot

Use this page to perform a soft reboot of the CDD-880. Note that the function of this page is identical to the **System Reboot** section of the **Admin | Firmware** page described earlier.

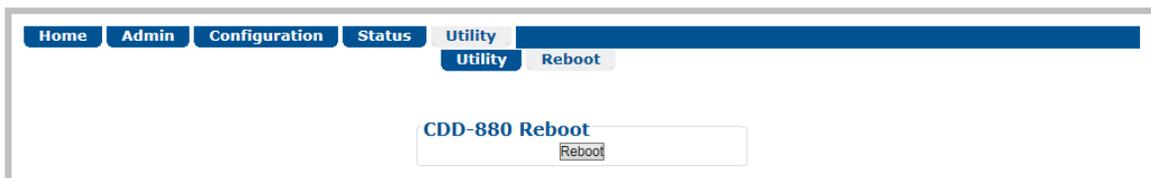
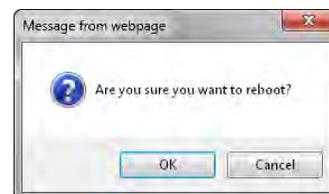


Figure 6-27. Utility | Reboot Page

System Reboot

Click **[Reboot]** to reboot the unit. A dialogue box appears to prompt continuation or cancellation of the reboot process:



Click **[OK]** to continue the reboot process, or **[Cancel]** to abort the process and return to the **Utility | Reboot** page.

Once the reboot process resumes, the **Utility | Reboot** page is replaced with the dynamic message **“Please wait... CDD-880 is rebooting. Login will be required in XX seconds”** – the time count decrements to 0 seconds before the unit reboots. After the reboot, login is required once again to resume use of the HTTP Interface.

Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

7.1 Overview

Serial-based Remote Product Management of the CDD-880 Multi Receiver Router is available using the CDD-880 rear panel 'CONSOLE' port.



- 1) **The Serial-based Remote Product Management Interface is intended to provide two important capabilities:**
 - First, it allows you to establish IP communications (HTTP, SNMP) when the unit is first being configured.
 - Second, the interface allows you to bring the CDM-840 back online through the serial or Telnet Interface over a very slow speed "backup channel".

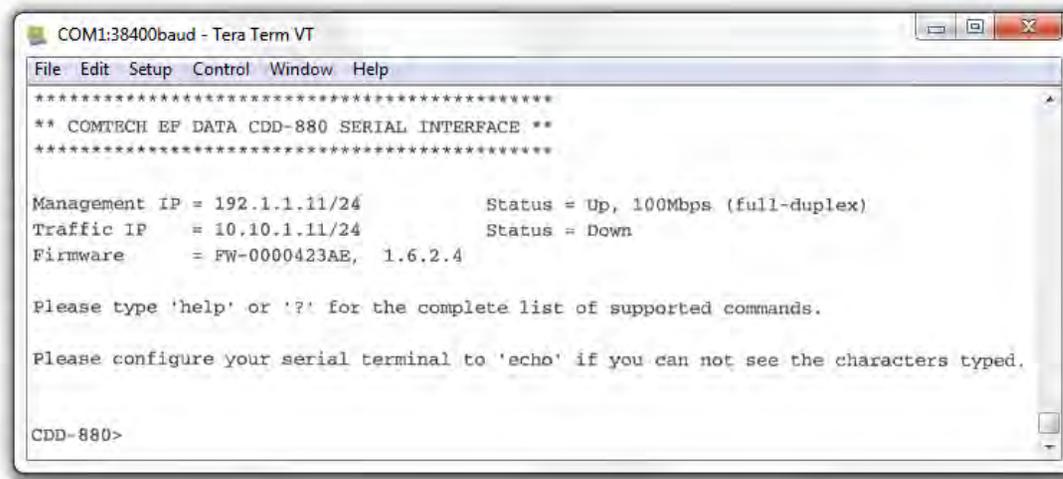
This interface is NOT intended to be a full featured interface to configure all aspects of the modem. Rather, its purpose is to provide enough commands to allow a terminal to be brought back online.

Once communications have been re-established, the standard interfaces (HTTP, SNMP, NetVue) can be used complete any additional detailed configuration/control/monitoring functions

USE OF THE SERIAL-BASED REMOTE PRODUCT MANAGEMENT INTERFACE IS RECOMMENDED ONLY FOR ADVANCED USERS.

- 2) **YOU MAY PROCEED WITH SERIAL-BASED REMOTE PRODUCT MANAGEMENT, ASSUMING THAT:**

- Your CDD-880 is operating with the latest version firmware files.
- Your CDD-880 is connected to a user-supplied, Windows-based PC as follows:
 - The PC serial port is connected to the CDD-880 rear panel 'CONSOLE' port with a user-supplied serial cable.
 - The PC Ethernet port is connected to the CDD-880 rear panel 'ETHERNET | TRAFFIC/MANAGEMENT | GE' 10/100/1000 BaseT Gigabit Ethernet port with a user-supplied hub, switch, or direct Ethernet cable connection.
 - The PC is running a terminal emulation program (for use of the CDD-880 Serial Interface) and a compatible web browser (for use of the CDD-880 HTTP Interface).
- The CDD-880 Management IP Address has been noted using the CDD-880 Serial Interface. (The firmware information (i.e., revision letters, version numbers, etc.) as shown may differ from your setup.)



```
COM1:38400baud - Tera Term VT
File Edit Setup Control Window Help
*****
** COMTECH EF DATA CDD-880 SERIAL INTERFACE **
*****

Management IP = 192.1.1.11/24      Status = Up, 100Mbps (full-duplex)
Traffic IP    = 10.10.1.11/24     Status = Down
Firmware      = FW-0000423AE, 1.6.2.4

Please type 'help' or '?' for the complete list of supported commands.

Please configure your serial terminal to 'echo' if you can not see the characters typed.

CDD-880>
```

Figure 7-1. CDD-880 Serial Interface Example

CDD-880 Serial Remote Product Management is available through the EIA-232 operational interface, where the 'Controller' device (the user PC or an ASCII dumb terminal) is connected directly to the 'Target' device (the CDD-880, via its DB-9M 'CONSOLE' port). This connection makes possible serial remote monitor and control (M&C) of the system through its CDD-880 Serial Interface.

Through this EIA-232 connection (for the control of a single device), data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets of variable length in accordance with the structure and protocol defined later in this chapter.

Access to the interface is accomplished with a user-supplied terminal emulator program such as Tera Term or HyperTerminal. Use this utility program to first configure serial port communication and terminal display operation:

- **38400 bps (Baud Rate)**
- **8 Data Bits**
- **1 Stop Bit**
- **Local Echo = ON**
- **Parity = NO**
- **Port Flow Control = NONE**
- **Display New line Rx/Tx: CR**

When the user-supplied terminal emulator program is configured correctly, upon power-up of the system, the COMTECH EF DATA CDD-880 SERIAL INTERFACE Info Screen appears, followed by the command prompt **CDD-880>**. From here, type **“help[cr]”** or **“?[cr]”** (without the quotes) to display the available “set” commands and “get” queries, and to review instructions for using the interface.

7.2 Remote Commands and Queries Overview

7.2.1 Basic Protocol

In an EIA-232 configuration, the Controller device is connected directly to the Target device via a two wire-plus-ground connection. All data is transmitted in framed packets as asynchronous serial characters, suitable for transmission and reception to the Controller using a universal asynchronous receiver/transmitter (UART). Controller-to-Target data is carried via EIA-232 electrical levels on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor:

- **Controller-to-Target:** The Controller device (e.g., the user PC/Serial Interface) is used to “set”, or transmit, instructions (commands) to – or to “get”, or request, information from (queries) – the Target device (i.e., the CDM-800).
- **Target-to-Controller:** The Target, in return, only transmits response information to the Controller when specifically directed by the Controller.

For Serial Remote Control, all issued commands (**Controller-to-Target**) require a response (**Target-to-Controller**). This response is either to return data that has been queried by the Controller, or to confirm the Target’s receipt of a command to change the Target’s configuration.

7.2.2 Packet Structure

The exchange of information is transmitted, Controller-to-Target and Target-to-Controller, in packets. Each packet contains a finite number of bytes consisting of printable ASCII characters, excluding ASCII code 127 (DELETE).

In this context, the Carriage Return and Line Feed characters are considered printable. With one exception, all messages from Controller-to-Target require a response – this will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target.

Controller-to-Target (Issued Command or Query)						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII Code 60 (1 character)	0000 (default) (4 characters)	/ ASCII Code 47 (1 character)	 (3 characters)	= or ? ASCII Codes 61 or 63 (1 character)	 (n characters)	Carriage Return ASCII Code 13 (1 character)

Packet “issued command” example: <0000/RSH=30[cr]

Packet “issued query” example: <0000/TFQ?[cr]

Target-to-Controller (Response to Command or Query)						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
> ASCII Code 62 (1 character)	0000 (default) (4 characters)	/ ASCII Code 47 (1 character)	 (3 characters)	=, ?, !, *, # (ASCII Codes 61, 63, 33, 42, or 35) (1 character)	 (n characters)	Carriage Return ASCII Code 13 (1 character)

Packet example – response received for issued query: >0000/BBU=107[cr][lf]

Detailed description of the packet components follow.

7.2.2.1 Start of Packet

- **Controller-to-Target:** This is the character ‘<’ (ASCII code 60).
- **Target-to-Controller:** This is the character ‘>’ (ASCII code 62).

The '<' and '>' characters indicate the start of packet. They may not appear anywhere else within the body of the message.

7.2.2.2 Target Address

In EIA-232 applications, this value is set to **0000**.



The Target Address designates the packet destination. The Controller does not have its own address. After the Controller sends a packet with the designated Target Address, the Target responds to the Controller, using this same address, to indicate the source of the packet.

7.2.2.3 Address Delimiter

This is the “forward slash” character '/' (ASCII code 47).

7.2.2.4 Instruction Code

This is a three-character alphanumeric sequence that identifies the message subject. Uppercase alphabetic characters ('A' to 'Z', ASCII Codes 65 to 90) and the numbers '0' to '9' *ASCII Codes 48 to 57) may be used. Wherever possible, each instruction code is named to serve as a mnemonic for its intended operation. This helps you interpret the code function, should it be shown in its raw ASCII form.

For example: **MLC** for **Management Link Configuration**, **IPA** for **Management IP Address**, etc.

7.2.2.5 Instruction Code Qualifier

This is a single character that further qualifies the preceding instruction code.

7.2.2.5.1 Controller-to-Target Instruction Code Qualifiers

The only permitted characters are '=' and '?'.

= (ASCII Code 61)

This character is used as the Assignment Operator (AO). It establishes that the Instruction Code that precedes it is issued as a **command** to assign or configure operation. The instruction set that follows serves to assign the Target's new parameter setting or operational value.

For example: From Controller-to-Target, <0/IG1=aaa.bbb.ccc.ddd/yy means "set the 'ETHERNET | TRAFFIC | GE' port IP Address to aaa.bbb.ccc.ddd/yy"

? (ASCII Code 63)

This character is used as the Query Operator (QO). It establishes that the Instruction Code that precedes it is issued as a **query** that returns the Target's current configured parameter setting or operational value.

For example: From Controller-to-Target, <0/IG1? means "what's the current 'ETHERNET | TRAFFIC | GE' port IP Address?"

7.2.2.5.2 Target-to-Controller Instruction Code Qualifiers

The permitted characters are '=', '?', '*', '!', and '#'.

= (ASCII Code 61)

This character is used in two ways:

1. If the Controller sends a query to the Target.

For example: <0/TFQ? (meaning "what is the current value of the transmit frequency?") – the Target responds with >0000/TFQ=xxxx.xxxx, the value for that queried parameter.

2. If the Controller sends an instruction to set a parameter to a particular value, and the value sent is valid, the Target acknowledges the message and responds with, for example, >0000/TFQ = (with no message arguments).

? (ASCII Code 63)

If the Controller issues a command to set a parameter to a particular value, and the value sent is not valid, the Target then acknowledges the message and responds with '?'. This indicates that there was an error in the message sent by the Controller.

For example: >0000/TFQ? (with no message arguments).

! (ASCII Code 33)

If the Controller issues a command that the Target does not recognize, the Target responds by echoing the invalid instruction code, followed by '!'.

For example: >0000/ABC!

*** (ASCII Code 42)**

If the Controller issues a command to set a parameter to a particular value, and the value sent is valid BUT the modem will not permit that particular parameter to be changed at present, the Target responds by echoing the valid instruction code, followed by '*'.

For example: >0000/TFQ* (with message arguments)

(ASCII Code 35)

If the Controller sends a correctly formatted command, BUT the Target is not in Remote Mode, the unit does not allow reconfiguration and responds by echoing the valid instruction code, followed by '#'.

For example: >0000/TFQ#

7.2.2.6 Optional Message Arguments

Arguments are not required for all messages.

Comma ',' (ASCII Code 44), period '.' (ASCII Code 46), the numbers '0' to '9' (ASCII Codes 48 to 57), and the uppercase alphabetic characters 'A' to 'Z' (ASCII Codes 65 to 90) may be used.

7.2.2.7 End of Packet

- **Controller-to-Target:** This is the 'Carriage Return' ([CR]) character (ASCII code 13).

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Default Passwords	DPW=	N/A	Command Only. Resets the admin username/password to: Username = "comtech" Password = "comtech"	DPW= DPW? DPW* DPW#	N/A	N/A
GE Address	IG1=	18 bytes numerical	Command or Query. Sets or returns the IP Address and network prefix for the 10/100/1000 BaseT GigE ETHERNET TRAFFIC GE port, in the form aaa.bbb.ccc.ddd/yy, where: (Permitted ranges – cannot all be zero) aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 0-255 yy = network prefix (range: 8 to 31) Other restrictions: If aaa>191, prefix may not be less than 24. If aaa>127, prefix may not be less than 16. EXAMPLE: <0/IG1=010.006.030.001/24	IG1= IG1? IG1* IG1#	IG1?	IG1=xxx.xxx.xxx.xxx/yy (see Description of Arguments)
Management IP Address	IPA=	18 bytes numerical	Command or Query. Sets or returns the IP Address and network prefix for the 10/100/1000 BaseT GigE ETHERNET TRAFFIC/MANAGEMENT GE port, in the form aaa.bbb.ccc.ddd/yy, where: (Permitted ranges – cannot all be zero) aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 0-255 yy = network prefix (range: 8 to 31) EXAMPLE: <0/IPA=010.006.030.001/24	IPA= IPA? IPA* IPA#	IPA?	IPA=xxx.xxx.xxx.xxx/yy (see Description of Arguments)
GE1 Link Configuration	LC1=	1 byte, value 0 thru 5	Command or Query. Sets or returns the GE1 Interface mode in the form x, where: 0 = Auto Negotiate 1 = 1000Mbps -Full Duplex 2 = 100Mbps – Full Duplex 3 = 100Mbps – Half Duplex 4 = 10Mbps – Full Duplex 5 = 10Mbps – Half Duplex	LC1= LC1? LC1* LC1#	LC1?	LC1=x (see Description of Arguments)
Management MAC Address	N/A	12 bytes, alpha-numerical	Query only. Returns the unique MAC Address for the modem. EXAMPLE: <0/MAC? >0000/MAC=00:06:B0:00:01:C2	N/A	MAC?	MAC=aabbccddeeff (see Description of Arguments)

GE MAC Address	N/A	12 bytes, alpha-numerical	Query only. Returns the unique GE MAC Address. EXAMPLE: <0/MG1? >0000/MG1=00:06:B0:00:01:C2	N/A	MG1?	MG1=aabbccddeeff (see Description of Arguments)
Management Link Configuration	MLC=	1 byte, value 0 thru 5	Command or Query. Sets or returns the Management Interface mode in the form x, where: 0 = Auto Negotiate 1 = reserved 2 = 100Mbps – Full Duplex 3 = 100Mbps – Half Duplex 4 = 10Mbps – Full Duplex 5 = 10Mbps – Half Duplex	MLC = MLC? MLC * MLC #	MLC?	MLC=x (see Description of Arguments)
Actual Negotiated Port Speed	N/A	None	Query only. Returns actual negotiated port speed in the form abcd, where: a = GigE negotiated port speed. b = the management port negotiated port speed. a, b, c, d have the following values: 0 = Link down 1 = 100 Full 2 = 100 Half 3 = 10 Full 4 = 10 Half 5 = 1000 Full	N/A	NPS?	NPS=abc (see Description of Arguments)
SNMP Read Community	SRC=	16 bytes, characters, no spaces	Command or Query. Sets or returns the SNMP read community string. NOTE: <i>Empty string is not allowed</i> EXAMPLE: <0/SRC? >0000/SRC=public	SRC = SRC!	SRC?	SRC =x (see Description of Arguments)
SNMP Write Community	SWC=	16 bytes, characters, no spaces	Command or Query. Sets or returns the SNMP write community string. NOTE: <i>Empty string is not allowed</i> EXAMPLE: <0/SWC? >0000/SWC=public	SWC = SWC!	SWC?	SWC =x (see Description of Arguments)

Appendix A. REFERENCE DOCUMENTATION

A.1 Overview



- 1) UNLESS OTHERWISE NOTED – This appendix collectively refers to the Comtech EF Data Advanced VSAT Series ODM-840 Remote Router, ODMR-840 Reduced Form Factor Remote Router, and ODMR-840B Remote Router Board Set as the ODM-840.
- 2) This appendix describes features that may be monitored or controlled by the user, or otherwise processed by the CDD-880 Multi Receiver Router. For detailed reading about the operational features of the Advanced VSAT Series group of products, consult the adjunct documentation that is specified in this appendix and is available for download from Comtech EF Data's web site (www.comtechefdata.com).

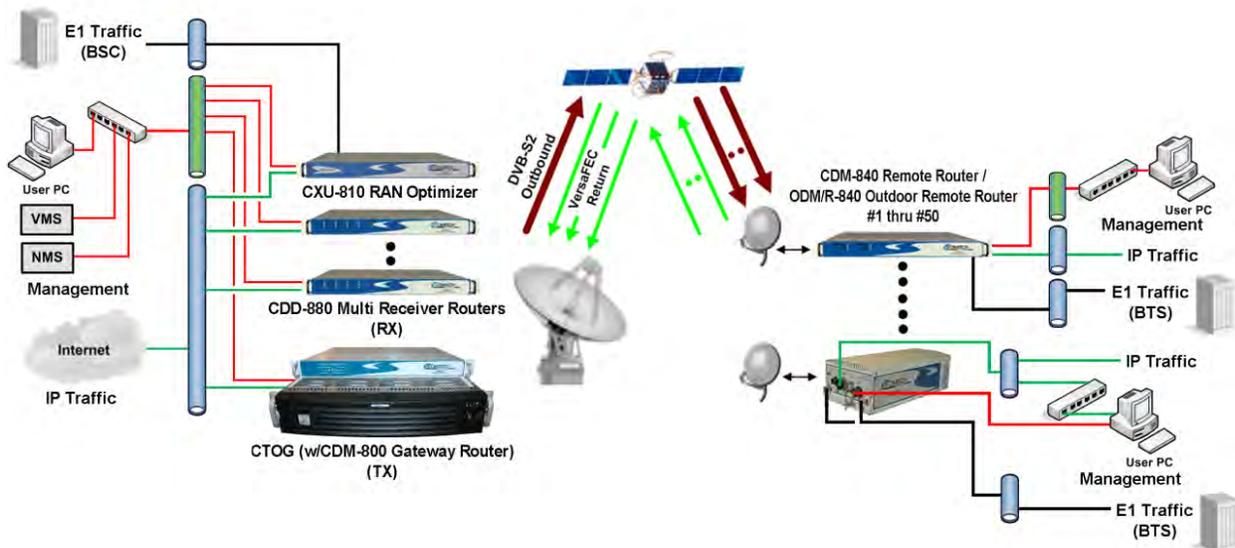


Figure A-1. Advanced VSAT Series Hub and Remote Site Products

A.2 FEC (Forward Error Correction) Options

The method of FEC used among Comtech EF Data's Advanced VSAT series of products differs according to Advanced VSAT Series product. This includes VersaFEC®, a family of short-block Low Density Parity Check (LDPC) codes with very low latency. VersaFEC® is a patent pending technology wholly owned and developed by Comtech EF Data and Comtech AHA Enterprise Products Group (the VersaFEC name is a trademark registered to Comtech AHA).

For the CDD-880 Multi Receiver Router: The hub site CDD-880 Multi Receiver Router uses the VersaFEC® family of short-block LDPC codes.



Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in this manual.

For the CDM-840 and ODM-840 Remote Routers: The FEC method used by the remote site CDM-840 and ODM-840 Remote Routers depends on the direction of signal processing in use:

- **The Rx (receive) side** of the 840 operates with error correction based upon the DVB-S2 standard for QPSK, 8-PSK, 16-APSK and 32-APSK with concatenated LDPC and Bose-Chaudhuri-Hocquenghem (BCH).
- **The Tx (transmit) side** of the 840 uses the VersaFEC® family of short-block LDPC codes.



- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)**

For the CDM-800 Gateway Router via the CTOG-250 Comtech Traffic Optimization Gateway: The hub site CDM-800 uses the FEC method based upon the DVB-S2 standard for QPSK, 8-PSK, 16-APSK and 32-APSK with concatenated LDPC and BCH.



Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)

A.3 VersaFEC ACM (Adaptive Coding and Modulation) Operation

The VersaFEC® Adaptive Coding and Modulation (ACM) feature is a patents-pending technology owned and developed by Comtech EF Data and Comtech AHA Enterprise Products Group.

ACM allows modulation and code rate (MODCOD) to change on a frame-by-frame basis subject to current link conditions. As ACM converts available link margin into increased capacity, average capacity gain of 100% or more is possible. This maximizes each remote's throughput under all conditions which, in turn, maximizes network efficiency and availability. ACM maximizes throughput regardless of link conditions (noise or other impairments, clear sky, rain fade, etc).

Return Link (Inbound) ACM operation is available in the CDD-880 Multi Receiver Routers and in the CDM-840 and ODM-840 Remote Routers. Outbound ACM operation is available in the CDM-800 Gateway Router via the CTOG-250 Comtech Traffic Optimization Gateway.



- **Appendix H. VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION) in this manual.**
- **Appendix D. VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION) in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix D. VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION) in the Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Appendix E. OUTBOUND ACM (ADAPTIVE CODING AND MODULATION) in the CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)**

A.4 BPM (Bridge Point-to-Multipoint) Operation

The Advanced VSAT BPM feature functions as a Learning Ethernet Switch when the “Working Mode” is set to BPM. This makes the Advanced VSAT equipment appear as a “Sky Ethernet Switch” and allows for a greatly simplified network deployment.

In BPM Mode, all L2/L3/L4 protocols such as VLAN, MPLS, IPv6, OSPF, and BGP will flow through the network as they would through an off-the-shelf Ethernet Switch.

The Advanced VSAT System, running in BPM Mode, supports Flat Networks, Flat Networks with Routers, and VLAN Trunking network topologies.



BPM operation is not available with the ODM-840 Remote Router.



- **Appendix C. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION in this manual.**
- **Appendix E. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix C. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION in the CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)**

A.5 ECM (Entry Channel Mode) Operation

ECM (Entry Channel Mode) operation is available in the CDD-880 Multi Receiver Router and in the CDM-840 and ODM-840 Remote Routers. ECM is based on slotted Aloha with random retransmission backoff. It supports multiple carriers through frequency assignments, which provide simplified deployment and scalability.

While a Remote Router is in Entry Channel Mode, it allows the passing of management traffic only – it will not transmit user data traffic. An ECM-enabled Remote Router may remain in the entry channel for an extended period if “online” communications are not required, or if dSCPC (dynamic Single Carrier Per Channel) resources are unavailable. While idle or waiting in the entry channel, the Remote Router sends periodic health status messages to the CTOG-250 and Vipersat Management System (VMS) while it continues to service VMS recovery logic timers.



- **Appendix D. ECM (ENTRY CHANNEL MODE) in this manual.**
- **Appendix G. ECM (ENTRY CHANNEL MODE) in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix G. ECM (ENTRY CHANNEL MODE) in the Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)**

A.6 dMesh (VMS Dynamic Mesh) Connectivity

dMesh (Dynamic Mesh) operation is available in the CDD-880 Multi Receiver Router and in the CDM-840 and ODM-840 Remote Routers. Mesh connectivity minimizes the requirement for communications that are routed through a hub and re-routed back to the remote segments of an Advanced VSAT Network.

Comtech EF Data leverages the concept of Bandwidth-on-Demand (BoD) by taking advantage of dSCPC (Dynamic Single Channel per Carrier) in a mesh environment and adapting it to Comtech EF Data's Advanced VSAT Network platform. This adds dynamic point-to-multipoint SCPC mesh circuits to the network's existing hub and remote link, and DVB-S2 outbound and VersaFEC dSCPC to the return link. Comtech EF Data manages these elements, and provides BoD in a mesh environment through its Vipersat Management System (VMS), the software switching engine behind Comtech's Vipersat technology.



- **Appendix F. dMESH (VMS DYNAMIC MESH) SOLUTIONS in this manual.**
- **Appendix L. dMESH (VMS DYNAMIC MESH) SOLUTIONS in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix K. dMESH (VMS DYNAMIC MESH) SOLUTIONS in the Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Appendix G. dMESH (VMS DYNAMIC MESH) SOLUTIONS in the CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)**

A.7 DPC (VMS Dynamic Power Control) Operation

The DPC (Dynamic Power Control) feature, provided in Comtech EF Data's CDM-840 and ODM-840 Remote Routers, provides a mechanism whereby remote satellite uplinks have their transmit power levels adjusted in order to optimize the receive signal quality as measured by the corresponding demodulator E_s/N_0 (the ratio of energy per symbol to noise density). This optimization process acts to either increase or decrease transmitted signal levels in order to:

- Achieve a minimum level of received E_s/N_0 consistent with providing an error free link or set margin.
- Reduce transmit power where sufficient link margin exists in order to optimize group station uplink saturation and/or satellite transponder power usage reducing costs.
- Increase link availability when margins apply (typically Ku-Band or Ka-Band).
- Maintain proper power backoff to eliminate high power amplifier saturation and carrier distortion.



- **Appendix G. DPC (VMS DYNAMIC POWER CONTROL) in this manual**
- **Appendix M. DPC (VMS DYNAMIC POWER CONTROL) in the Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)**
- **Appendix L. DPC (VMS DYNAMIC POWER CONTROL) in the Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Appendix H. DPC (VMS DYNAMIC POWER CONTROL) in the CTOG-250 Comtech Traffic Optimization Gateway with CDM-800 Gateway Router Installation and Operation Manual (CEFD P/N MN-CTOG250)**

Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS

B.1 FEC Overview

The CDD-880 Multi Receiver Router uses, as its FEC (Forward Error Correction) method, a family of short-block, very low latency, Low Density Parity Check (LDPC) codes called **VersaFEC**[®]. VersaFEC is ideal for lower data rates that demand the shortest possible latency. It is a patent pending technology wholly owned and developed by Comtech EF Data and Comtech AHA Enterprise Products Group (the VersaFEC name is a trademark registered to Comtech AHA).

B.2 VersaFEC (Short-block LDPC)

While LDPC coding represents a significant development in the area of FEC and its performance is exceptional in terms of coding gain, its higher latency is considered disadvantageous in some applications.

Comtech EF Data's development of LDPC incorporated research into ways to reduce the block size of LDPC (and hence its latency) while preserving the coding gain performance very close to the Shannon bound. The result is development of a set of VersaFEC codes with two distinct purposes:

1. To provide an expanded choice of combinations of modulation and coding that **significantly** reduces latency without compromising coding gain performance.
2. To provide combinations of modulation and coding (**MODCODs**), which are suitable for not only Constant Coding and Modulation (**CCM**) applications, but are also the basis for a patent-pending Adaptive Coding and Modulation (**ACM**) system.

VersaFEC offers a sufficient range of code rates and modulation types that optimize link performance under most conditions. **Figure B-1** compares the performance of the VersaFEC codes with the Shannon bound. Note that the chart uses *SNR* in place of *E_b/N₀* – a convention for comparing ACM MODCODs. SNR is defined as $E_b/N_0 + 10_{\log}$ (**Spectral Efficiency**).

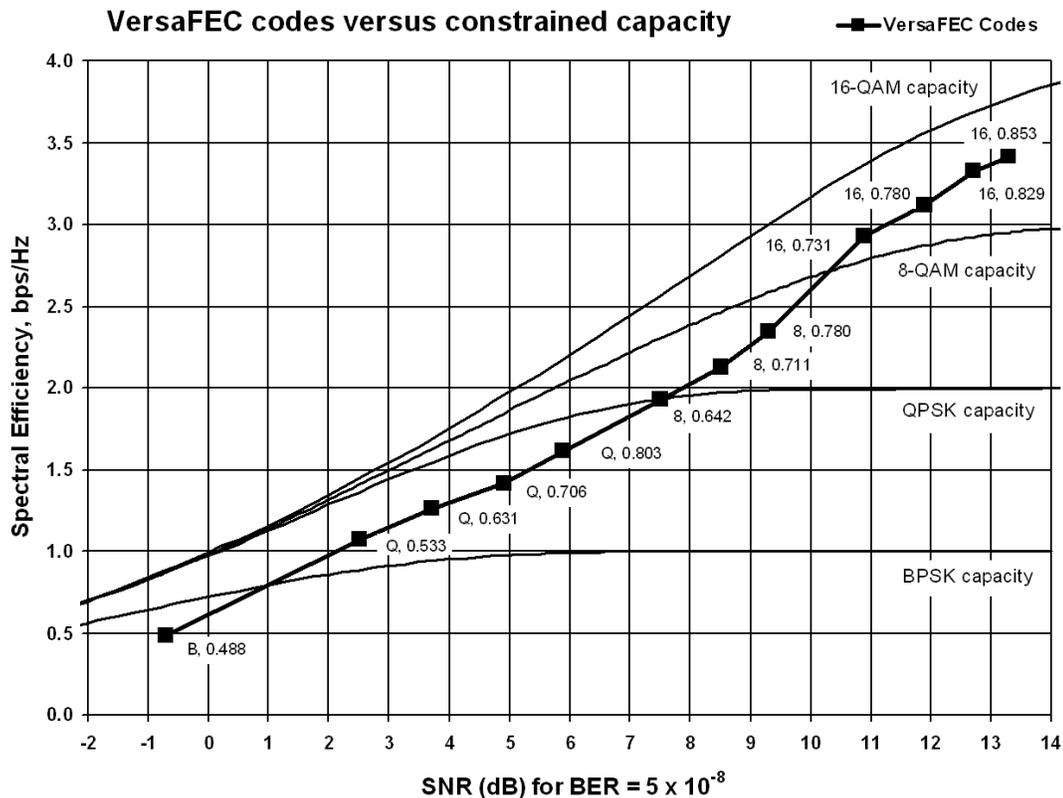


Figure B-1. The VersaFEC Codes versus Shannon Capacity

Table B-1 specifies the 12 modulation types / code rates that comprise the VersaFEC MODCOD Set. These chosen modulation types (BPSK, QPSK, 8-QAM and 16-QAM) and code rates afford a continuous progression of performance in terms of both Eb/No and spectral efficiency – essential aspects of a well-engineered ACM system.

Table B-1. The VersaFEC MODCOD Set

Modulation (MODCOD No.)	Code Rate	Spectral Efficiency (bps/Hz)	Block Size (kbits)	Typical Eb/No, for BER = 5 x 10 ⁻⁸ (dB)	Latency at 64 kbps, in milliseconds	Data Rate, CCM Mode	
						Minimum (kbps)	Maximum (Mbps)
BPSK (00)	0.488	0.49	2	2.4	26	16	2.19
QPSK (01)	0.533	1.07	4.1	2.2	53	18	4.80
QPSK (02)	0.631	1.26	4.1	2.7	59	21	5.67
QPSK (03)	0.706	1.41	4.1	3.4	62	23	6.34
QPSK (04)	0.803	1.61	4.1	3.8	66	26	7.22
8-QAM (05)	0.642	1.93	6.1	4.6	89	31	8.67
8-QAM (06)	0.711	2.13	6.1	5.2	93	35	9.60
8-QAM (07)	0.780	2.34	6.1	5.6	97	38	10.53
16-QAM (08)	0.731	2.93	8.2	6.3	125	47	13.16
16-QAM (09)	0.780	3.12	8.2	7.1	129	50	14.04
16-QAM (10)	0.829	3.32	8.2	7.7	131	54	14.91
16-QAM (11)	0.853	3.41	8.2	8.1	132	55	15.35

B.3 CDD-880 Error Performance Characteristics

On the pages that follow, **Figure B-2** through **Figure B-5** illustrate the guaranteed error performance characteristics of the CDD-880.

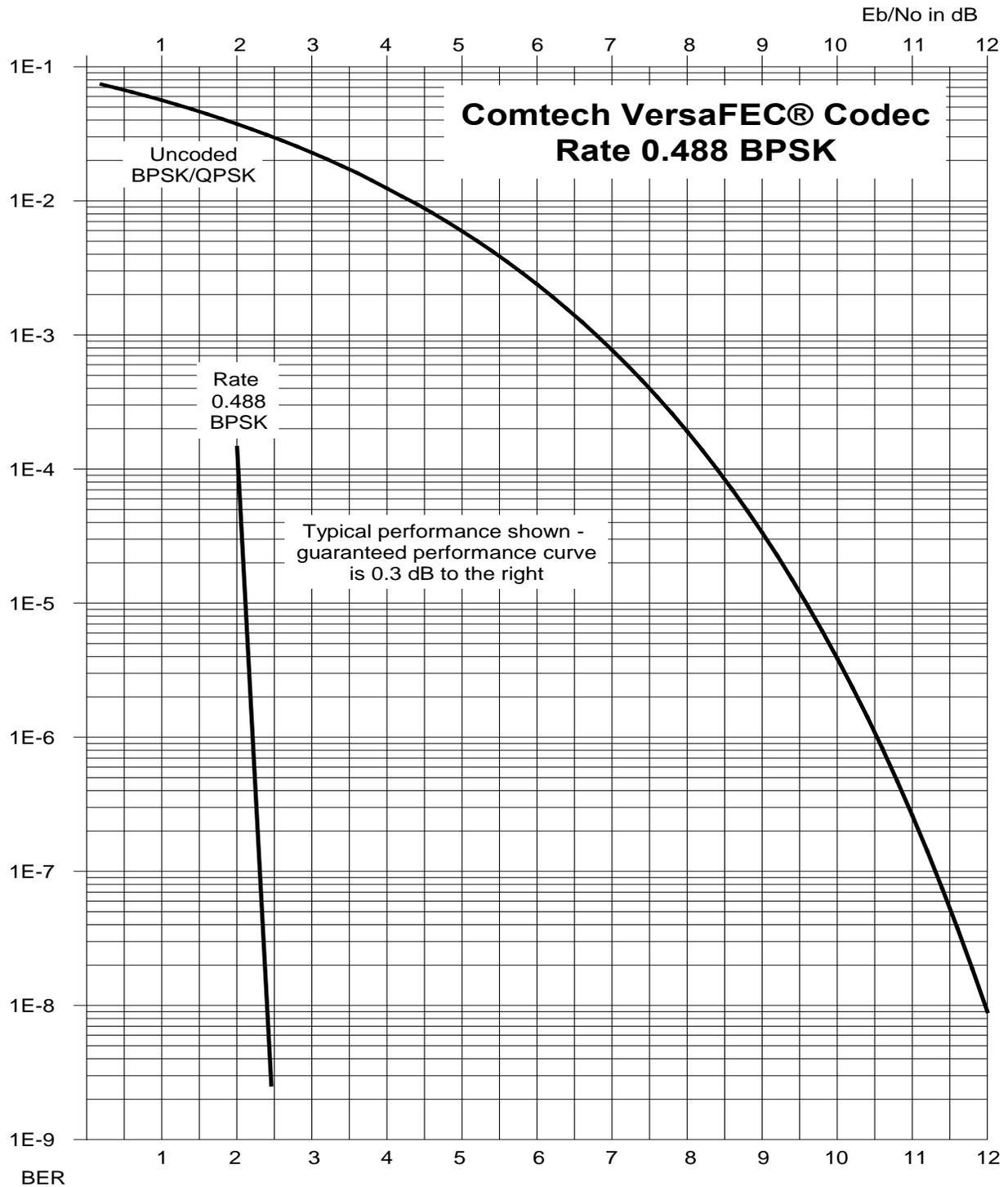


Figure B-2. VersaFEC Codec – BPSK, Rate 0.488

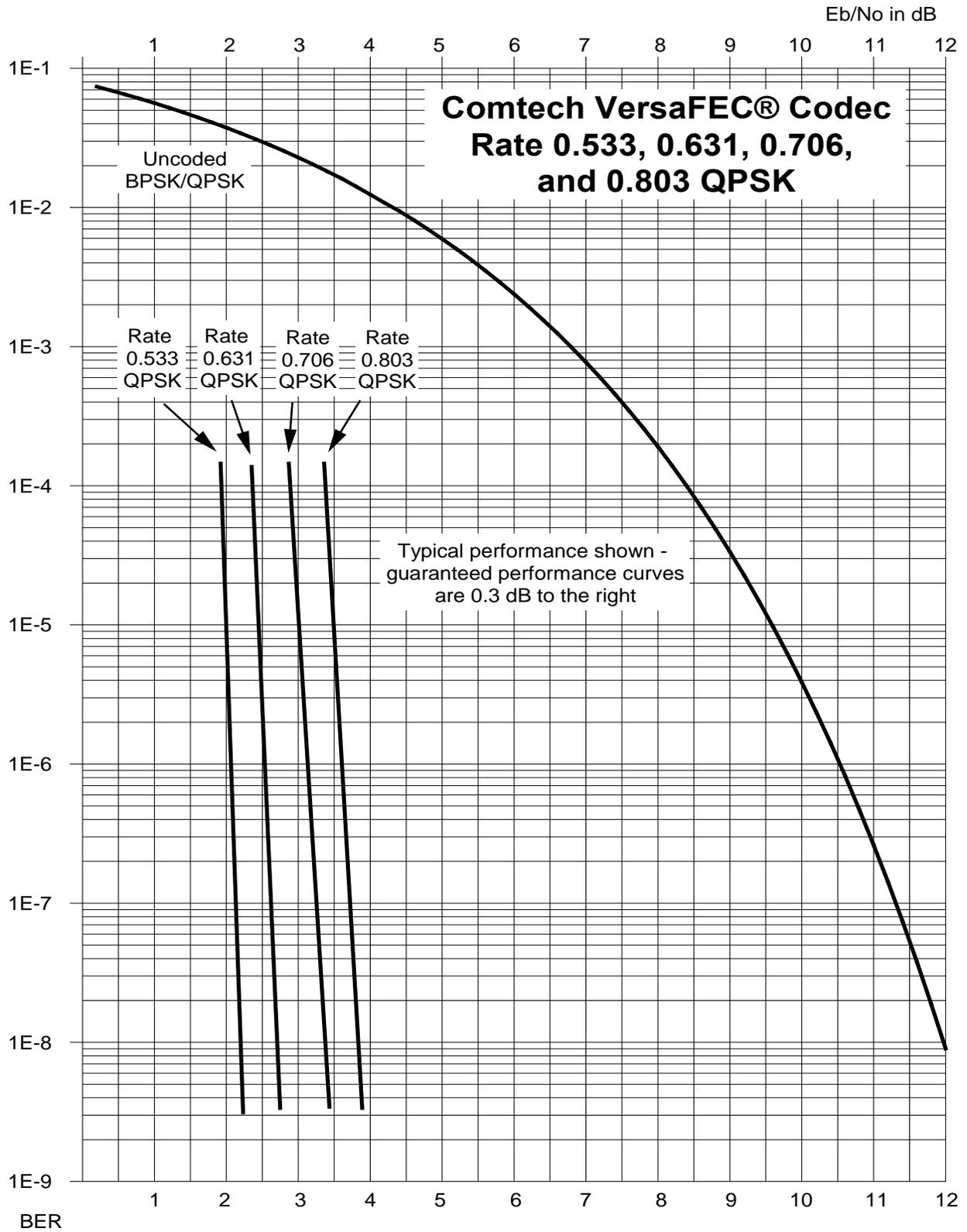


Figure B-3. VersaFEC Codec – QPSK, Rate 0.533, 0.631, 0.706 and 0.803

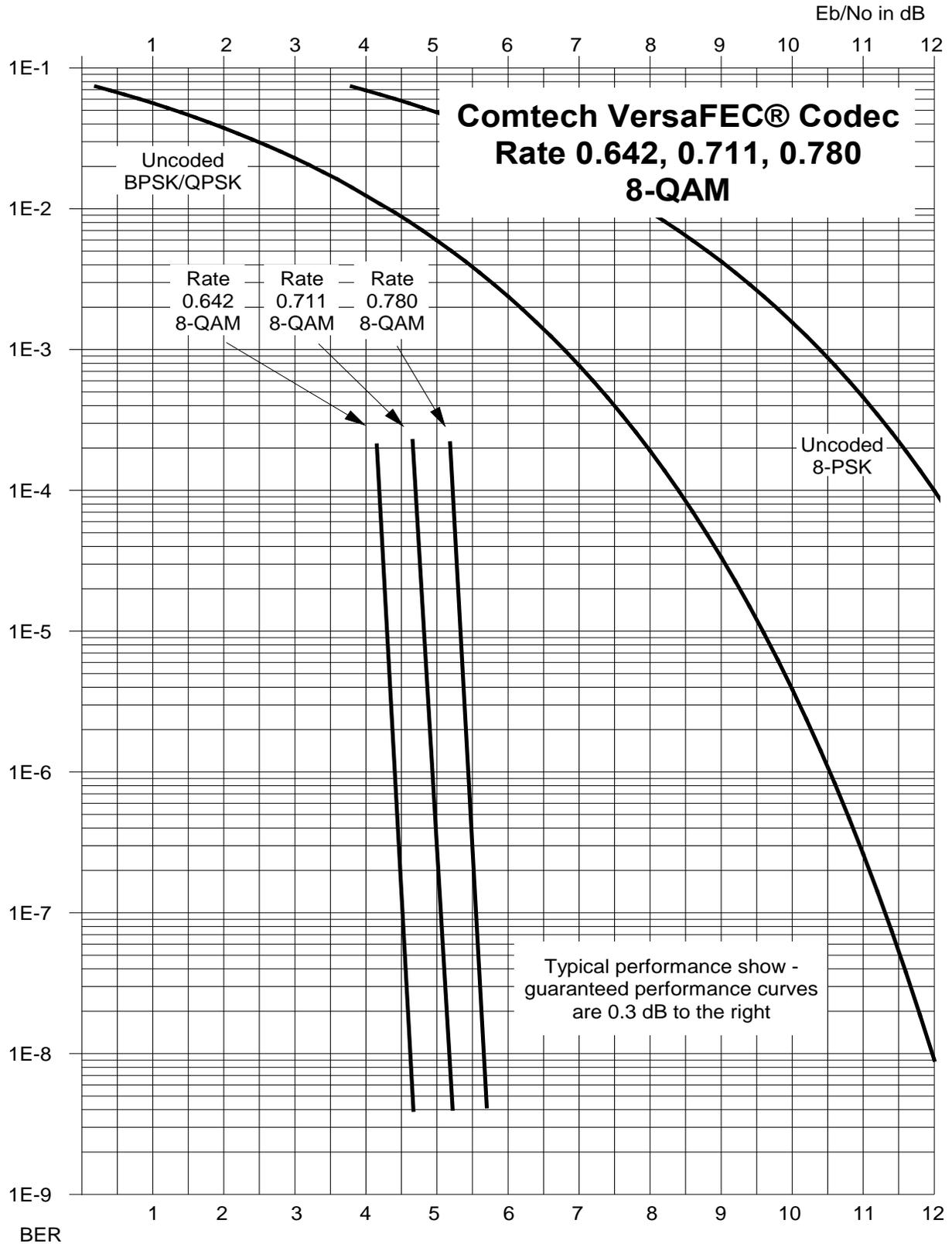


Figure B-4. VersaFEC Codec – 8-QAM, Rate 0.642, 0.711, and 0.780

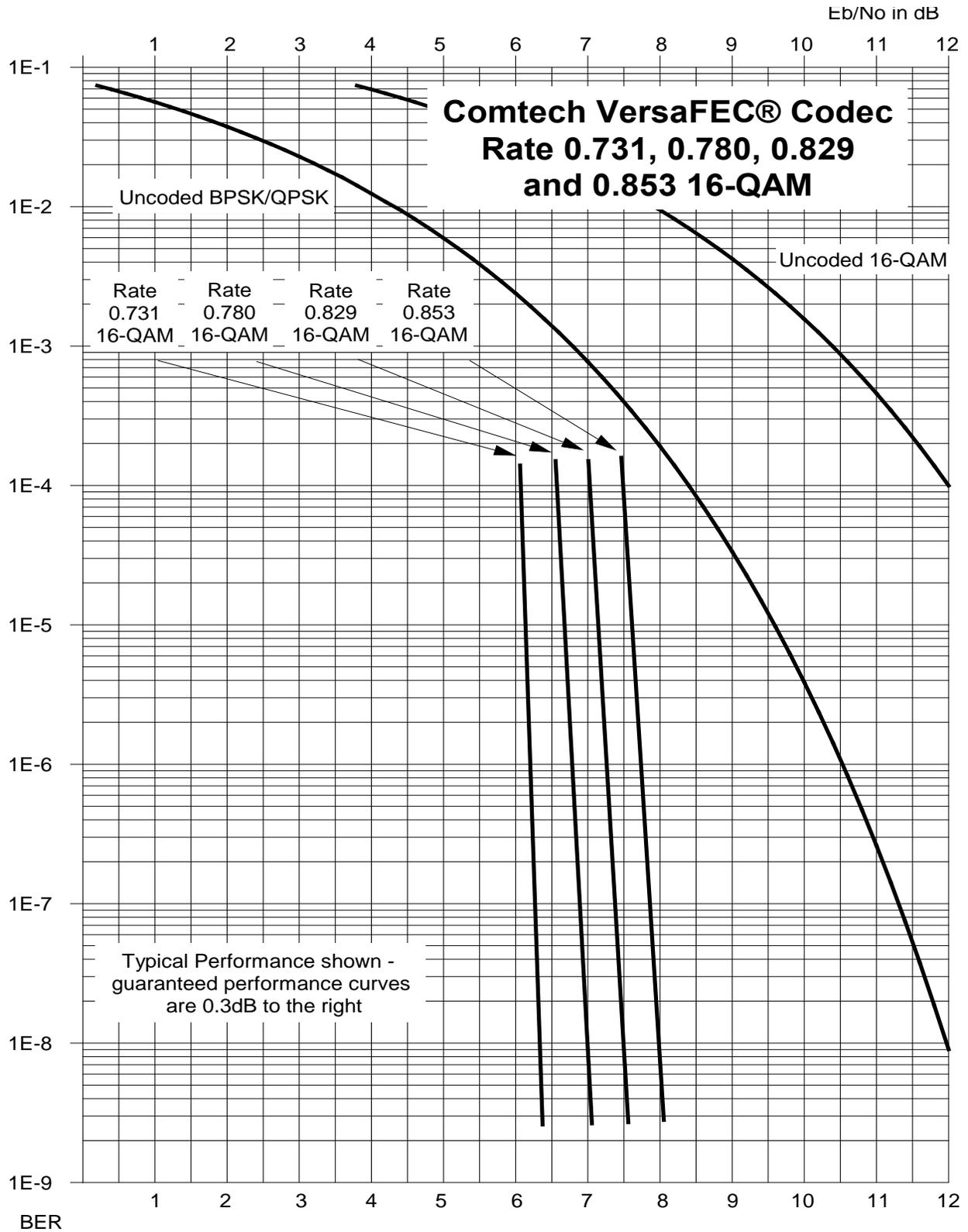


Figure B-5. VersaFEC Codec – 16-QAM, Rate 0.731, 0.780, 0.829 and 0.853

Appendix C. BPM (BRIDGE POINT-TO-MULTIPOINT) OPERATION

C.1 BPM (Bridge Point-to-Multipoint) Overview

The overall intent of the Advanced VSAT BPM (Bridge Point-to-Multipoint) feature is to make the Advanced VSAT equipment appear as a “Sky Ethernet Switch”. This allows for a greatly simplified network deployment.

In BPM Mode, all L2/L3/L4 protocols, such as VLAN, MPLS, IPv6, OSPF, and BGP, flow through the network as they would through an off-the-shelf Ethernet Switch.

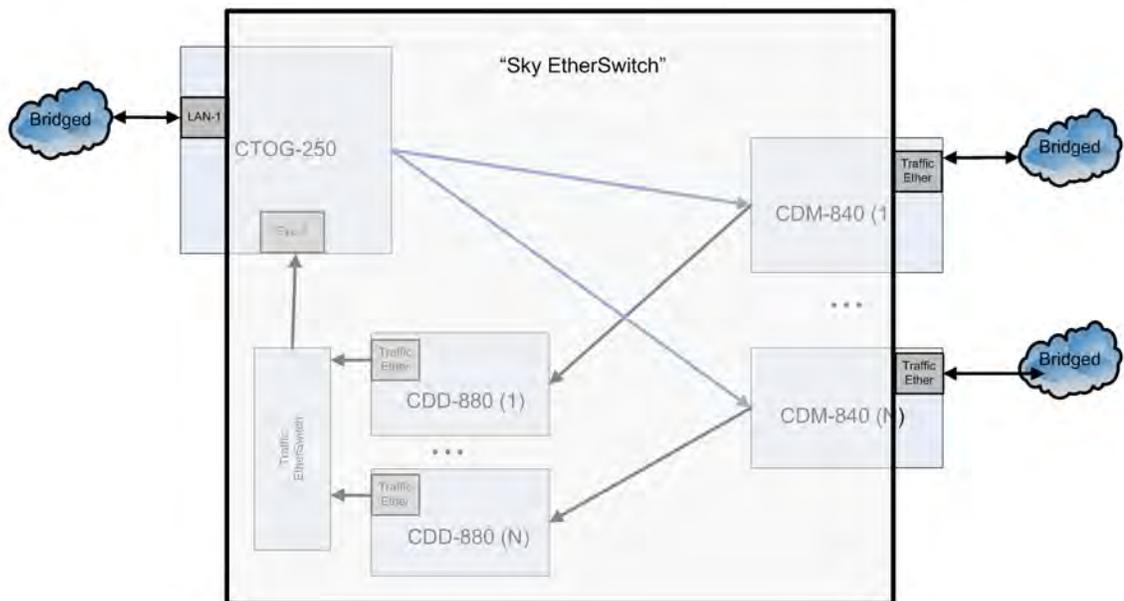


Figure E-1. Advanced VSAT BPM “Sky Ethernet Switch”

C.1.1 BPM Terminology

Term	Definition
ACM/VCM	Adaptive Coding and Modulation / Variable Coding and Modulation
Bridge Mode	This Advanced VSAT Network Working Mode configures the Traffic ports of the CTOG-250 and CDM-840 to function as a Bridge.
BPM Mode	Bridge Point-to-Multipoint Mode
Comtech Dynamic Routing Protocol (CDRP)	CEFD Proprietary protocol that automatically synchronizes the CTOG-250's Route table with the CDM-840's LAN connected routes – i.e., the routes that are directed to the LAN ports of the CDM-840.
CTOG-250	Comtech Traffic Optimization Gateway 250.
Entry Channel Mode (ECM)	Shared Aloha channel used in Vipersat dSCPC Mode that allows a remote terminal to gain access to the Network.
Flat Network	A network in which all devices are directly connected to each other and all devices are on the same IP subnet.
IGMP	Internet Group Management Protocol
Router Mode	This Advanced VSAT Network Working Mode configures the Traffic ports of the CTOG-250, CDD-880, and CDM-840 to function as a Router.
Single Hop on Demand (SHOD)	This CEFD technology allows for dynamic creation of Single Hop Mesh connections from one CDM-840 to another CDM-840. <i>SHOD requires the Vipersat Management System (VMS).</i>
VLAN Access Mode	This mode, only available in the CDM-840, forces the Traffic Interface to carry traffic for only one user-configured VLAN.
VLAN Trunking Mode	This is the default mode for BPM, where all packets (with and without VLAN tags) arriving at the CTOG-250 and CDM-840 pass through the system without modification. A trunked port can pass two or more VLANs on the interface.

C.2 Supported Network Configurations

When running in BPM Mode, the Advanced VSAT System supports Flat Networks, Flat Networks with Routers, and VLAN Trunking network topologies.

C.2.1 Flat Network

In a Flat Network (**Figure E-2**), all devices are on the same IP subnet. This is a very easy-to-use topology for simple and/or small networks.

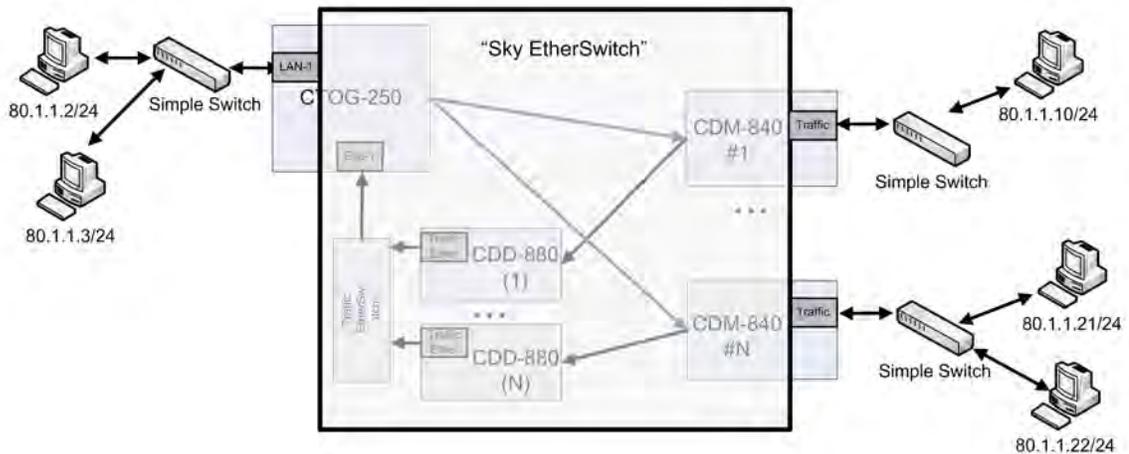


Figure E-2. Flat Network

C.2.2 Flat Network with Routers

This variation of the Flat Network includes Routers at each site. With this topology (**Figure E-3**), the Routers can be placed on the same subnet as if they were connected to the same Ethernet Switch, and all core routing protocols such as OSPF, RIPv2, BGP, VRRP, etc. work as expected.

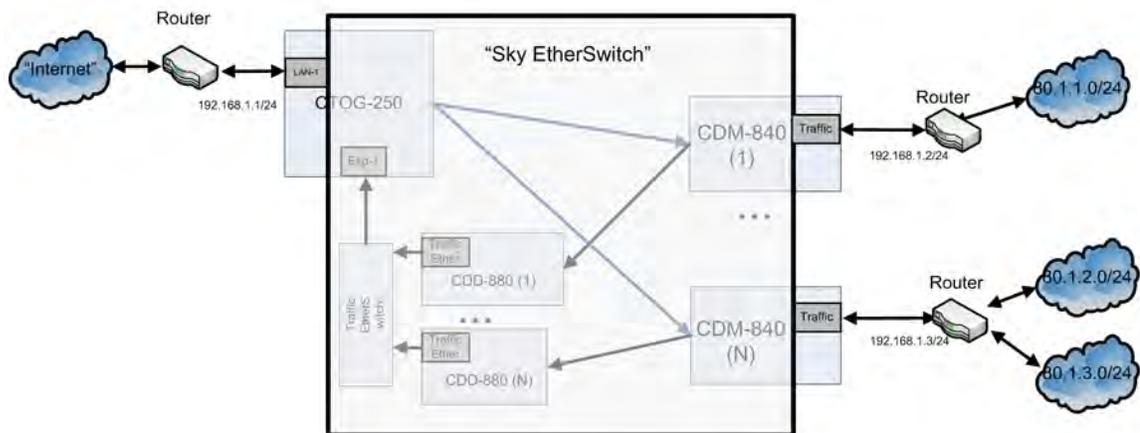


Figure E-3. Flat Network with Routers

C.2.3 VLAN Trunking

In a VLAN Trunking topology (**Figure E-4**), the Hub side equipment functions as a VLAN trunking interface. You can map Outbound packets (Hub to Remote) to the desired QoS Group (see **Sect. E.6**).

By default, the CDM-840 Remote Router equipment functions as a VLAN trunk and passes all traffic received on the WAN and Traffic LAN ports. In this mode, you should have a VLAN-enabled Ethernet Switch at each remote to properly break out the VLAN into the desired network topology.

In addition, you can optionally configure the CDM-840 in Access Mode with a user assigned VLAN ID (see **Sect. E.4**).

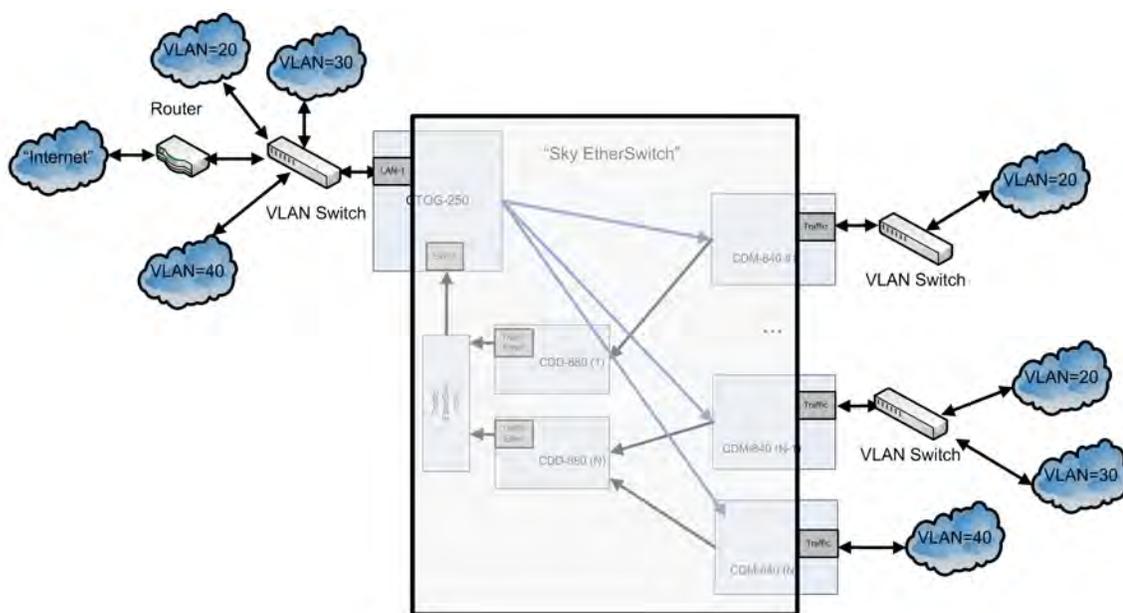


Figure E-4. BPM with VLANs

C.3 Packet Processing

C.3.1 Traffic Network / Ethernet Switch Behavior

The Advanced VSAT BPM feature functions as a Learning Ethernet Switch when you set the “Working Mode” to BPM. BPM has the following basic functionality:

- MAC addresses associated with each segment/port are learned by inspecting the source MAC for packets arriving at each Ethernet port.
- Once the port association for a MAC address is learned, an Ethernet Switch will not transmit Ethernet packets with that MAC address to other segments/ports.

- Broadcast packets are sent out all interfaces.

For Advanced VSAT BPM Mode, it is important to note that the CTOG-250 Comtech Traffic Optimization Gateway and CDM-840s learn MAC addresses and avoid any unnecessary transmission. In BPM Mode, the CDD-880 Multi Receiver Router functions as a receive-only pass-through to the CTOG-250.

C.3.2 Management Network

Note that, while the Advanced VSAT BPM feature supports Bridged Traffic ports, the Management ports for all units in the Advanced VSAT System must operate in Router Mode.

When in BPM Mode, the Traffic ports on the Advanced VSAT units do not have IP Addresses (as you would expect from an Ethernet Switch). Therefore, the units cannot be managed (SNMP, Web, Telnet) or pinged from this interface.

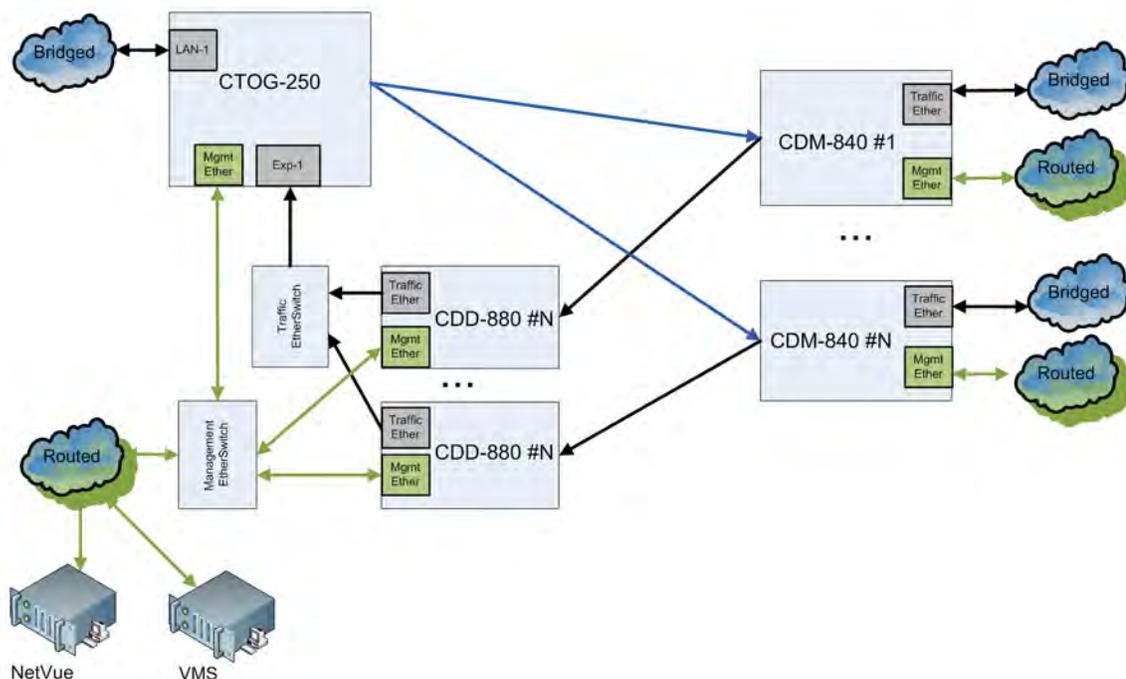


Figure E-5. Management Network in BPM Mode

When configuring the CTOG-250 for “BPM” Working Mode, Comtech Dynamic Routing Protocol (CDRP) continues to work as expected to populate the CTOG-250 with the routes required to manage the remote CDM-840s via their Management IP Addresses. Handle the Return Link Routed Management Traffic by entering a default route (0.0.0.0/0 “toWAN”) in the CDM-840’s routing table.

As with “Router” Working Mode, you must enable CDRP in order for ACM/VCM on the DVB-S2 Outbound Carrier to work for Management Traffic destined to each remote.

User traffic on the Traffic ports does not require CDRP, as BPM automatically and seamlessly handles ACM/VCM for this traffic.

When operating the network with the Comtech NetVue or Vipersat Management System (VMS), the Advanced VSAT units (CTOG-250/CDM-800, CDM-840, and CDD-880) are managed through the Management Network using the Management Ethernet port and Management IP Addresses.

C.4 IEEE 802.1Q Support

Advanced VSAT support for IEEE 802.1Q includes VLAN Trunking, Access Mode and Multiple VLAN Tagging support.

C.4.1 VLAN Trunking

The Advanced VSAT Hub equipment always functions in VLAN Trunking Mode. Trunking Mode means that Ethernet packets received by the CTOG-250 LAN-1 interface are passed, unchanged and unfiltered, to the appropriate remote modem.

Likewise, when the CDM-840 is in Trunking Mode, the VLAN tags are passed, unchanged and unfiltered, through the modem.

The CDD-880 is a receive-only pass-through in BPM Mode. As such, it receives the packets from the remotes and passes them to the CTOG-250 for processing and forwarding.

C.4.2 Access Mode Support

As part of 802.1Q support, the CDM-840 supports Traffic port configuration in either Trunk or Access Mode. Access Mode allows the CDM-840 to function as a VLAN edge switch to add and remove VLAN tags to connect a distant end network with other networks.

- All packets received at the Traffic Ethernet port are tagged with the assigned Access Port VLAN ID.
- All packets having the matching VLAN ID that are then received from the WAN have the VLAN tag removed, and the packets are passed out the Traffic LAN port.
- In **Access Mode**, the CDM-840 drops all packets that already have VLAN tags that it receives at its Traffic LAN port.
- In **Access Port Mode**, packets that do not have a matching VLAN ID that are received from the WAN are dropped.

(Note that this is not normal behavior as, once the MAC addresses have been learned at a given remote, all other remotes will then perform a hardware-level filter on the packets.)

C.4.3 Multiple VLAN Tagging Support

The Advanced VSAT platform supports processing Ethernet packets with multiple stacked VLAN tags, with the following limitations:

- At the CTOG-250, only the outermost VLAN ID is used for mapping to the appropriate QoS Groups.
- In Trunking Mode, L2 Header Compression only compresses packets with one or two VLAN Headers. Packets with more than two VLAN Headers are allowed to pass, but only the first two VLAN headers will not be compressed.

C.5 Multicast BPM Behavior

In BPM Mode, Multicast packets are forwarded in two directions:

- **Outbound Path (CTOG-250 ► CDM-840):** Multicast packets arriving at the CTOG-250 are passed out the WAN to all CDM-840s using the “VCM Only MODCOD” option for the matching QoS Group (based upon VLAN or Subnet).
- **Return Link Path (CDM-840 ► CDD-880 ► CTOG-250):** Multicast packets arriving into the CDM-840 Traffic port are automatically passed out the CTOG-250’s Traffic port only. Internet Control messages (such as OSPF, RIP, and BGP) that fall into the 224.0.0.0 - 224.0.1.255 address range are automatically passed out both the CTOG-250’s LAN and WAN ports.

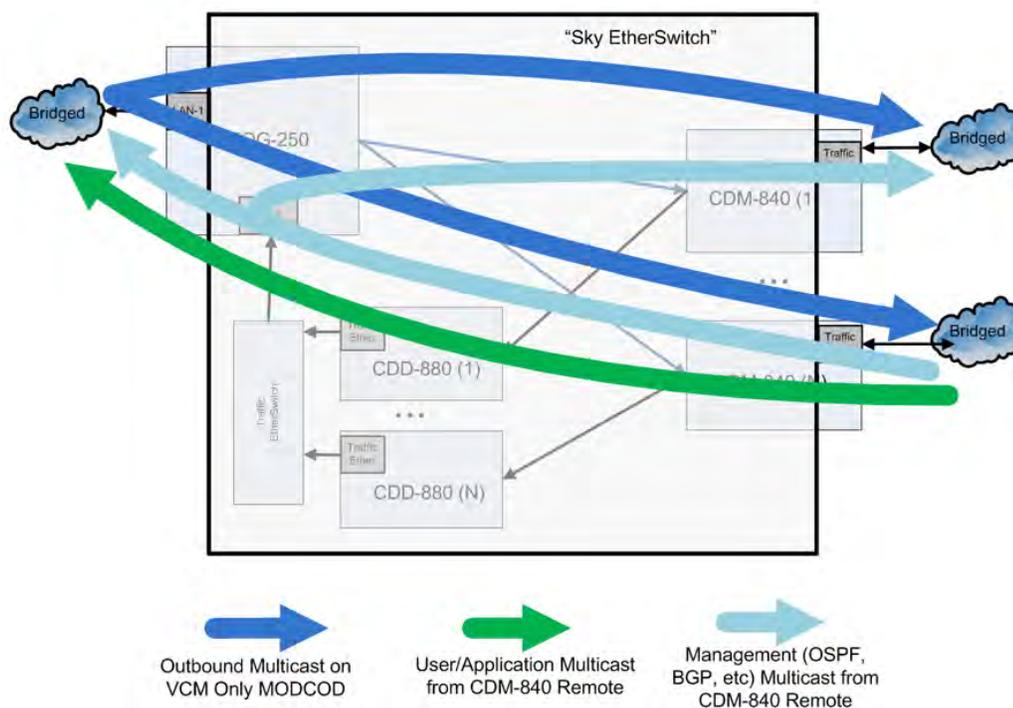


Figure E-6. Multicast Behavior in BPM Mode

If required, you can create QoS rules with “Filter All” enabled to filter undesired Multicast from traversing the satellite network for both the CTOG-250 and the CDM-840.

C.5.1 Multicast Management/Routed Behavior (No Change)

In both BPM and Router Modes, Multicast packets arriving at the Management (routed) port of the CTOG-250 and CDM-840 must be configured to be transmitted to the WAN by adding a Multicast-specific route table entry with a “/32” subnet.

Packets arriving at the CDM-840 downlink pass out the CDM-840 Ethernet port based upon the following criteria (configurable via NetVue or the Web page for each CDM-840):

- **Downlink (outbound from the Hub Segment) Multicast All** – All downlink outbound Multicast packets pass to the Traffic LAN interface of the CDM-840 unit.
- **Use IGMP (Internet Group Management Protocol)** – Only remotes that have IGMP clients enabled with the Multicast address pass the Multicast packet to the CDM-840’s LAN port.

C.6 BPM and Group QoS with Outbound ACM/VCM

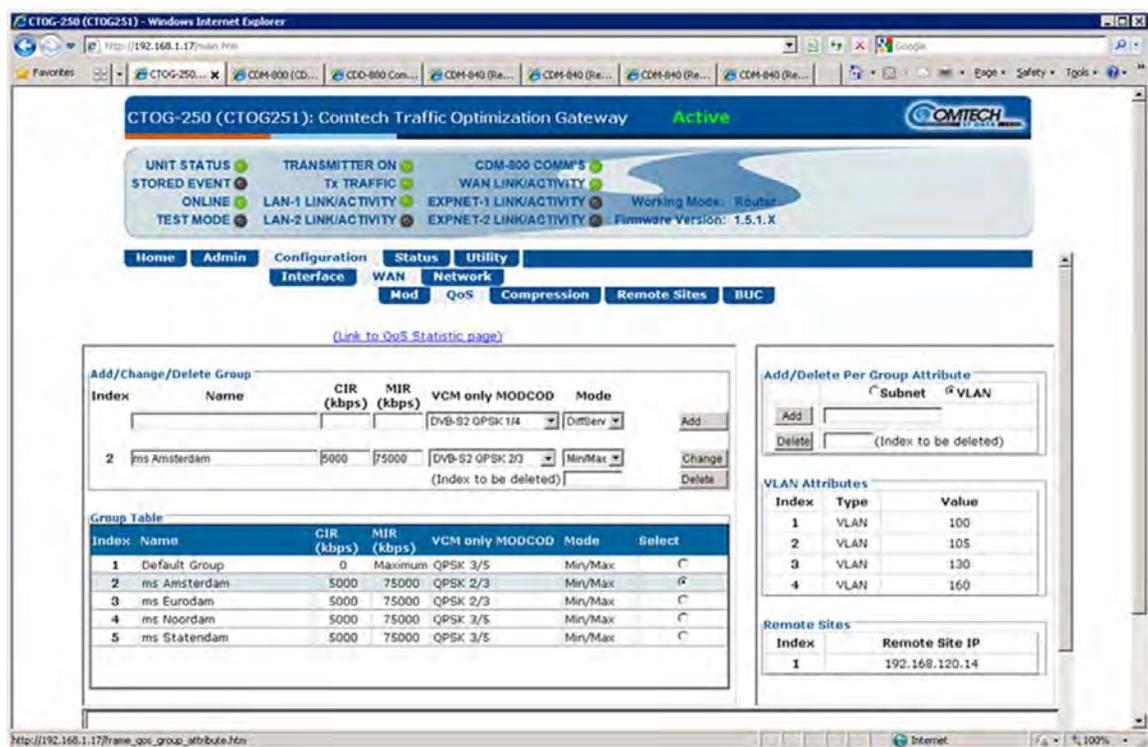


Figure E-7. Configuring VLAN to QoS Group Mapping (CTOG-250 shown)

ACM/VCM on the Outbound carrier works with BPM by seamlessly matching packets to the correct remote site. While no configuration is required, you have the ability to first use a VLAN ID, and then use a Subnet/Mask, to associate a packet to a QoS Group. This functionality allows you to partition the Outbound Carrier capacity.

In BPM Mode, you must define a simple VLAN mapping algorithm to map traffic for a given remote to a single QoS Group and a single VLAN ID.

However, in cases where it is desired to support the same VLAN ID across multiple remotes but continue to map the traffic for a remote to a single QoS Group, you have the ability to assign the same VLAN with different subnet/masks.

Once you add a QoS Group, you can add up to 32 VLAN tags and/or 32 Subnet/Masks per QoS Group.

Packet-to-QoS Group mapping employs a strict hierarchical matching algorithm:

Incoming Packet	Matching criteria
No VLAN header	<p>Uses the Destination IP Address of the packet to match the packet to the QoS Group with the user configured Subnet/Mask.</p> <p>The desired QoS Group must not have any VLAN tags.</p>
1 VLAN Tag	<p>First match on the QoS Group with the configured VLAN tag.</p> <p>If more than one QoS Group has the packet's VLAN ID, then the QoS Group with the matching Subnet/Mask will be used.</p> <p>QoS Groups with a different VLAN ID or no VLAN IDs will not be matched.</p>
2 VLAN Tags	<p>Same as the 1 VLAN Tag case, but the outermost VLAN tag will be used for matching purposes.</p>

If the packet fails to match on any of the User Configured QoS Groups, the packet is placed into the Default QoS Group for processing.

C.7 Hub Network Configuration

In order for the BPM feature to operate as expected, you must configure the Hub Network as defined here.

A standard off-the-shelf Ethernet switch that supports port isolation and MAC learning is required. All ports connected to the CEFD equipment should have MAC learning enabled.

There are three basic deployment approaches:

1. A standalone CTOG-250
2. Multiple independent CTOG-250s
3. CTOG-250 redundancy.

For the standalone CTOG-250 approach, there are no restrictions on the Hub network beyond requiring that you connect the traffic ports for all of the CDD-880s and the CTOG-250 to the same Ethernet Switch.

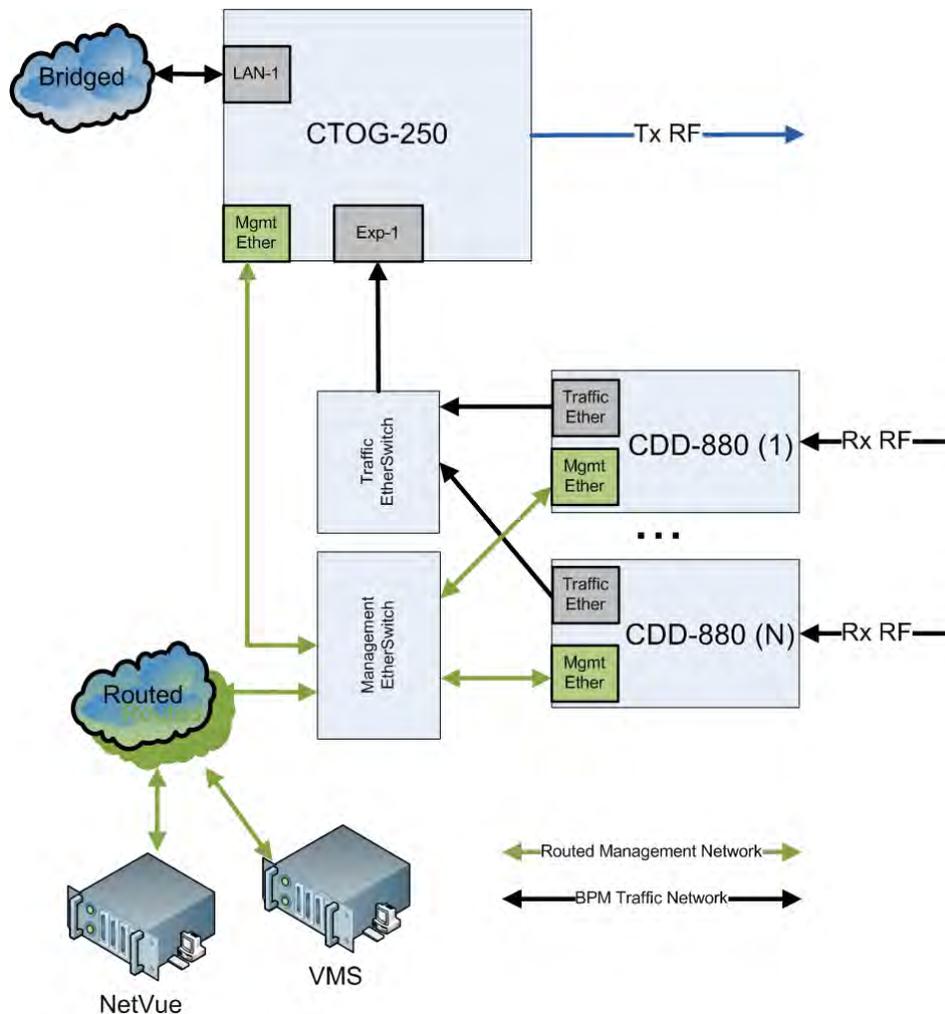


Figure E-8. Hub Configuration – Standalone CTOG-250, No Redundancy

While the **Figure E-8** diagram suggests inclusion of the management network portion, it is not strictly required. However, what *is* strictly required is that the following holds true for all Advanced VSAT deployments:

- The Management IP Addresses for all units have IP connectivity to the NetVue and VMS server’s IP Address.
- CDD-880 management ports must have a packet path to the Management IP Address of the CDM-840s.
- CDM-840s have a packet path to the Management IP Address of the CTOG-250.

If you have multiple Advanced VSAT outbound carriers at a single Hub, Comtech EF Data recommends the deployment architecture shown in **Figure E-9**.

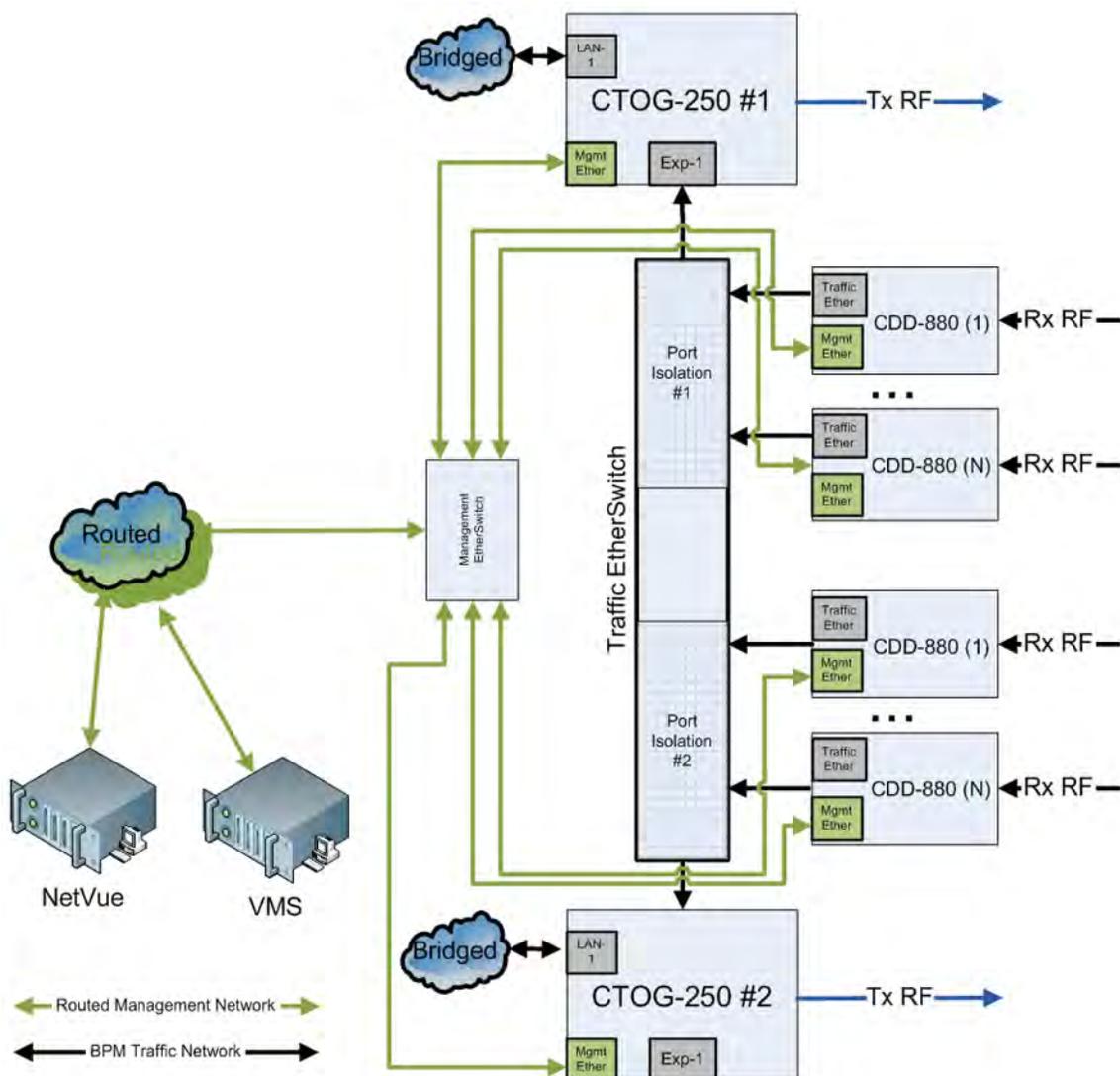


Figure E-9. Hub Network Configuration

If you have multiple Advanced VSAT outbound carriers at a single Hub, Comtech EF Data recommends the deployment architecture shown in **Figure E-10**. In this case, there is no need for port isolation for each of the respective outbound networks; however, you **MUST** configure the “Static CTOG-250 IP” that is found on the CDD-880 **Configuration | Network | Working Mode** web page.

Once you set this value, then the CDD-880 is automatically associated with the desired CTOG-250. The CDD-880 and CTOG-250 exchange a proprietary handshake mechanism that allows the packets coming from the CDD-880s to be associated with the correct CTOG-250, as long as you enable MAC learning on the attached Ethernet Switch.

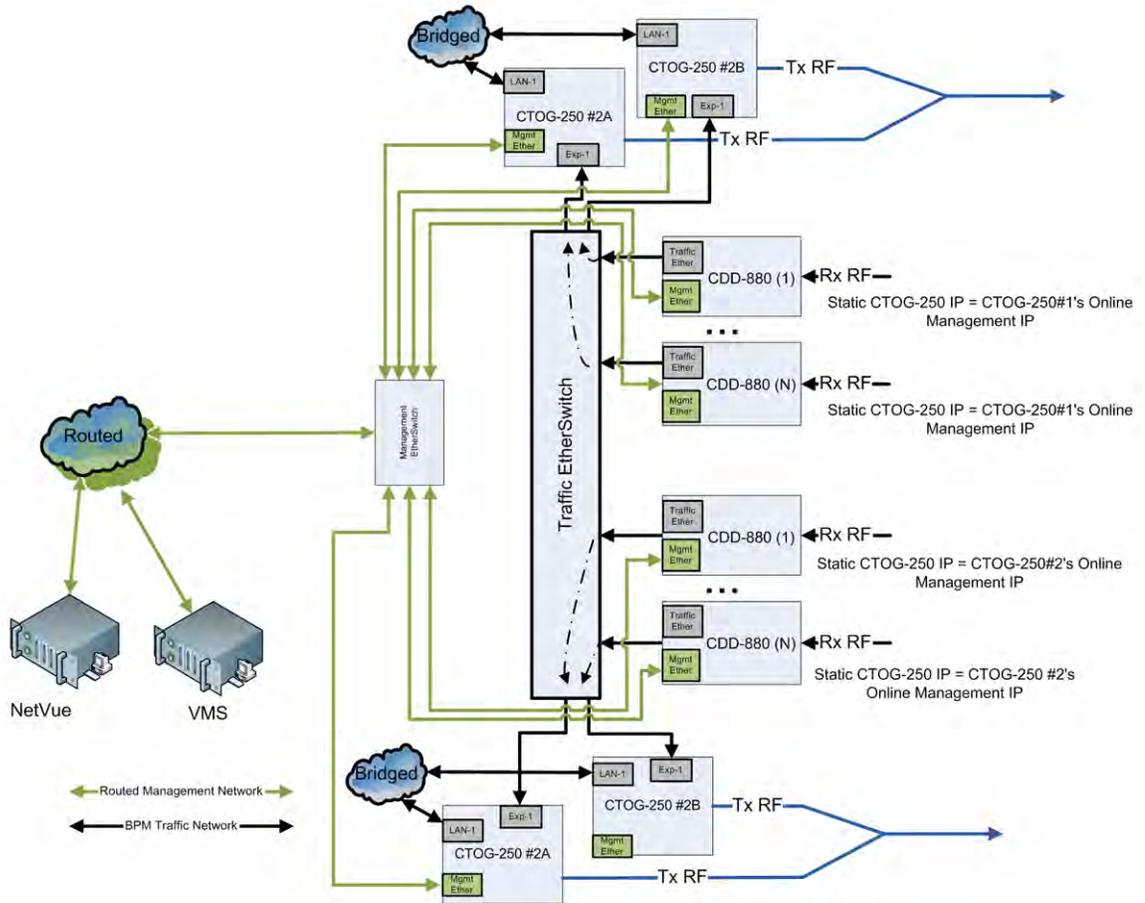


Figure E-10. Multiple CTOG-250 Outbounds in Redundant Mode

C.8 Compatible Features and Detailed Specifications

Advanced VSAT BPM Mode is compatible with the following features:

Feature	Comments
Group QoS (CTOG-250) and QoS (CDM-840)	
Header Compression	<p>Includes the following L2 Protocols:</p> <ul style="list-style-type: none"> • Ethernet 2.0 • Ethernet 2.0+VLAN-tag+VLAN-tag • 802.3-raw • 802.3-raw+VLAN-tag+VLAN-tag • 802.3+802.2+VLAN-tag • 802.3+802.2+SNAP • 802.3 +802.2+SNAP+VLAN-tag+VLAN-tag <p>Includes the following L3/L4 Protocols:</p> <ul style="list-style-type: none"> • IP, UDP, TCP, RTP
Payload Compression	
PTP (Precision Timing Protocol)	
RANOP with E1	
dSCPC with VMS	
Entry Channel Mode (ECM)	
AES-128	
Return Link ACM	
ACM/VCM on the Outbound	
Comtech Dynamic Routing Protocol (for the management network)	
Multicast	
IPv6 (traffic ports only)	
VLAN trunking	
VLAN Access Mode on the CDM-840	
CTOG-250 and CDD-880 device redundancy with the VMS	

The following features are **not** supported when in BPM Mode:

- The standalone CDM-800* does not support BPM due to packet per second limitations.
- Single Hop-on-Demand (SHOD) Mesh.
- CDD-880 Port Diversity.



***Starting with Firmware Ver. 1.5.1.X, the CDM-800 no longer supports standalone mode. The CDM-800 must be paired with a CTOG-250.**

The Advanced VSAT BPM Working Mode has the following detailed specifications:

Attribute	Value	Comments
Maximum Ethernet Frame Size	2018 Bytes	Includes FCS but not the preamble
Working Mode	Routing or BPM	All units in the network MUST be configured the same. All units in the network must be configured to "BPM" for BPM to function as expected.
Traffic port	Bridge in BPM Mode Routed in Router Mode	
Manage Port	Always in Router Mode (not configurable)	Applies to CTOG-250, CDM-840, CDD-880
VLAN Access Mode Support	CDM-840 will support VLAN Access Mode for a single VLAN ID.	Access Port VLAN ID = 1..4095
WAN Labels	1-2047	Must be unique across all CDM-840s that shared a CTOG-250 Outbound Carrier. WAN Labels seamlessly provide hardware level filtering to improve network performance.

C.9 Summary

The Advanced VSAT Bridge Point-to-Multipoint feature and functionality enables the support of network architectures requiring IEEE 802.1Q Standards in a number of simple yet powerful network deployments. This is made possible, beginning with Advanced VSAT Firmware Version 1.5.X.X, while taking advantage of all of the features and benefits of the Advanced VSAT Solutions platform.

Appendix D. ECM (ENTRY CHANNEL MODE)

D.1 ECM (Entry Channel Mode) Overview



- Comtech EF Data CDM-840 Remote Router Installation and Operation Manual (CEFD P/N MN-CDM840)
- Comtech EF Data ODM-840 Remote Router / ODMR-840 Reduced Form Factor Remote Router / ODMR-840B Remote Router Board Set Installation and Operation Manual (CEFD P/N MN-ODM840)

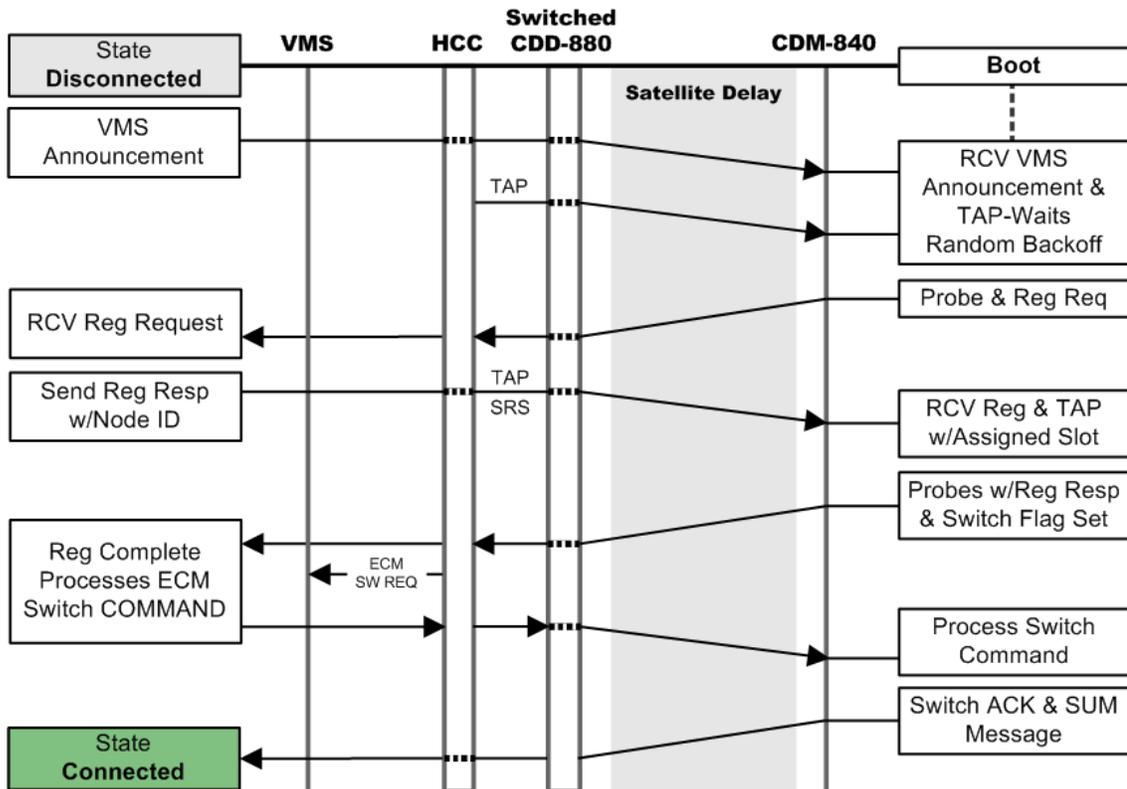


Figure D-1. ECM – Message Processing Diagram

Figure D-1 illustrates the processing diagram for Entry Channel Mode (ECM) messaging. ECM is a feature based on slotted ALOHA with random retransmission backoff. ECM supports multiple carriers through frequency assignments, which provide simplified deployment and scalability.

In a typical Comtech EF Data Advanced VSAT System network, the CDD-880 Multi Receiver Router serves as the **HCC – Hub Channel Controller** – a dedicated hub demodulator selected (mode set) as an ECM controller; Comtech EF Data’s CDM-840 or ODM-840 Remote Routers support ECM as an installed component of a typical remote site cluster.

D.1.1 ECM Terminology

Abbreviation	Term	Comments
ASR	Application Switch Request	ASR is a private protocol used by the CDM-840 to request bandwidth from the VMS.
BUC	Block Up Converter	The BUC is used in the Tx (uplink) of satellite signals to convert a band of frequencies from a lower frequency to a higher frequency.
CDRP	Comtech Dynamic Routing Protocol	CDRP is used to simplify the deployment of Comtech EF Data’s Advanced VSAT solution in an IP-routed network.
dSCPC	Dynamic Single Channel Per Carrier	dSCPC is a Comtech EF Data FAST Feature used to enable dynamic allocation and sharing of bandwidth among users.
HCC	Hub Channel Controller	The HCC is a dedicated CDD-880 that generates the TAP and is responsible for all request transactions from each CDM-840 while in Entry Channel Mode.
LNB	Low-Noise Block Down Converter	The LNB is the receiving device on a parabolic satellite dish used for the Rx (downlink) of satellite signals
RID	Remote Identification	The RID is a message, presented to the Hub Channel Controller upon each transmission into the ALOHA channel, which contains the IP Address and control flag.
SAS	Set of ALOHA Slots	SAS is used as random access for initial request messaging from the CDM-840s.
SRS	Set of Registration Slots	SRS is used for time sensitive management message transactions.
SUM	Status Update Message	SUM is used for updating VMS device control parameters, such as Tx Frequency, Data Rate, Current MODCOD, Eb/No, Es/No, ACM information, etc.
TAP	Transmission Announcement Protocol	The TAP is the time and frequency reference message sent on intervals to synchronize any listening CDM-840s into the Entry Channel.
VMS	Vipersat Management System	A VMS is a configuration, management, and control tool that is used to configure the Advanced VSAT Network and respond to network anomalies.

D.1.2 ECM Theory of Operation

While a CDM-840 is in Entry Channel Mode, it allows the passing of management traffic only – it will not transmit user data traffic. An ECM-enabled CDM-840 may remain in the entry channel for an extended period if “online” communications are not required, or if **dSCPC (Dynamic Single Carrier Per Channel)** resources are unavailable. While idle or waiting in the entry channel, the CDM-840 sends periodic health status messages while it continues to service VMS recovery logic timers.

Note that a “channel” refers to a fixed carrier slot on the satellite that allows the CDM-840 Remote Router random access (in time) to a readied HCC (CDD-880) for transacting each acquired transmission. Each CDD-880 supports only one Entry Channel; this channel is always assigned to Demod #1.

The HCC uses a **TAP (Transmission Announcement Protocol)** message to broadcast a key subset of transmit parameters that match its receive configuration, but assumes all other site specific parameters were preconfigured at the time of antenna commissioning. In addition, the TAP provides timing information in the form of slot parameters that define the required acquisition time of the receiver and the amount of time allowed for data transmission. The TAP also contains a list of CDM-840s that successfully transmitted during the previous cycle. The list of CDM-840s from which the HCC expected – but did not receive – a response is also provided; these CDM-840s are assigned a slot for the next cycle.

Each associated CDM-840 achieves loose time synchronization via the broadcast TAP message transmitted at periodic intervals. Since the TAP transmits via the satellite, all CDM-840s receive it at effectively the same time, with delay differences (due to geographic variation of each remote site cluster) compensated with a specified guard time. Upon receipt of the TAP message, the CDM-840 resets its ECM time reference and uses the slot information to determine/select the next transmit opportunity:

- If the CDM-840 has transmitted in the previous cycle, and does not indicate it is finished, it receives an assigned slot as indicated by its IP Address.
- If the CDM-840 does not have an assigned slot, it randomly picks one from the available contention slots.
- If no contention slots are available, the CDM-840 waits for the next cycle.

This process allows each CDM-840 to transmit at a discrete time to minimize the chance of collision. To reduce slot contention further, a random backoff (next slot) algorithm is deployed if the transmission was not received. Each CDM-840 attempts to enter the network by gauging its transmissions from this timing reference, randomly picking one of the **Set ALOHA Slots (SAS)** presented by the TAP message. The transmit “on” time is of a fixed duration, allowing sufficient time for the receiving CDD-880 to acquire and pass the management signaling messages. The CDM-840 will continue to attempt access on cadence intervals using random backoffs, selecting a different SAS until receiving positive acknowledgement from the HCC.

Upon valid reception, the HCC processes the **Remote Identification (RID)** packet containing the CDM-840 IP Address, TAP (Group) ID, and ECM state flags. Each CDM-840 sign-on IP Address is added to a list of CDM-840(s) that are queued and await assignment.

Depending on the ECM state flag, the CDM-840 either remains idle in the channel or is assigned one of the next available time-sensitive slots. Each slot, labeled as a **Set of Registration Slot (SRS)**, is also assigned through the TAP and allows the CDM-840 to complete any necessary transaction without further contention.

The CDM-840 then holds an SRS until it receives its assignment into dSCPC or determines that all necessary transactions are complete; at this time, it releases the slot by signaling the HCC through the RID message.

Upon release of the slot, the HCC re-assigns it to the group of contention slots. This cycle repeats until all CDM-840s either have been switched to dSCPC channels or require no further interaction.

Once the CDM-840 indicates that registration with VMS is complete (via one of the flags in the RID message), on behalf of the CDM-840 the HCC requests dSCPC assignment by placing the CDM-840 IP Address into the “switch pending” list and sending an ECM type switch request message to the VMS. The VMS, upon receipt, either *grants* the request and signals the HCC to remove the CDM-840 from its list, or *ignores* the request and leaves the CDM-840 in the “switch pending” list. The HCC repeats this request at 12-second intervals up to five times before it removes the CDM-840 from the “switch pending” list. While the CDM-840 is in this “switch pending” ECM state, it continues to send SUM health status update messages to the VMS on timed intervals. Since all ECM transmissions from the CDM-840 contain a RID, this causes the CDM-840 to be placed back in the “switch pending” list. This cycle continues until the CDM-840 switches, or is set to ECM **Wait** state, or goes offline.

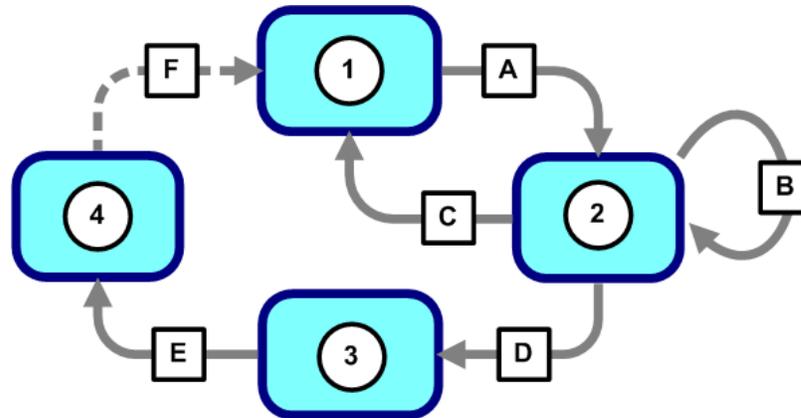
The VMS is the last step in the entry process that provides network registration, and grants or ignores dSCPC resources. If resources are limited because of bandwidth, hardware, or unavailability, the CDM-840s will remain in the entry channel pending assignment.



The VMS plays no role in ECM timing or control.

D.1.2.1 CDD-880 ECM Message Processing

Figure D-2 illustrates the internal logic diagram of the HCC processing of remote messages.



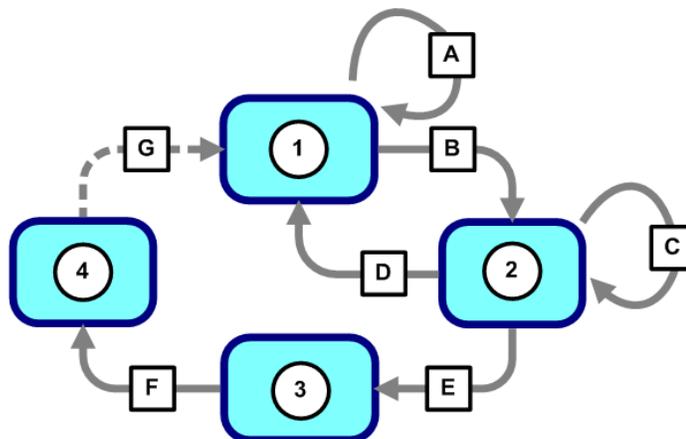
Processing Segment	Description	Remarks
1	ALOHA	
2	TAP	In "Assigned Slot" list
3	SWITCH PENDING	In "Switch Pending" list – Switch Request sent to VMS up to 5X in 12-second intervals until response
4	SWITCHED	

Action	Remarks
A	RID Detected – add to Detection List of TAP
B	RID Detected – add to Detection List of TAP
C	Missed 'N' Consecutive Cycle
D	Registration complete – no more slots needed
E	"Disable" message received from VMS
F	CDM-840 received "Revert" message from VMS

Figure D-2. ECM Message Processing – CDD-880 Multi Receiver Router

D.1.2.2 CDM-840 ECM Message Processing

Figure D-3 illustrates the internal logic diagram of the remote processing registration message.



Processing Segment	Description	Remarks	Action	Remarks
1	ALOHA	"Not Registered" or "Reverted"	A	Random attempts with backoff until in TAP
2	REGISTRATION		B	In TAP
3	SWITCH PENDING		C	Send Registration Protocol until complete
4	SWITCHED		D	Not in TAP
			E	Registration complete – no more Slots needed
			F	Received "Switch Command" message from VMS
			G	Received "Revert" message from VMS

Figure D-3. ECM Message Processing – CDM-840 Remote Router

- The CDM-840s are configured to receive the outbound carrier and are given a TAP (Group) identifier number (default 1) that sets the internal filtering if multiple TAPs are used.
- Upon receipt of the TAP message, the CDM-840 sets modem transmission parameters (if required), initializes timing, and picks at random an SAS to start entry by sending a *probe* (slot transmission).
- The CDM-840, based on its current ECM state, either requests an *assigned slot* or waits to be *switched*:
 - An *assigned slot request* indicates to the HCC if the CDM-840 has more data (e.g. registration protocol) to send.
 - A *switch request* indicates that the CDM-840 is requesting dSCPC bandwidth. These two flags are independent.

D.2 ECM Operational Scenarios

D.2.1 Scenario 1 – VMS Initial Registration Process

For proper registration with the VMS, initialization (power-up and bootup) of the ECM-enabled CDM-840 is required.

Upon initialization, the CDM-840:

1. Receives a VMS Announcement, sets up an active VMS IP Address, and initializes ECM TAP processing;
2. Transmits a registration request using a selected SAS, and sets a “Needs Slot” flag in the RID message;
3. Receives the HCC response, through the TAP, assigning an SRS;
4. Continues to transmit the registration request message in SRS;
5. Receives registration from the VMS (Standard Processing);
6. Transmits a registration acknowledgement to the VMS in SRS – it signals the HCC by clearing “Needs Slot” and sets the “Registered with VMS” and “Need to be Switched” flags in the RID message.
7. Receives the HCC response, through the TAP, as an acknowledgement – the HCC then clears the SRS allocation and sends ECM switch requests to the VMS on behalf of the CDM-840 (Standard Processing);
8. Waits for VMS dSCPC assignment (Standard Processing).

D.2.2 Scenario 2 – Reverted or Auto-Recovered Messages

“Revert” or “Auto Recover” of an already registered CDM-840 is required when:

- The CDM-840 was forced into or dropped back to ECM mode;
- The CDM-840 transmits into an SAS setting due to a “Need to be Switched” flag in the RID message;
- The HCC sends ECM switch requests to the VMS on behalf of the CDM-840 (Standard Processing).

D.2.2.1 ECM Revert Cycle Timing

When a CDM-840 reverts from dSCPC to ECM, there is typically no wait because the CDM-840 is always monitoring TAP cycles to synchronize. It then randomly selects a slot in the next cycle and transmits. If the probe is not detected at the corresponding CDD-880 (as indicated by the next TAP to the CDM-840), it backs off by doubling the cycle and selecting another random slot. If the revert happened near the end of the cycle the CDM-840 wait for next TAP.

The **Slots in Frame** setting is determined by the number of remotes in the cluster that are either waiting in the channel or put back into the channel for recovery. Example, if there was only one CDM-840 attempting to enter the network, it would be simple to determine the number of required slots would be two – one for contention, and one for assignment. However, in any given network there may be many CDM-840s attempting to pass through the ECM channel depending on their state or network environment. Other catastrophic and potential real world conditions may include hub outage (although unlikely), sun outages, rain fade, or regional nightly power-down schedules.

In normal operations, only one to a few CDM-840s would be accessing the channel. The worst-case scenario is where all CDM-840s are placed in ALOHA on the ECM channel and depending on slot count the contention will be high until the ECM controller starts to cycle down through the reception list and all CDM-840s are cleared.

In any case, it is important to accurately assign the total number of number of slots in order to reduce contention and reduce the time it takes for all CDM-840s to re-enter the network dSCPC resources. While it might seem obvious to adjust the **Slots in Frame** setting to a large number, however this could have an inverse effect, because adding more slots increases the cycle time adding potentially more delays-per-CDM-840 attempting access the channel.

While trial and error may be used to determine the correct settings (based on the actual network parameters), Comtech EF Data enables you to avoid such a tedious process with its available **ECM Calculator**. This tool, provided upon request, presents theoretical analysis, number of cycles and time to capture all waiting CDM-840s.



Contact Comtech EF Data Product Support to obtain the ECM Calculator.

D.2.2.2 ECMv2 Backoff Algorithm

The ECMv2 Backoff Algorithm optimizes between quick entry in a quiet network and minimal collisions in an active network. Its key feature is the concept of fixed-length data slots within a repeating frame (or cycle). You can control the number of slots in a frame based on the known number of CDM-840s trying to gain entry into the network. Each total slot consists of three components:

- Acquisition Preamble
- Data Segment for Management Messages
- Guard Band to resolve timing uncertainty

An integral number of VersaFEC blocks are used for both the preamble and the data segment; the guard band will vary due to system timing uncertainties and propagation delay due to the geographic dispersion of the CDM-840s.



A Guard Band of 50ms is sufficient in most cases to accommodate geographical latency differences and internal timing errors.

The preamble is pre-determined based on calibration tables for receiver acquisition at the current data rate and MODCOD. The data segment is sized to support the largest messages needed to complete the Entry Channel handshake protocol and maintain status and CDRP. The actual size (in milliseconds) of each slot is therefore a function of the data rate and the number of bits in a VersaFEC block for the MODCOD of the ECM channel.

When a CDM-840 is ready to transmit, it waits for receipt of a TAP message that establishes time synchronization between all CDM-840s. The TAP message also describes the configuration of the Entry Channel Control receiver. The CDM-840 uses the information in the TAP to configure its own Tx parameters and then checks for available ALOHA Slots. If slots are available, it randomly selects one of the available slots.



During heavy use, it is possible that all available slots will be dedicated to CDM-840s that have already initiated the entry handshake although this situation should never last more than two cycles unless there are collisions or degraded link state.

The slot number, multiplied by the total slot length (in milliseconds) provides the start time for transmission, which is always relative to the receipt of the last TAP message.



The total slot length is the sum of the Guard Band, Preamble, and Data Segment that are all provided in the TAP message.

After transmitting its request, the CDM-840 waits for the next TAP message that indicates if that transmission was detected by the Entry Channel Controller. If the transmission is detected, the CDM-840 receives an assigned slot in the current frame and continues to receive assigned slots until it indicates it has completed its entry protocol. If the next TAP does *not* include an assigned slot, the CDM-840 assumes a collision occurred and begins the backoff algorithm.

The backoff is based on contention levels of 2^n (where $n = 0$ to 4 ; i.e. $2^0=1$, $2^1=2$, $2^2=4$, $2^3=8$, and $2^4=16$). The Contention Level always starts at 0, which means the CDM-840 transmits in the next frame when it receives a TAP message. If the transmission is not detected, the CDM-840 goes to Contention Level 1 and picks a random slot in one of the next two frames. If it is *still* not detected, Contention Level goes to 3 and the CDM-840 randomly picks a slot in one of the next four frames.

If the CDM-840 is not detected by Contention Level 4 (16 frames), it then resets to Contention Level 0 and tries again – the CDM-840 uses one random number to select a frame at the current contention level and another random number to select a slot within the frame.



Since the CDM-840s are not aware of each other, their Contention Levels are independent and determined only by when they were initially ready to transmit.

D.3 ECM Operation Using the HTTP Interfaces



For detailed information, see:

- Section D.1.1 in this appendix, for descriptions of the terminologies referred to in this section.
- Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in this manual
- Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT in this manual
- Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT and Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT in the CDM-840 or ODM-840 Installation and Operation Manuals (CEFD P/N MN-CDM840 or MN-ODM840)
- Appendix G. ENTRY CHANNEL MODE SWITCHING in the adjunct CEFD publication VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

The CDD-880 and CDM-840 provide several means for configuring ECM operation via Remote Product Control with a user-supplied PC:

- CDD-880 and CDM-840 HTTP (Web Server) Interfaces using a compatible Web browser.
- Ethernet-based Simple Network Management Protocol (SNMP) using a Network Management System (NMS) and Management Information Base (MIB) File Browser.



COMTECH EF DATA RECOMMENDS USE OF THE ETHERNET-BASED SNMP INTERFACES AND THE SERIAL-BASED REMOTE CONTROL INTERFACES FOR ADVANCED USERS ONLY. COMTECH EF DATA STRONGLY ENCOURAGES USE OF THE PERTINENT HTTP INTERFACES FOR MONITOR AND CONTROL (M&C) OF ADVANCED VSAT PRODUCTS.

You may proceed with Ethernet-based Remote Product Management (HTTP or SNMP), assuming that:

- Your Advanced VSAT products are operating with their latest version firmware files.
- Your Advanced VSAT products are connected to a user-supplied, Windows-based PC as follows:
 - The PC serial ports are connected to the CDD-880 and CDM-840 rear panel 'CONSOLE' ports with user-supplied serial cables.
 - The PC Ethernet ports are connected to the CDD-880 rear panel 'ETHERNET | TRAFFIC/MANAGEMENT | GE' and CDM-840 rear panel 'ETHERNET | MANAGEMENT | FE' Ethernet ports with user-supplied hubs, switches, or direct Ethernet cable connections.
 - The PC is running a terminal emulation program (for operation of the Serial Interfaces) and a compatible web browser (for operation of the HTTP Interfaces).
- You have noted the CDD-880 and CDM-840 Management IP Addresses using the pertinent Serial Interfaces.
- The HTTP interface figures as featured throughout this appendix are intended for user reference only and are subject to change. The firmware information (i.e., revision letters, version numbers, etc.) as displayed may differ from your setup.

Figure D-4 and **Figure D-5** show the CDD-880 and CDM-840 HTTP Interface “splash” pages, and the menu tree diagrams for accessing ECM operation.

Use the CDD-880 HTTP Interface to configure a basic set of parameters that define the channel group. The settings consist of Enabling, TAP Multicast IP Address, TAP (group) ID, Guard Band and a total count of Slots in Frame (combined SAS and SRS) per cycle.

Use the CDM-840 HTTP Interface to configure one of three modes (states) of ECM operation: **Online**, **Wait** or **Offline**.

You must also specify an LNB LO Frequency and Satellite Frequency Conversion to accommodate mismatches between the hub site LNB and remote site BUCs. Channel parameters are determined from the CDD-880 configuration settings. If spectral inversions apply, all hub receiving CDD-880s that are part of that downlink chain must be set to match.

Page functionality that is not specific to the operations described in this appendix appears as dimmed for both figures.

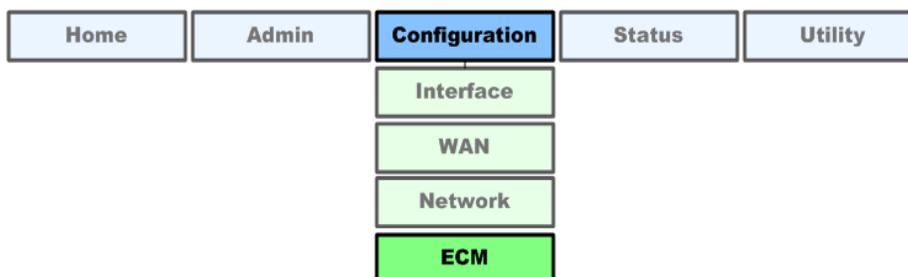
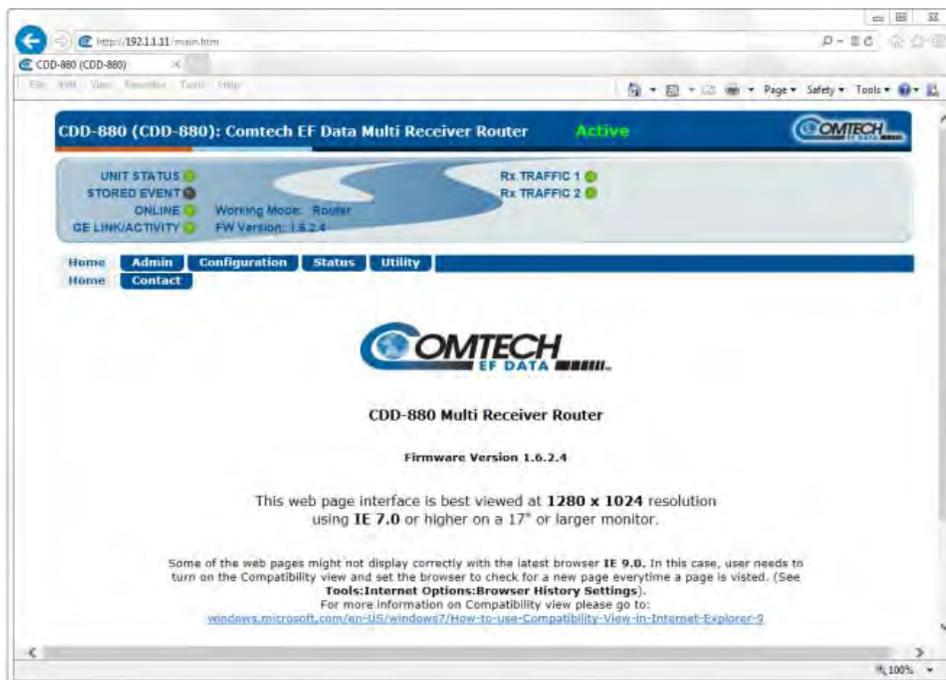


Figure D-4. CDD-880 HTTP Interface – Splash Page and ECM Operation Menu Tree (FW Ver. 1.6.2.X)

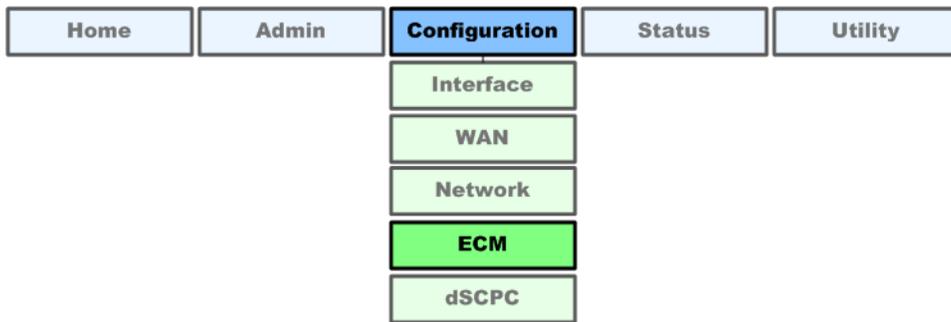
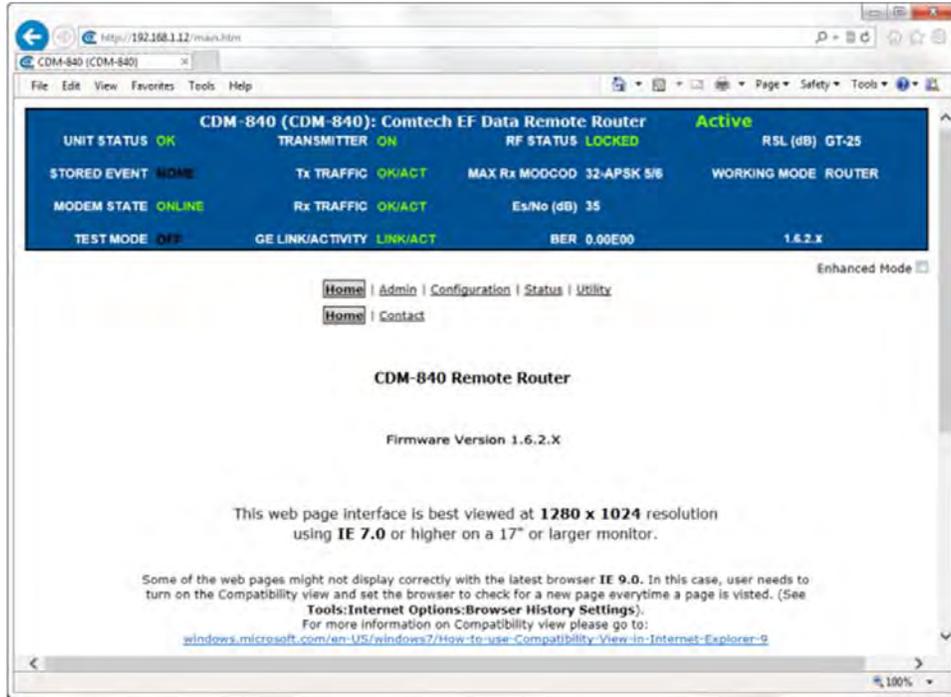


Figure D-5. CDM-840 HTTP Interface – Splash Page and ECM Operation Menu Tree (FW Ver. 1.6.2.X)

Note that ECM uses Demod 1 as the ALOHA channel. Proper deployment of ECM in the Advanced VSAT Network requires complimentary configuration of both the hub site CDD-880(s) and the remote site CDM-840(s) using each product’s HTTP Interface ‘**Configuration | ECM**’ page (Figure D-7).

D.3.1 CDD-880 HTTP Operation – Hub Channel Controller (HCC)

Click the **Configuration** tab, and then the **ECM** tab to open the page (Figure D-6).

ECM Hub Configuration

Enable:

Multicast IP:

Group ID:

Guard Band:

Preamble:

Data Slot Size:

Slots in Frame:

Cycle Length:

LNB LO Frequency: MHz

Satellite Frequency Conversion: MHz

ECM Hub Status

Current contention slots available: 0

Index	IP	State	Frames Transmitted	Error Frames
0	0.0.0.0		0	0

Figure D-6. CDD-880 HTTP Interface – Configuration | ECM Page

ECM Hub Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Enable:** – This feature activates Demod-1 (Rx TRAFFIC 1) on this unit to function as the ECM Controller for a group of CDM-840s. Use the drop-down list to select operation as **Enable** or **Disable**, and then click **[Submit]** to save.
- **Multicast IP:** – Enter the IP address for the Multicast of the TAP message that is sent out by this CDD-880 to all of the associated CDM-840s in that group.
- **Group ID:** (0-255) – Assigning a unique Group ID number to this CDD-880 (i.e., the HCC) and its associated CDM-840s defines the group of equipment that will respond to the output of the controller. Enter the Group ID number for the CDD-880.



While “0” is an acceptable assignment, the preferred practical range is from 1 to 255.

- **Guard Band:** (1-1000) – Enter the Amount of Transmit Off time, in milliseconds, between slots to prevent signal overlap.
- **Preamble:** – This *read-only* value identifies the preamble length in VersaFEC frames.
- **Data Slot Size:** – This *read-only* value identifies the minimum number of Versa FEC blocks in a data slot.
- **Slots in Frame:** – This *read-only* value identifies the allowable total number of slots for each frame. When assigned slots are needed, they are taken from this pool.

- **Cycle Length:** – This *read-only* value identifies the total cycle length, in milliseconds, of the TAP message.
- **LNB LO Frequency:** – Assign the LNB LO value, used to send RF frequency values in TAP messages. Resolution = 100Hz.
- **Satellite Frequency Conversion:** – Assign the correct **Satellite Frequency Conversion** value, in MHz, for this hub unit based on the RF equipment used at this site.

Click **[Submit]** to save.

ECM Hub Status (*read-only*)

- **Current Contention slots available** – “Contention slots” are the number of time slots in the TAP transmission cycle that are available for assignment to requesting (probing) Remotes.

From left to right:

Column	Description
Index	This is the automatically assigned internal table index number.
IP	IP address for the identified CDM-840 Remote Router.
State	Current state of this CDM-840 – one of the following will apply: <ul style="list-style-type: none"> • Probing – The unit is requesting service (registration / switching) from the VMS. • Registered – The unit has been registered with the VMS. • Waiting to switch – the Unit is awaiting <i>d</i>SCPC switch command from the VMS.
Frames Transmitted	Count of frames received from this CDM-840.
Error Frames	Count of frames received with errors from this CDM-840.

D.3.1.1 Tap Message

The TAP message is a standard UDP/IP multicast forward over the outbound channel with a payload containing the following sections:

- Standard Vipersat Header (distinguishes TAP from other Vipersat messages)
- Timestamp field (set by CDM-840 [at WAN interface] when TAP is received)
- ALOHA Channel Frequency Plan (Frequency, Data Rate, Modulation, and Coding)
- Slot and Timing Control

D.3.2 CDM-840 HTTP Operation – Remote Router Terminals

Click the **Configuration** tab, and then the **ECM** tab to open the page (Figure D-7).

Figure D-7. CDM-840 HTTP Interface – Configuration | ECM Page

ECM Remote Configuration

- **Mode:** – Use the drop-down list to select operation as **Disabled**, **Offline**, **Wait**, or **Online**. Each ECM state establishes a different role for the CDM-840 in the overall Advanced VSAT Network operations:
 - **Online** – This is the most common ECM state, whereby the CDM-840 powers up, requests network registration, and switches to dSCPC at the minimum site policy data rate setting.
 - **Wait** – Keeping a CDM-840 in the ECM channel can result in *oversubscription*, where some percentage of CDM-840s waits their turn for SCPC pooled resources. To avoid oversubscription, this ECM state provides the network operator with the ability to selectively control the CDM-840s through manual, scheduled, or externally switched request commands.

With the CDM-840s set to **Wait**, they continue to send their health status update messages to the VMS and to the CTOG-250 Comtech Traffic Optimization Gateway (with integrated CDM-800 Gateway Router). The VMS messages update connected link status;

when dynamic routing mode is enabled, the ACM, CDRP, and data traffic statistics messages sent to the CTOG-250 maintain the forward path ACM and routing tables.

- **Offline** – In this ECM state, the CDM-840 does not transmit and remains idle until a new ECM state is selected either locally or from the VMS. Examples for use of this particular ECM state are COTM (communications on the move) or military maneuvers providing radio silence conditions.

Click **[Submit]** to save.

- **Multicast IP:** – Enter the IP address for the Multicast of the Transmission Announcement Protocol (TAP) message that is sent out by the CDD-880 to all of the associated CDM-840s in that group.
- **Group ID:** (0 to 255) – Enter the Group ID number for the CDD-880 to which this unit belongs.
- **Power Hunt Enable:** – Use the drop-down list to select this function as **Disable** or **Enable**. When enabled, the transmission power control feature for the unit modulator is activated while in Entry Channel Mode (ECM). This function provides compensation during periods of impaired transmission or for instances when the initial (baseline) power value is insufficient, and assists in maintaining return link integrity.
- **Rx LO Frequency:** – Assign a value, in MHz, to the Rx LO (Low Oscillator) Frequency.
- **Tx LO Frequency:** – Assign a value, in MHz, to the Tx LO (Low Oscillator) Frequency.
- **ECM Power:** (-40.0 to 0.0) – Enter the power level, in dBm, for transmission of the ALOHA ECM signal. This level was determined for this unit when its terminal was commissioned, and must be calibrated with the satellite provider.

Click **[Submit]** to save.

ECM Remote Status

This section provides the following *read-only* information:

- **Cycle Length:** – The Cycle Length is the total length of time, in milliseconds, between the start of a transmission and the completion of the transmission cycle (TAP) transmitted by the CDD-880 to the CDM-840s in the ECM group. It is the product of the number of slots and the slot length (consisting of the preamble, data slot size, and guard band).
- **ALOHA State:** – The ALOHA State indicates the current state of this unit during the ECM cycle:
 - **Idle** – The unit is not transmitting; either inactive or waiting for switching assignment.

- **Active** – The unit is actively transmitting (probing) to the Hub for either registration or request for switching to dSCPC.
- **Switched** – the Remote has successfully switched from ECM to dSCPC.
- **Current Tap:** – Indicates current value of sequential progression of TAP message transmission. Ranges from 0 to 255, then repeats.
- **Current Slot:** – The time slot number that has been assigned to this unit in the transmission cycle for switching from ECM to dSCPC.
- **Home State Revert Timer:** – The time, in seconds, that must pass without receiving communications from the HCC (Hub Channel Controller – i.e., Demod #1 on the CDD-880, the designated ECM controller) TAP message before this unit is reverted from dSCPC mode back to ECM to re-establish communications settings for receiving the TAP. *This parameter is set in the VMS.*
- **Probing Duration:** – Amount of time, in seconds, that this unit has been transmitting to the HCC to request registration and switchout.
- **Seconds Until Next Probe:** – The time period, in seconds, before this unit will again transmit to the HCC.

ECM Tx Statistics

This section provides the following *read-only* information:

- **Total Count:** – This is the total number of transmissions since the modem entered Entry Channel Mode.
- **Successes:** – This is the number of successful (entire) transmissions received by the hub.
- **Failures:** – This is the number of incomplete transmissions that were detected by the hub.
- **No Detect:** – This is the number of transmissions that were undetected by the hub
- **Last Status:** – This displays the status of the most recent transmission as **Success**, **Failure**, or **No Detect**.
- **Seconds since last xmit:** – This is the number of seconds since the last transmission, regardless of status.



Whenever the modem reverts from dSCPC to ECM, the statistics will clear.

- Lists of CDM-840s with Assigned Slots (previous transmission succeeded / failed)

- List of CDM-840s that have completed their handshake in the last cycle

As noted elsewhere, receipt of a TAP causes all listening CDM-840s to synchronize internal transmit timing clock in order to minimize collisions in the ALOHA channel.

D.3.2.1 HCC Configuration

The TAP IP Address specifies the multicast address that all CDM-840s in the group use to receive the TAP:

- Timing as exposed to the user is message interval;
- Total slot count that derives the Cycle Length is set in milliseconds;
- All other parameters are calculated based on current rate;
- The Date Slot Size is fixed at 6, and VersaFEC Blocks and Preamble is computed in milliseconds based on the specified data rate;
- Guard Band is determined during terminal commissioning.

D.3.2.2 Hub Operation

After configuration and initialization, the HCC broadcasts the TAP message on cycle intervals waiting for ALOHA channel RID messages. Successful reception of the RID places the CDM-840 IP Address along with its ECM state flag (i.e., **Online**, **Wait**, or **Offline**) into the first queued list. The controller checks the flag to determine next operation. If the ECM state is **Online**, an SRS is assigned for next TAP processing.

- The CDM-840 receives the TAP with its IP Address in the SRS list and, based on where its place is in the sequential order, determines the slot assignment. By design convention, assigned slots are at the end of the cycle and whatever remains is used for contention at the beginning of the cycle. With the assignment, the CDM-840 transmits management data in its assigned slot and awaits acknowledgment and next assignment.
- After the CDM-840 completes its registration protocol, it releases the active flag in the next RID cycle. At this point, the HCC will remove the processing CDM-840's IP Address from the list clearing the SRS allocation. If the CDM-840 is not switched out of ECM mode, it will proceed to send a Status Update Message (SUM) every minute in order to maintain its active status with VMS. Typically, a SUM should only require one transmission unless there is contention, in which case the CDM-840 will go into back-off mode until the CDM-840 received acknowledgment from the HCC that the SUM was successfully transmitted.

Appendix E. PORT DIVERSITY

E.1 Port Diversity Overview



CAUTION – It is critical for certain system operations that Management Traffic and Data Traffic remain isolated – there must be a separate subnet for each interface.

Comtech EF Data therefore does not recommend the use of Port Diversity unless it is used to implement physical link redundancy schemes. Operations that do not use such physical link redundancy should maintain the physical isolation of Management Traffic and Data Traffic on different ports.

If you use Port Diversity, you must take great care within your network routing elements to ensure that there is no mixing between the Management Traffic and Data Traffic domains.

The CDD-880 Multi Receiver Router uses the Port Diversity feature to create a redundant link to the unit by assigning the IP Addresses for both the ‘ETHERNET | TRAFFIC/MANAGEMENT | GE’ port and the ‘ETHERNET | TRAFFIC | GE’ port to one of the physical interfaces. Both ports can be used to route data with Port Diversity disabled – each port will have its own IP Address and Subnet. Traffic pertaining to that subnet is routed over that interface, and manual routes can be routed to either port, dependent on the network topology and configuration.

The Port Diversity feature must be used in a setup with multiple (i.e., two or more) switches. The switches need to be running Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP).

It is important that STP or RSTP is running when connecting multiple switches, as the redundant links will cause switching loops, causing devices to stop responding.

STP is automatically enabled by default on Cisco Catalyst Switches. You might need to configure and enable STP on other switches such as Linksys, Cisco Small Business, D-Link, etc.

Based on the switch environment, the CDD-880 will elect the best path and use that port as the Active Port to pass data over the two subnets. The Port Diversity feature makes decisions based on physical link status first; however, if both links are physically up, it will make Active Port decisions based on Bridge Protocol Data Units (BPDUs) via STP/RSTP.

BPDUs are ranked in order as follows:

1. Lowest Root bridge ID
2. Lowest Root path cost
3. Lowest sender bridge ID
4. Lowest sender port number

The CDD-880 also follows this ranking. Tweaking STP/RSTP parameters allows for the election of which port to use first.

E.2 Operational Examples

Figure E-1 shows a potential intended use for Port Diversity. The core network has physical path redundancy including redundant Ethernet switches. As per the ranking order explained previously, Port Diversity allows the CDD-880 to choose the physical path based first on physical link state, and then via BPDU information provided by the switches' STP/RSTP processes. The CDD-880 can react to a failure of any of the numbered links (identified in the figure as L1 through L5) as needed. Management Traffic (GE MGMT#x) and Data Traffic (GE ST #x) subnets exist on the same physical port, but care must be taken in the routing core to keep the traffic isolated at the subnet level.

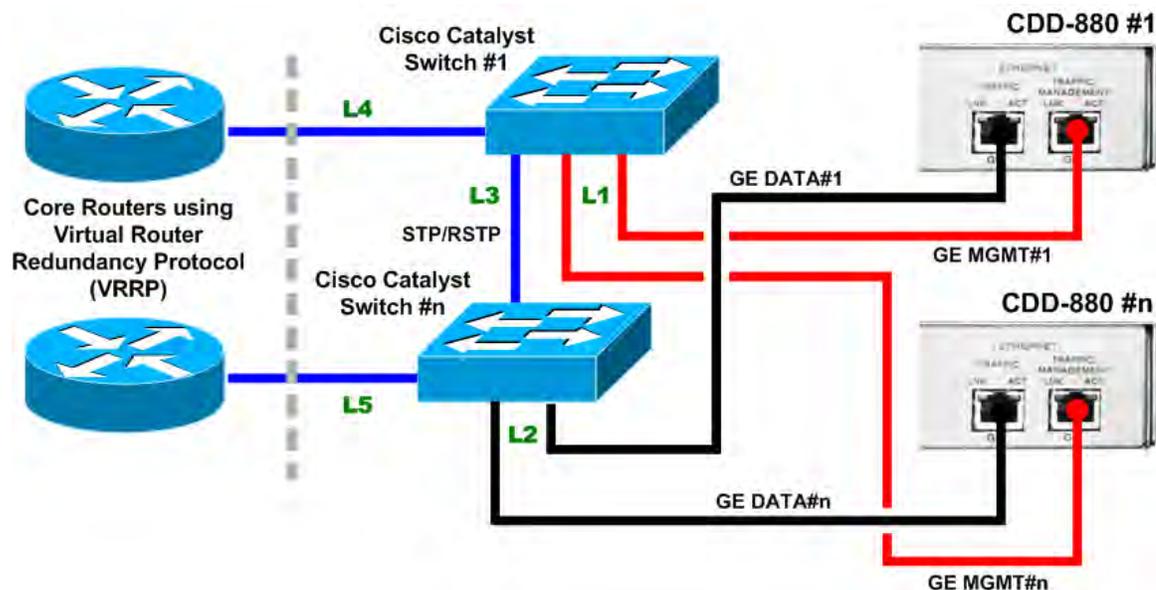


Figure E-1. Port Diversity Example #1

Within the STP/RSTP domain, one bridge will be the Root bridge. The switch with the lowest priority (0-61440 in increments of 4096) is elected as Root. By default, the switches will have a priority of 32768; if all switches have the same priority, then the switch with the lower base MAC Address is elected as the Root.

 **The Virtual Router Redundancy Protocol (VRRP) eliminates the single point of failure inherent in the static default routed environment.**

A switch running STP/RSTP may take longer than 30 seconds to allow a port to forward traffic. Ports connected to the CDD-880 should be designated as Edge Ports, or use Portfast if using a Cisco switch, to minimize downtime during a switch. **Figure E-2** shows a three-switch setup example, where Links **L1**, **L2**, **L4**, and **L5** are Edge Ports.

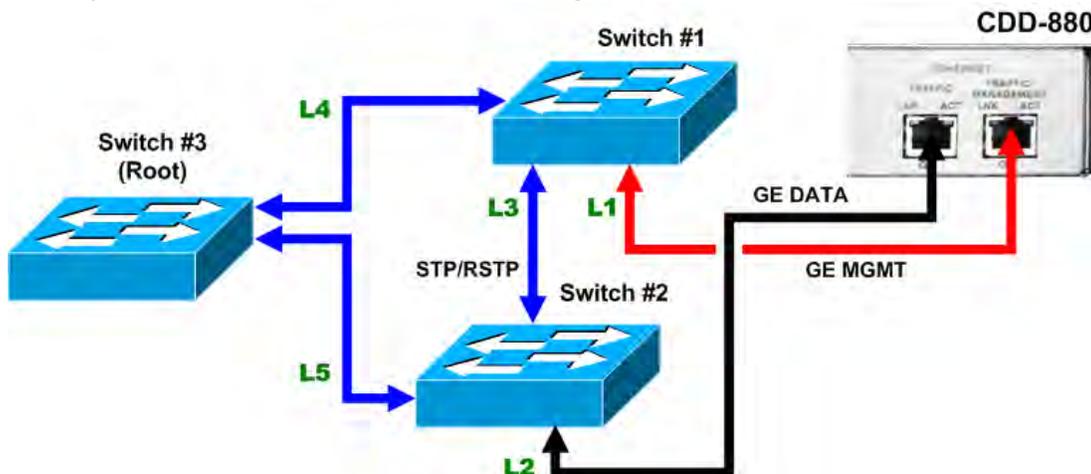


Figure E-2. Port Diversity Example #2 – Three-Switch Setup

Once the switches are configured to run STP/RSTP, a Root switch is elected, and Port Diversity is enabled; both the Data Traffic (**GE DATA**) and Management Traffic (**GE MGMT**) IP Addresses of the CDD-880 will be multi-homed to the chosen path's interface. When a physical path is chosen or changed, the CDD880 will issue Gratuitous ARP for both subnets to update the ARP/MAC tables of local network elements. The CDD-880 HTTP Interface is accessible from either configured IP Address.

Using this setup, **Switch #3** has the lowest priority (Root); **Switch #1**'s priority is a higher number than **Switch #3**, but lower than **Switch #2**. Alternately, the same setup is achievable by setting the path cost to the Root lower on **Switch #1** than on **Switch #2**. This setup responds to changes in Links **L4** and **L5**. For example, if Link **L4** is down, the CDD-880 will switch to Link **L2**, as the path to the Root is better.

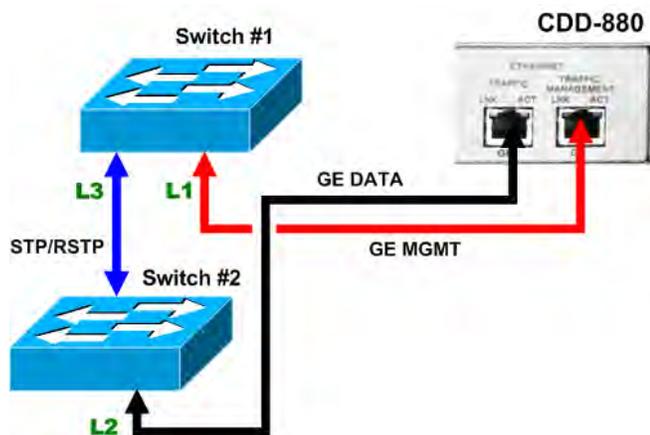


Figure E-3. Port Diversity Example #3 – Two-Switch Setup

As shown in **Figure E-3**, a two-switch setup is possible; however, one switch will be elected as Root, either by priority or by the MAC Address. This switch will be the primary link until it is physically down, as it is the Root.

E.3 Configuration Examples

E.3.1 Spanning Tree (Global) Configuration – CiscoIOS

To set up STP with a Priority of 16384 for the switch:

```
!  
spanning-tree mode pvst  
spanning-tree extend system-id  
spanning-tree vlan 1 priority 16384  
!
```

Alternately, *rapid-pvst* mode can be used to run RSTP.

E.3.2 Interface Configuration – CiscoIOS

To set up the interface to be Edge Port/Portfast:

```
!  
interface GigabitEthernet0/7  
switchport mode access  
switchport nonegotiate  
spanning-tree portfast  
!
```

Note that the first two commands disable the native trunk negotiation in IOS.

E.4 Port Diversity Operation



For detailed information, see:

- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in this manual**
- **Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT in this manual**

The CDD-880 provides several means for configuring Port diversity operation via Remote Product Control with a user-supplied PC:

- CDD-880 HTTP (Web Server) Interfaces using a compatible Web browser. See **Sect.E.4.1**.
- Ethernet-based Simple Network Management Protocol (SNMP) using a Network Management System (NMS) and Management Information Base (MIB) File Browser.

- Serial-based Remote Control Interface using a terminal emulation program or Windows Command-line.



COMTECH EF DATA RECOMMENDS USE OF THE ETHERNET-BASED SNMP INTERFACE AND SERIAL-BASED REMOTE CONTROL INTERFACE ONLY FOR ADVANCED USERS. COMTECH EF DATA STRONGLY ENCOURAGES USE OF THE CDD-880 HTTP INTERFACES FOR MONITOR AND CONTROL (M&C) OF THE CDD-880.

THE HTTP INTERFACE FIGURES FEATURED THROUGHOUT THIS APPENDIX ARE INTENDED FOR USER REFERENCE ONLY AND ARE SUBJECT TO CHANGE. THE FIRMWARE INFORMATION (I.E., REVISION LETTERS, VERSION NUMBERS, ETC.) AS DISPLAYED MAY DIFFER FROM YOUR SETUP.

E.4.1 Port Diversity Operation – CDD-880 HTTP Interface

Figure E-4 shows the CDD-880 HTTP Interface “splash” page, and the menu tree diagram for accessing Port diversity operation. Page functionality not specific to Port diversity operation appears dimmed in this diagram.

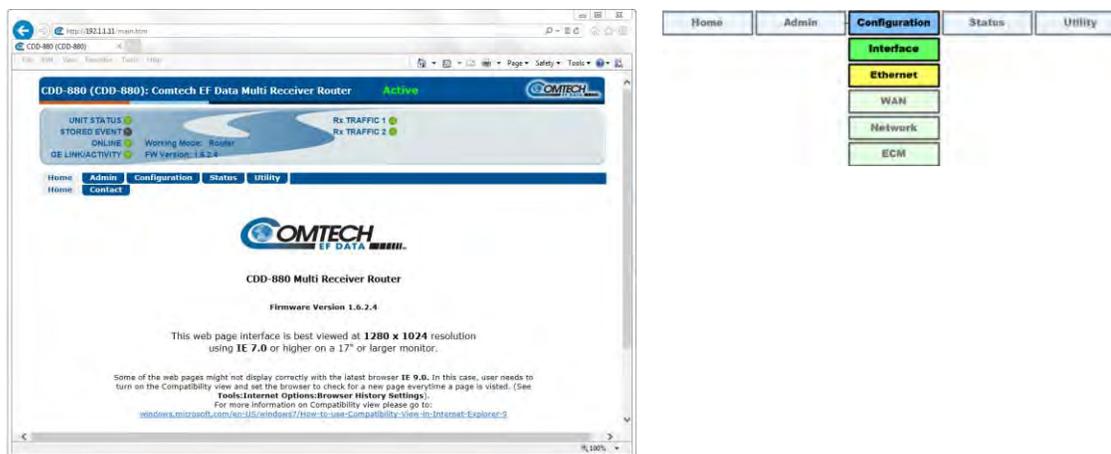


Figure E-4. CDD-880 HTTP Interface – Splash Page and Port Diversity Operation Menu Tree (FW Ver. 1.6.2.X)

Use the CDD-880 HTTP Interface ‘**Configuration | Interface | Ethernet**’ page (Figure E-5) for the operation of the Port Diversity feature.

As shown in Figure E-5: Use the drop-down list in the *Port Diversity Configuration* section of this page to **Enable** or **Disable** this feature. Click [**Submit**] to save.

With Port Diversity **disabled**, each port has its own IP Address and Subnet. Traffic pertaining to that subnet is routed over that physical interface, and manual routes can be routed to either port.

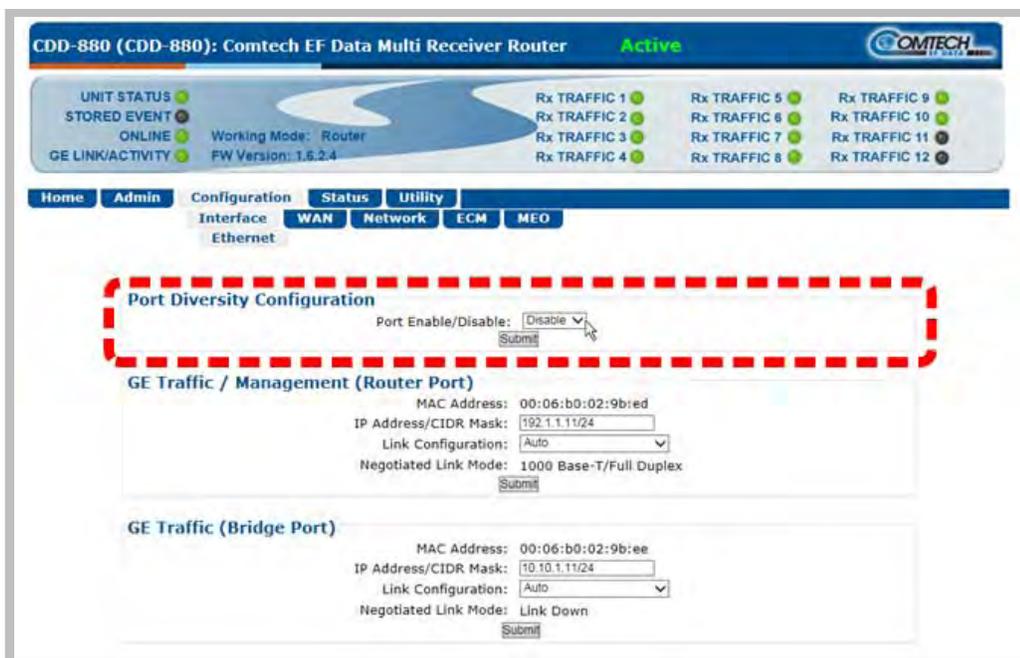


Figure E-5. Configuration | Interface | Ethernet Page – Diversity Port Disabled
As shown in Figure E-6: With Port Diversity **enabled**, manual routes are routed to the correct IP subnets, but over the same physical port.

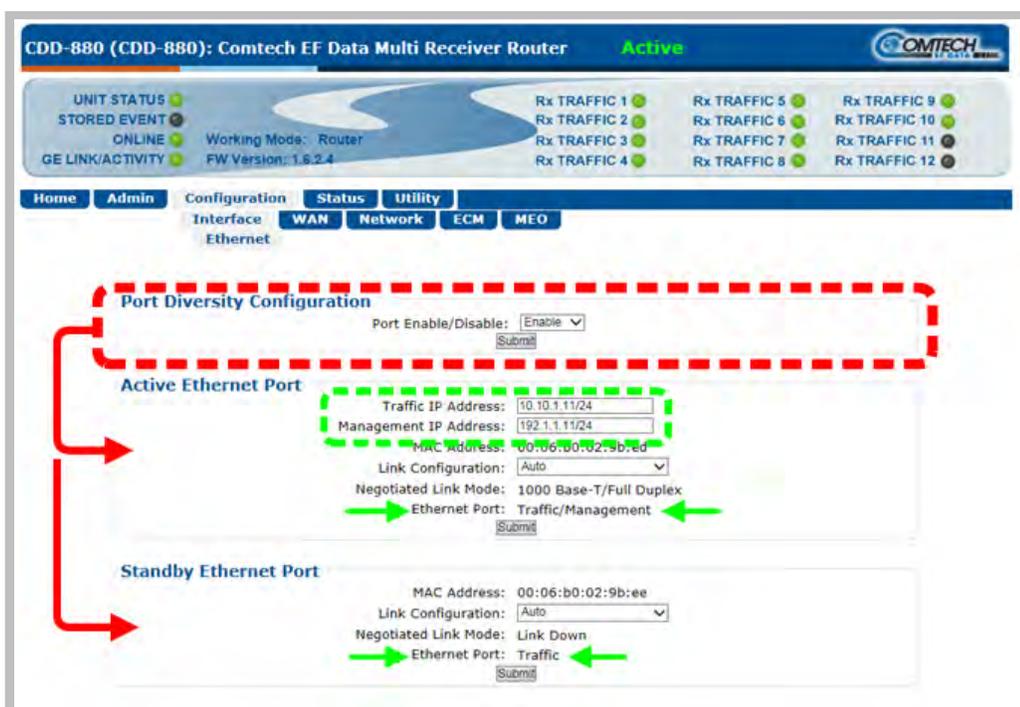


Figure E-6. Configuration | Interface | Ethernet Page – Diversity Port Enabled
Once **enabled**, the Port Diversity feature creates a redundant link to the CDD-880 by assigning the IP Addresses for both the 'ETHERNET | TRAFFIC/MANAGEMENT | GE' port and the 'ETHERNET | TRAFFIC | GE' port to one of the physical interfaces.

- To reflect Port Diversity feature operation, the “**GE – Traffic / Management (Router Port)**” section label changes to “**Active Ethernet Port**” and the “**GE Traffic (Bridge Port)**” section label changes to “**Standby Ethernet Port.**”
- The bottom of these page sections updates further to include a *read-only* port reference (i.e., “**Ethernet Port: Traffic/Management**” and “**Ethernet Port: Traffic**”).

Based on the switch environment the CDD-880 elects the best path and uses that port as the active port to pass data over the two subnets.

Path selection is based first on physical status, and then the BPDUs that are sent out by switches. If there is a change in the physical port status or in the BPDUs that makes the standby port preferable, the CDD-880 automatically reassigns both IP addresses to the standby port and makes it the new active port. The CDD-880 then issues Gratuitous ARP for both subnets to update the ARP/MAC Tables of local network elements.

Appendix F. dMESH (VMS DYNAMIC MESH) SOLUTIONS

F.1 dMesh (Dynamic Mesh) Overview



VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

Mesh connectivity minimizes the requirement for communications that are routed through a hub and re-routed back to the remote segments of an Advanced VSAT Network. The benefit of a mesh circuit is that it reduces the time it takes to establish and maintain communications between remote sites. This eliminates double hop scenarios, provides less latency, and improves Quality of Service (QoS) between remote AVSAT locations; geostationary satellite single hop link latency is thereby maintained for real-time applications such as VoIP and videoconferencing. This is not a new concept – it has been implemented for many years in terrestrial microwave applications.

Although there are many satellite modem manufacturers producing new generations of products, few provide the means to address point-to-point or point-to-multipoint mesh connectivity or offer premium commercial-grade services between AVSAT locations. Mesh offerings are typically limited to TDM/TDMA and DAMA solutions, or “best-effort” service for circuit-switched voice as well as limited VoIP and data throughput.

Comtech EF Data leverages the concept of Bandwidth-on-Demand (BoD) by taking advantage of Dynamic Single Channel per Carrier (dSCPC) in a mesh environment and adapting it to Comtech EF Data’s Advanced VSAT Network platform. This adds dynamic point-to-multipoint SCPC mesh circuits to the network’s existing hub and remote link, and DVB-S2 outbound and VersaFEC dSCPC to the return link. Comtech EF Data manages these elements, and provides BoD in a mesh environment through its Vipersat Management System (VMS), the software switching engine behind our Vipersat technology.

F.2 Operational Features

F.2.1 Vipersat Management System

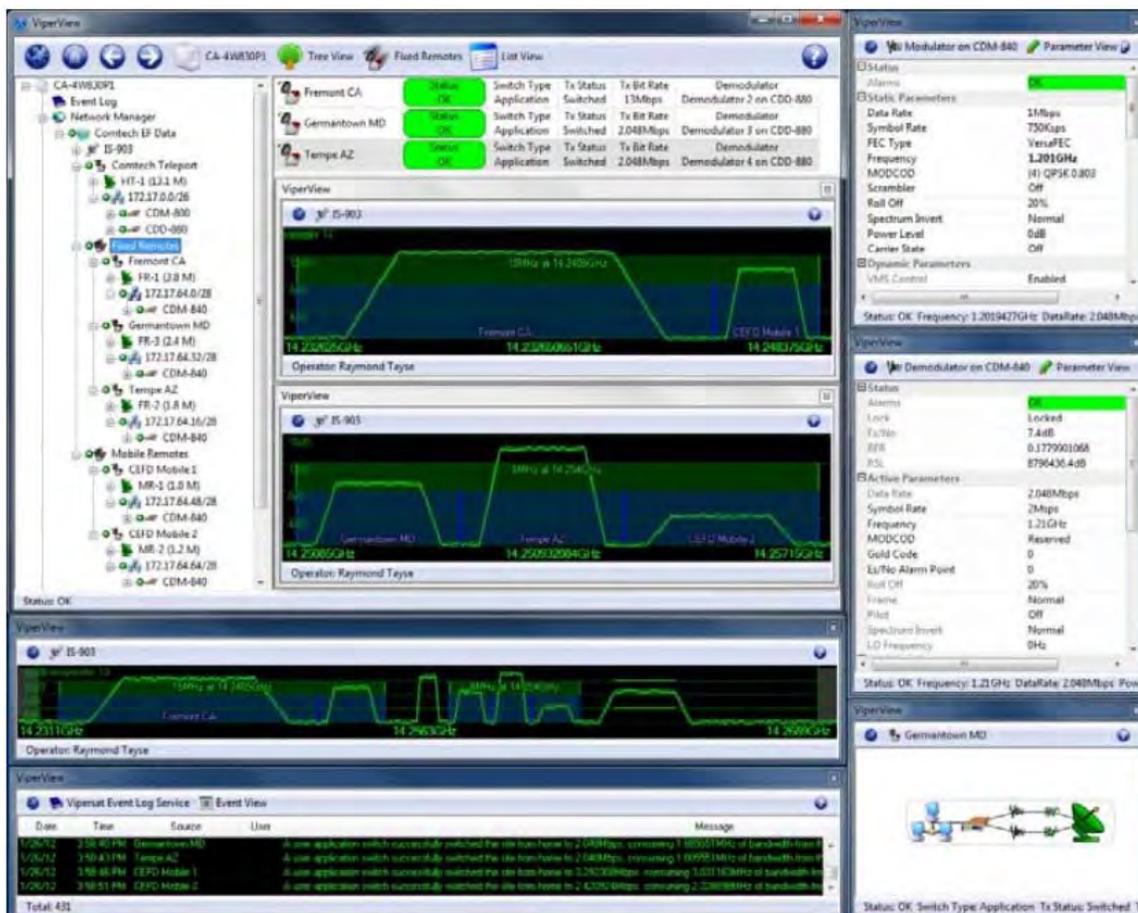


Figure F-1. Vipersat Management System – Graphical User Interface (GUI)

Figure F-1 shows a typical VMS graphical user interface (GUI). The VMS GUI displays a graphical representation of the deployed modems and demodulators, remote subnets, RF carriers, and switching events.

Figure F-2 shows typical deployment of a Comtech EF Data Advanced VSAT Network. The Advanced VSAT IP Network operates at Layer 3 in a routed mode of operation that supports dynamic mesh. A major advantage of the Vipersat technology is that its design encompasses the use of Comtech EF Data’s Advanced VSAT offerings (CTOG-250 Comtech Traffic Optimization Gateway w/CDM-800 Gateway Router and CDD-880 Multi Receiver Router at the hub site, and CDM-840 Remote Routers with CDD-880 Multi Receiver Routers at the remote sites).

For example, the Vipersat technology accommodates a mesh environment as follows:

- Similarly-equipped CDD-880s are used at the Vipersat-enabled hub and at the remote sites. The only differences between the network hub and remote site CDD-880s are the software interfaces and VMS configuration of the units. This intuitive design and configuration allows

for rapid deployment of units at the remote site and their addition to the VMS database at the hub site.

- The network provides a true single hop solution for point-to-point or point-to-multipoint connectivity between remote sites. VMS automatically sets up the circuits either by Type of Service (ToS) detection through the remote site CDM-840, or a Distribution List configured in the VMS server with the respective remote site policies.

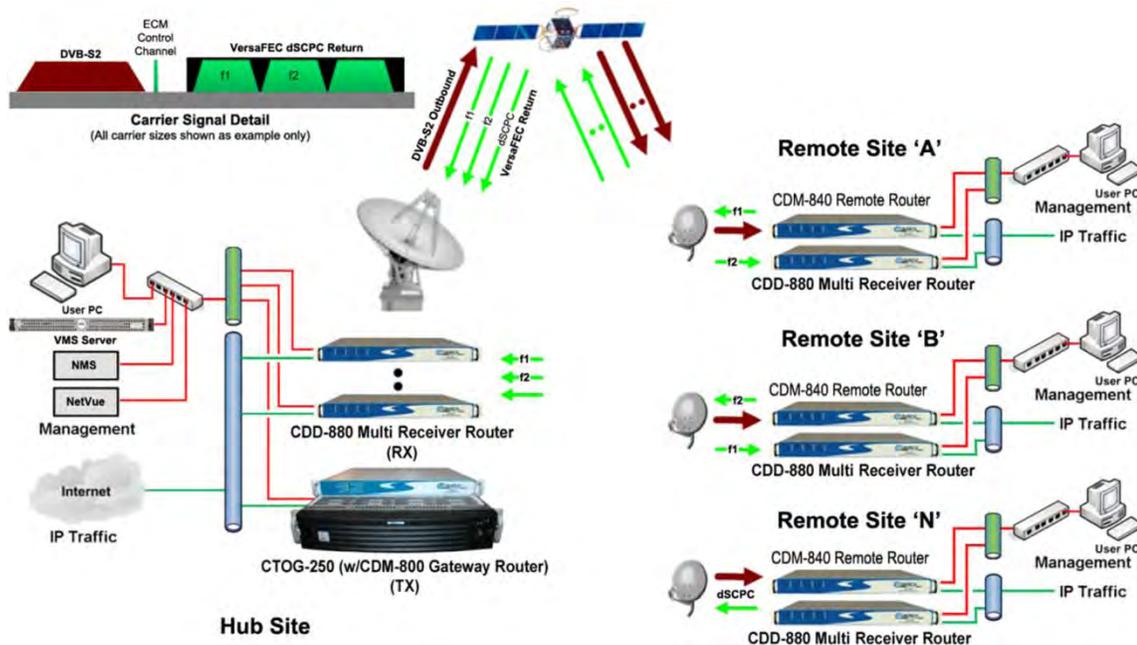


Figure F-2. VMS-configured Advanced VSAT Network

Startup of an application such as VoIP or videoconferencing initiates a switch request using ToS Detection. Upon ToS protocol detection, the CDM-840 forwards a switch request defined by network operator switching policy to VMS for the required bandwidth. VMS in turn, upon verification of available space segment and CDD-880 Expansion Demodulators, sends switching commands to the appropriate remote CDM-840 subnets, thus changing the CDM-840's Tx frequency/power level/data rate and a varying assortment of modulation and coding combinations called MODCODs, where applicable.

An available remote site CDD-880 is also tuned to receive the corresponding remote transmission, and a mesh circuit is created. As with Remote Sites 'A' and 'B', Remote Site 'N' is communicating with the Hub site via the CDD-880 Expansion Unit on another internal demodulator port. Since the CDD-880 Expansion Units at Remote Sites 'A' and 'B' also have a demodulator port tuned to their respective carrier, it is necessary to filter the traffic between them at the Hub site to avoid duplicate packets and unnecessary hub loading. This requires the entry of filter routes only at the hub's CDD-880 Expansion Unit. VMS automatically manages these routes – entering them when needed, and removing them when not.

From the VMS server interface, the Distribution List feature allows the operator to pre-define mesh circuits based on an Entry Channel Mode (ECM) switch, multicast transmission from remotes to a group of remotes, or the setup of monitor remotes. When the remote terminals

are powered on, their presence in the dSCPC distribution mesh is constant unless taken out by operator intervention.

F.2.2 Return Link VersaFEC ACM

F.2.2.1 VersaFEC®

The transmit (Tx) side of the CDM-840 uses a family of short-block LDPC codes called **VersaFEC®**. VersaFEC is a patent pending technology wholly owned and developed by Comtech EF Data and Comtech AHA Enterprise Products Group (the VersaFEC name is a trademark registered to Comtech AHA).

VersaFEC is ideal for lower data rates that demand the shortest possible latency. The VersaFEC codes are equally well-suited to Constant Coding and Modulation (CCM) applications.

F.2.2.2 Adaptive Coding and Modulation (ACM)

Adaptive Coding and Modulation (ACM) in the CDM-840 is used in conjunction with VersaFEC and is currently for *IP traffic only*.

ACM is a technique that allows for automatic change in modulation and FEC Code Rate in response to changing link conditions. ACM may be used in packet-based satellite links to boost system throughput. The basic goal of ACM is to capture historically unused satellite system link margin and convert this margin into additional data throughput.

An ACM system is set up using a constant physical layer symbol rate – and therefore occupied bandwidth – and power, but with a varying assortment of MODCODs. The MODCODs are selected to span a range of Es/No (Energy per Symbol to Noise density ratio) so that if a system detects a change in link margin – e.g., fading – it can use a different MODCOD to preserve the link, albeit at a different user throughput rate. Therefore, in an ACM system, as Es/No increases or decreases, so does the user data rate.

With ACM enabled, the CDM-840 offers significant operational enhancements:

- ACM maximizes throughput regardless of link conditions (noise, clear sky, rain fade, inclined orbit, antenna pointing error, or other impairments). Initial setup is easy and requires no further user intervention.
- ACM turns fade margin into increased link capacity – gains of 100% or more are possible, compared to traditional CCM. This is accomplished by automatically adapting the modulation type and FEC code rate to give highest possible throughput.

With a CCM system, severe rain fading can cause the total loss of the link – the result being zero throughput. ACM can keep the link active during heavy fades with lower throughput, and can yield much higher system availability.

The requirements for an ACM system that approaches the minimum possible latency are:

- The shortest possible LDPC codes that give performance at or very close to DVB-S2, in order to minimize latency, and which do not use interleaving.
- Design of the encoder to further reduce latency to the minimum possible.
- A constant number of symbols per block, to reduce the demodulator and decoder complexity, and significantly also reduces latency in the ACM case.
- The elimination of the need for pilot symbols for carrier tracking at low SNR by substitution of other modulation techniques. This further reduces the complexity of the demodulator.
- A reduction in the number of MODCODs to further reduce complexity.
- The inclusion, at the physical layer, of an overhead channel to permit the reporting of SNR metrics back to the originating end. Note that this does not have to be enabled or disabled – it is part of the fundamental frame structure of VersaFEC ACM, and has been taken into account in the code rate.

F.2.2.2.1 ACM and Dynamic Mesh

Although ACM and mesh are independent of one another, ACM is supported in a mesh environment. Return link ACM for the remote CDM-840 to the hub CDD-880 link is modeled after the Comtech EF Data CDM-625 Advanced Satellite Modem's ACM approach and framing, while adapting control techniques to operate in a dynamic point-to-multipoint network that includes a mesh environment.

F.2.2.2.2 ACM and Dynamic Power Control (DPC)



Appendix M. VMS DYNAMIC POWER CONTROL (DPC)

The Dynamic Power Control (DPC) feature provided in Comtech EF Data's Advanced VSAT products provides a mechanism whereby remote satellite uplinks have their transmit power levels adjusted in order to optimize the receive signal quality as measured by the corresponding demodulator E_s/N_0 (the ratio of energy per symbol to noise density).

DPC and ACM function independent of one another, whereby power is modified first or second in combination with ACM. Depending on conditions, DPC and ACM can be operated exclusively or in combination, sharing the same resources for checks and balances. When DPC and ACM are operating in combination, the CDM-840/CDM-850 receives the LQRM comparing value to current settings and depending on conditions adjusts power or modifies MODCOD.

F.3 Operational Example

F.3.1 Requirements for Bandwidth-on-Demand and Dynamic Mesh with Single Hop on Demand (SHOD)

For any dynamic switch to occur, you need to adhere to some minimum requirements:

- Your active network is an Advanced VSAT Network platform Version 1.5.2.1 or greater running a Vipersat Management System (e.g., VMS Version 3.12.x).
- Space segment in the shared dSCPC bandwidth pool must be available.
- CDD-880 Expansion Units must be available at the hub site and each AVSAT remote site.
 - The hub site and remote site must be equipped identically. You may populate each CDD-880 1RU chassis with up to 12 demodulators – two demodulators per card, up to six cards per unit. This provides a maximum of 12 point-to-multipoint dynamic mesh circuits between remote sites (assuming each remote site is equipped with a fully populated CDD-880).
 - If more circuits are needed, you simply add more CDD-880s at the AVSAT remote sites and at the hub location. (Again, the units at either side of the network must be populated equally with the appropriate number of demodulator cards.)

Such configurations allow transmission of a single carrier from an originating remote CDM-840, a benefit that results in requiring operation of a lower-wattage BUC and/or use of a smaller antenna, when compared with what would be required with multiple carriers transmitted from a remote site.



Care should be taken to insure that differential in receive gain between the hub antenna and remote mesh antennas does not exceed TBD.

F.3.2 Dynamic Mesh Operation

Meshed links can be set up based on specific applications that are sent from one remote site to another remote site or group of remotes sites. The easiest way to demonstrate the meshing capability of a Vipersat-managed Advanced VSAT Network is by using Distribution Lists.

Distribution Lists allow you to set up a list of sites to be included in a switch under defined circumstances, such as meshing based on an ECM switch, multicast transmission from a remote to a group of remotes, or the setup of monitor remotes. This feature can be used to tune expansion demodulators at a list of sites for upstream switched services, to provide for point-to-multipoint distribution on an InBand service connection.

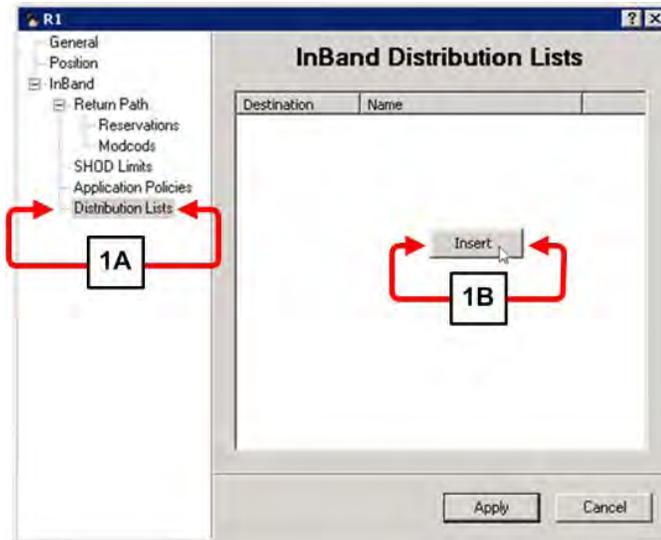
F.3.2.1 Create a Distribution List



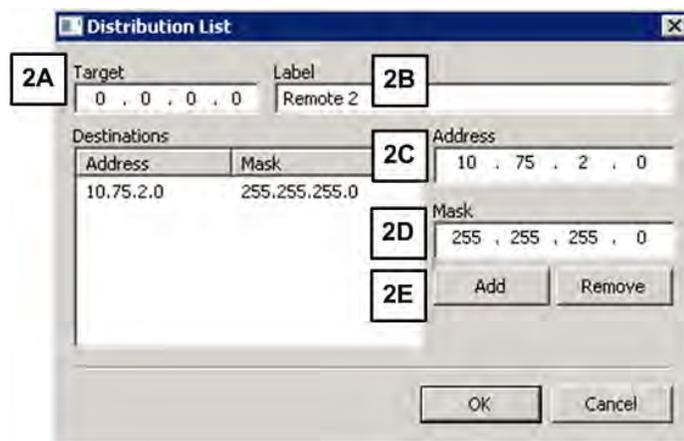
Chapter 3. VMS Configuration “Define Distribution Lists” in VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

Use the VMS to set up a Distribution List. Do these steps:

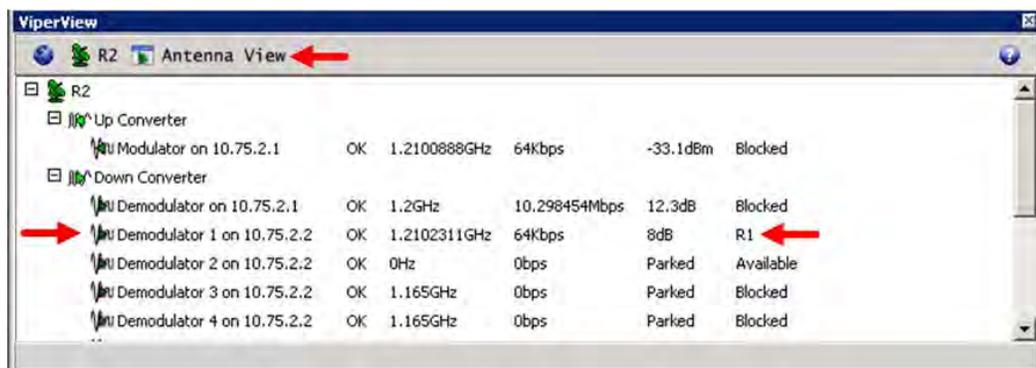
1. From the VMS GUI, right click on a remote site icon to open the Properties page:



- a) Highlight the **Distribution Lists** tag.
 - b) Right-click in the white space below the **InBand Distribution Lists** label. Click the **[Insert]** button that appears. The **Distribute List** dialogue window appears.
2. If the distribution is intended for multiple remotes, you may use the **Distribute List** dialogue window to enter them:



- a) The target box shows all zeros, which means that any packet destined to the subnets shown here causes the VMS to set up a mesh connection.
 - b) Enter a **Label** that is easy to remember, such as the name of the target remote (e.g., **Remote 2**).
 - c) Enter the network **Address** for the remote subnet.
 - d) Enter the subnet **Mask**.
 - e) Click [**Add**]. The network **Address** and subnet **Mask** appear in the **Destinations** window.
3. **Add CDD-880 Expansion Units to Antenna View.** To set up a mesh, the VMS must have available CDD-880 Expansion Units at the target remote site. Remote site mesh units must be dropped on the antenna and made available as shown here:



Note that this is the antenna view for R2 (Remote 2) and Demodulator #1 of this remote site's CDD-880 Expansion Unit is already involved in a mesh with R1 (Remote 1).

4. **Define your filtering rules.** The VMS dynamically enters filters at the Hub demodulator(s) when it sets up a mesh. It does this to prevent loops and duplicate packets on the network. Filters are also a function of the mesh location at the remote site. The CDD-880 HTTP Interface **Configuration | Network | Routing** page (**Figure F-3**) defaults the Mesh Location to **Hub**.



To ensure proper operation and to prevent network loops, you **MUST** make sure that each remote site CDD-880 Expansion Unit has its Mesh Location set to Remote. The inset in Figure F-3 shows such a Mesh Location setting.



See Sect. 6.3.3.3.1 Configuration | Network | Routing in Chapter 6. **ETHERNET-BASED REMOTE PRODUCT MANAGEMENT** in this manual for details about using this interface.

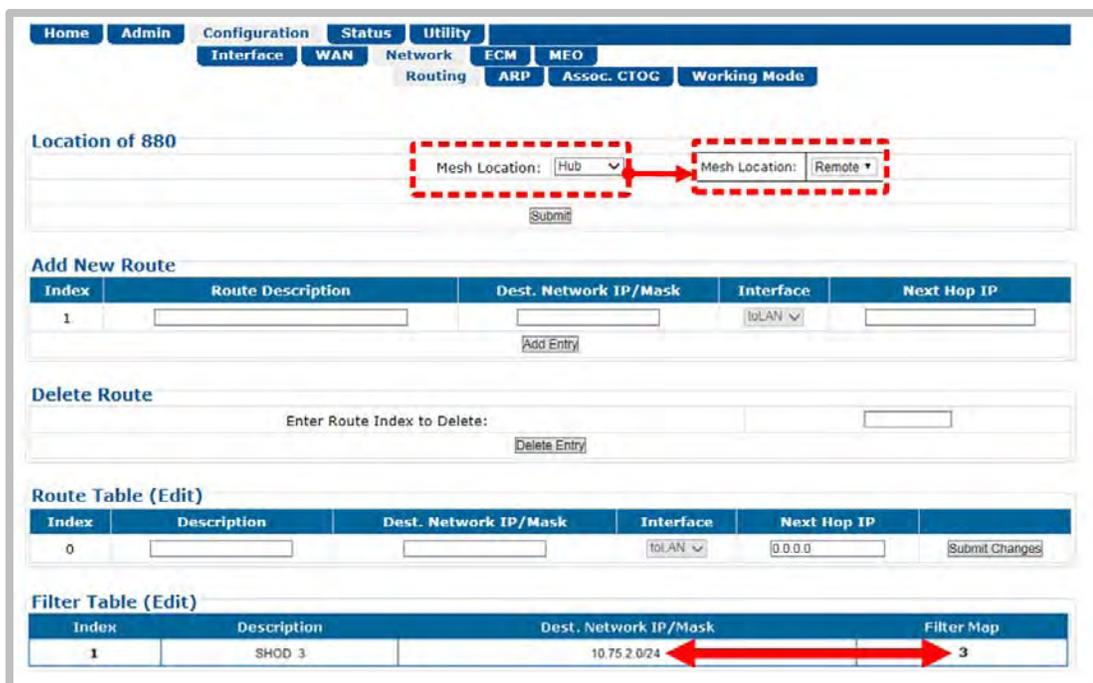
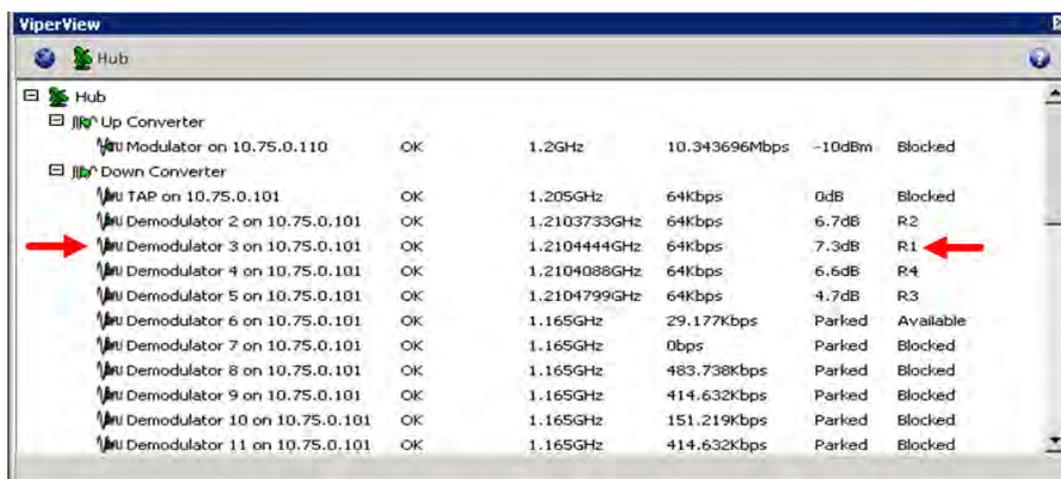


Figure F-3. CDD-880 HTTP Interface – Configuration | Network | Routing Page

For each individual mesh connection, the VMS enters a SHOD (Single Hop On Demand) at the Hub site CDD-880 demodulator as shown in **Figure F-3**. The **Filter Table** lists the **Destination Network IP/Mask** and a **Filter Map**. This **Filter Map** corresponds to the Hub site CDD-880 demodulator that is tuned to the remote site originating the mesh.



The intent of this filter rule is to block any packets originating from R1 that are destined to R2. This prevents traffic to the meshed remote site from going on to the Hub LAN and being retransmitted by the TDM (CTOG-250) outbound.

- Single Hop On Demand (SHOD):** The VMS adds an additional SHOD filter to the Hub CDD-880 for this subnet. If the traffic subnet is part of a subnet that can be described in one route statement (e.g., a subset of the same Class C that is the management subnet), this is

not necessary. However, any subnets that are past a router at the target remote must be entered as external subnets.

- 6. Mesh Setup Based on ToS Detection:** The detection by a CDM-840 Remote Router of a ToS stamped packet can provide the means for setting up a SHOD mesh connection from that remote to another remote within the network.



For these SHOD connections, it is assumed that each remote site that is part of the SHOD connection has, at minimum, one CDD-880 Expansion Unit.

When a Remote site CDM-840 detects a packet that has been stamped with a ToS value that matches the user defined value, the CDM-840 then sends a switch request to the VMS, requesting the user defined bandwidth. The switch request also contains the address that the ToS stamped packet was destined for.

The VMS processes the switch request and compares the destination address to the list of known subnets to determine if the destination belongs to another remote within the network. If the address does belong to another remote, the VMS will look for available hardware and bandwidth, and then issue tuning commands to set up the connection. Each direction of the mesh is set up independently; i.e., the detection that occurs at Remote 1 establishes a connection from Remote 1 to the other remote involved. However, the other remote must perform detection for set up in the opposite direction, thus creating a full duplex mesh connection.

F.4 Compatibility

All Comtech EF Data products are designed to ensure seamless cohesion when interfacing its CDM-840s or demodulators to a single VMS Server. **Table F-1** lists the available Comtech EF Data products that are supported by Vipersat technology.

Table F-1. Comtech EF Data Product Compatibility Reference

Product	Max Data Rate (Mbps)	In-Band	Out-of-Band	Mesh	dSCPC Switching Methods							
					Scheduled	Manual	ToS	Load	QoS	VESP	Hitless	Advanced
CDM-570/CDM-570L	9.98	X	X	X	X	X	X	X	X	X	X	X
CDM-570A/CDM-570AL												
CDM-600/CDM-600L	20		X		X	X				X		X
CDM-625	25		X		X	X				X		X
CDM-625A												
CDM-750	169		X		X	X				X		X
CDM-760												
CDM-800*	160		X									X
CDM-805 (p/o CTOG-250)		X	X	X	X	X	X	X	X	X	X	X
CDM-840/ODM-840	15.35	X	X	X	X	X	X	X	X	X	X	X
CDM-850												
SLM-5650A	155	X	X	X	X	X	X	X		X		X
CDD-562L	9.98	X	X	X	X	X	X	X	X	X	X	X
CDD-564/CDD-564L	9.98	X	X	X	X	X	X	X	X	X	X	X
CDD-880	15.35	X	X	X	X	X	X	X	X	X	X	X
CDD-890												

* Standalone, or as part of CTOG-250 Comtech Optimization Gateway

F.5 Summary

Vipersat provides a dynamic mesh for remote-to-remote communication through its use of a unique equipment topology and switching engine. It requires only a single transmitted SCPC carrier from each remote, as opposed to having multiple carriers at each site. Corresponding remote sites need available CDD-880 Multi-Receiver Router Expansion Units to receive the mesh transmission; this establishes a true dynamic SCPC circuit between remotes.

Hardware costs are also significantly lower due to the ability to deploy the CDD-880s at both the hub location and the remote sites. ACM maintains link connectivity by “down revving” the MODCODs while maintaining a constant symbol rate and power level.

Appendix G. DPC (VMS DYNAMIC POWER CONTROL)

G.1 DPC (Dynamic Power Control) Overview



VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)



This appendix provides information on Dynamic Power Control in reference to the return path only – CDM-840 Remote Router to CDD-880 Multi Receiver Router control.

Satellite networks are subject to uplink/downlink degradations due to rain fade or other environmental factors. To ensure target link availability, network designers must take into account the rain region on both sides of a link, and design the terminals and operating point to include the appropriate link margins.

Satellite network operators typically lease Power Equivalent Bandwidth (PEB) from satellite owners. In clear sky operation, the terminals on both sides of the link transmit with RF power on the ground as a means to employ the PEB of the satellite that is assigned to that link. The presence of rain or other environmental attenuation lowers the RF power received at the satellite relative to clear sky conditions.

In principle, terminals with sufficient RF power could increase their transmit power during rain loss conditions, to compensate for the loss and maintain the PEB on the satellite. However, rain fade may occur at the uplink or downlink location, which presents an ambiguity for each transmitting modem. If you control power solely on receiving quality and not power-limited at the transmitter, you may exceed the satellite PEB – thereby oversubscribing service level agreements or, worse, resulting in adjacent carrier interference.

Such oversubscription is common in traditional uplink power control technology. Modems, in general, can automatically compensate for rain attenuation, but with power constraints and set limits not to exceed site margins. Running uplink power at margin, however, tends to flat-line power availability. If the modems are fed sufficient information to determine which side of the link is being impacted by rain fade, the power may exceed margin limits without compromising PEB, whereby the terminal knows the contribution of attenuation on the downlink and the remainder of uplink attenuation is between the transmitting terminal and the satellite. The additional information is obtained by monitoring the hub's outbound transmission and taking

the clear sky quality reading as a zero reference, then disseminating the offset to all listening remotes.

The Dynamic Power Control (DPC) feature as available with Comtech EF Data's Advanced VSAT products provides a mechanism whereby remote satellite uplinks have their transmit power levels adjusted in order to optimize the receive signal quality as measured by the corresponding demodulator E_s/N_0 (the ratio of energy per symbol to noise density). This optimization process acts to either increase or decrease transmitted signal levels in order to:

- Achieve a minimum level of received E_s/N_0 consistent with providing an error free link or set margin.
- Reduce transmit power where sufficient link margin exists in order to optimize group station uplink saturation and/or satellite transponder power usage reducing costs.
- Increase link availability when margins apply (typically Ku-Band or Ka-Band).
- Maintain proper power backoff to eliminate high power amplifier saturation and carrier distortion.

G.2 Dynamic Power Control

G.2.1 About DPC

DPC is a selectable software feature operating independently on CDM-840s exchanging a UDP message between the receiving unit (where the signal quality is being measured) and the transmitting unit (where the power level is to be adjusted). This message contains link quality status, which is directed to the transmit site on timed intervals, updating the link state.

DPC is divided into two segments: return path remote to hub/forward path hub to remote.

On the return path, power adjustments can interoperate with Adaptive Coding and Modulation (ACM) by combining modulator output power adjustments with ACM step points. This exchange allows the transmit power level to try and compensate for fade before it is necessary to decrease data link capacity. The fade reporting adjustment is maintained by Adaptive Control Loop (ACL), which reports receiving E_s/N_0 using messages over the LAN/WAN data transmission segments. The ACL continuously updates the link conditions for each active receiving demodulator.

The CDM-840 takes receipt of these messages via the outbound channel in order to take the appropriate actions. Thus, depending on the link estimation compared to internal power curves, the link is adaptive through configuration limits that maintain power budgets on the satellite.

G.2.2 DPC Functionality

The CDM-840 receives each message and compares it to tables, automatically adjusting the uplink modulator transmit power to maintain a target signal-to-noise ratio (SNR) as measured by the downlink signal quality at the corresponding receive demodulator(s). This exchange provides a mechanism to compensate for varying signal levels during transmit uplink/downlink fade conditions.

The power control algorithm is a closed loop servomechanism linked to the received E_s/N_0 value as the input function; the modulators transmit power attenuator as the output function. You control modulator transmit power only by the algorithm, assuming that the transmit up-conversion chain (BUC) is a fixed gain block.

DPC can be applied to any or all of the CDM-840s with the exception of the Entry Channel Mode (ECM) control CDD-880s in Dynamic Single Carrier Per Channel (dSCPC) networks. Since the ECM burst CDD-880s are dSCPC fast acquisition receivers, they cannot provide accurate signal quality E_s/N_0 measurements, which is critical in closing and maintaining a stable power control loop mechanism. The “Power Hunt” function is used in place of the closed loop control, and is described later in this appendix.

G.2.2.1 Entrance Link Cabling

DPC relies on basic fundamental settings before it can operate properly. These parameters build the foundation on which the control can reference all power variations. One significant but often overlooked parameter is the transmit cable attenuation between the CDM-840 and the BUC.

The entrance link cable run can be problematic when trying to balance the modulator’s output signal level to the output gain power of the BUC. If the mismatch of balance is not calculated during site commissioning, this can result in:

- Too much cable attenuation and not enough power from the modulator to drive the BUC output to achieve required uplink power, or
- Not enough cable attenuation and the minimum output power of the modulator is still overdriving the BUC, or worse, PEB on the satellite.

To help manage this problem, DPC Power Reference calibration takes into consideration budgeted parameters, maximum data rate, and power margin to determine rated and/or terminal maximum power. The Power Reference function uses the budgeted values, calculating from current power determining the amount of power required to achieve maximum. If the calculated power exceeds the modulator’s maximum output power range, the cable run has too much attenuation. This can possibly limit the terminal from reaching budgeted margin and/or terminal maximum power.

Power Reference calibration returns an error if the modulator output level is >0 dBm. If this happens, you are notified to reevaluate budget values or cable attenuation **before Power**

Reference power is complete. Although modulator minimum power (-40 dBm) is still important, it is not as critical to overall performance. The best balance for nominal operation is somewhere in the middle of the range, leaving headroom on the top and bottom. This range balance is extremely important when operating the network in dSCPC, as the system varies symbol rate and power.



For more information on CDM-840 commissioning and cabling considerations, see Comtech EF Data Quick Reference Document QR-CDM840.

G.2.2.2 Operational Essentials

Three basic criteria apply to power control function:

- Power Reference
- Rated Maximum Power
- Terminal Maximum Power

Each plays an important role in constraining and maintaining power adjustments on the fly, with range check parameters, Tx Power Margin, and Maximum Data Rate providing power constraints.

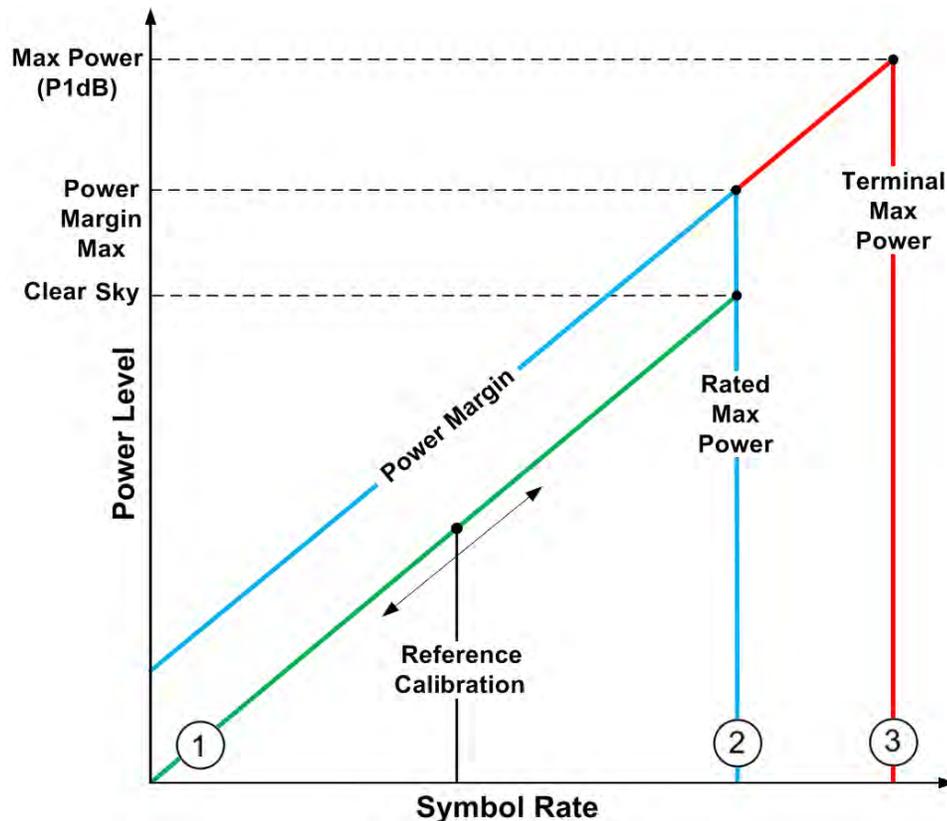


Figure G-1. DPC Power Scale

G.2.2.2.1 Power Reference

Reference Calibration uses the listed operational essentials to take a unique approach in determining a power reference. This approach allows setting the reference at any point during dSCPC operation. However, to avoid the risk of improper entrance link balance, the operator MUST calibrate at the time of antenna commissioning.

The DPC Power Scale (**Figure G-1**) represents the different calibration levels and limits depending on link-budgeted power parameters. When using the DPC Reference Calibration, the requirements that follow must be taken into consideration to determine link quality and the achievable maximum power.

G.2.2.2.2 Reference Calibration

Per **Figure G-1**: Line 1 (the green line) represents the calibration point which you may call any time during dSCPC operation. Reference calibration uses current symbol rate and MODCOD to target error-free link quality. Reference recalibration, during normal operation, forces re-evaluation, which could represent a different point on the scale, but not modifying maximum power set points.

G.2.2.2.3 Rated Maximum Power

Per **Figure G-1**: Line 2 (the blue line) indicates the breakpoint of rated maximum power given by the link budget parameters of maximum data rate, MODCOD, and margin. This is the power adjustment between clear-sky and fade conditions and how much additional power is applied without exceeding assigned terminal PEB. *This assumes hub downlink fade or backoff condition is not set/unknown.*

G.2.2.2.4 Terminal Maximum Power

Per **Figure G-1**: Line 3 (the red line) shows terminal maximum power if the hub downlink fade condition is given and the remote's BUC gain compression point is known.

Without these two variables, the terminal is not allowed to increase power beyond the rated maximum; with these two pieces of information, the hub backoff control allows the power to adjust greater than budgeted margin.

G.2.2.2.5 Target Power

The target power for DPC is based on MODCOD switch-points (**Figure G-2**), which correspond to SNR requirement for $BER = 5 \times 10^{-8}$.

The calculated target power for a given E_s/N_0 is increased by one switch-point in this table; this is done to prevent unnecessary ACM switching if the terminal power is marginal, and also to give full range for set MODCOD. This targeted power increase is independent of ACM operation.

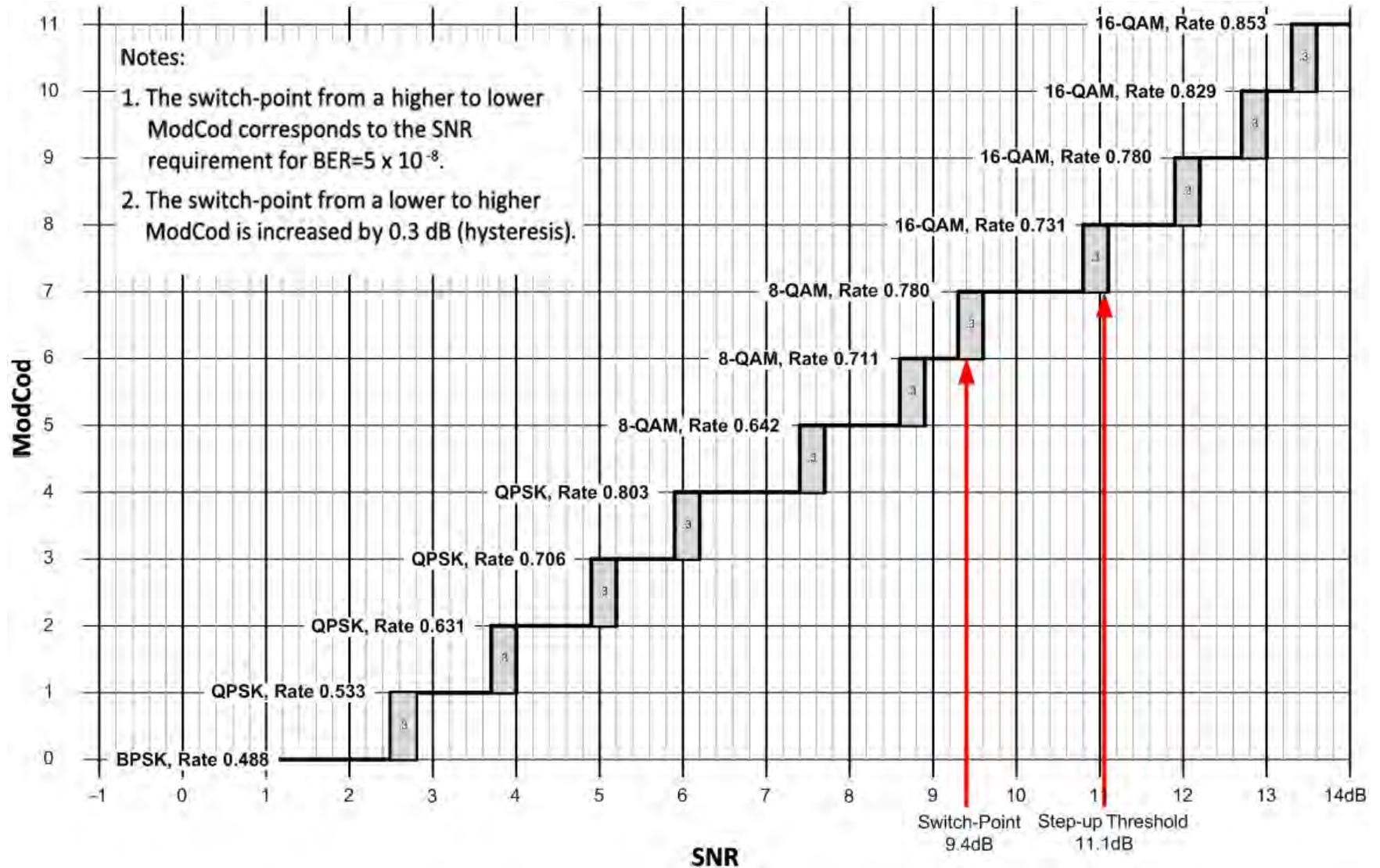


Figure G-2. ACM – MODCOD Switch-Point

G.3 DPC Operation

Dynamic Power Control operates independently from any upper Network Management System (NMS), relying solely on a peer-to-peer exchange between the transmitting and receiving terminals. This means that the logic control is embedded into each unit and requires no interaction from any external process.

At a very basic level, the receiving demodulator is configured and assigned the Management IP Address of the corresponding remote modulator; the demodulator then starts sending an IP Packet (Link Quality Report Message, or LQRM) on varying timed intervals, depending on measured signal quality. The modulator receiving the LQRM compares the signal quality to target quality value, and adjusts its output power level accordingly.

DPC requires a power reference value in order to operate properly. While this value should be determined during clear-sky operation, the Adaptive Control Loop (ACL) will work either way.

The power reference value should equal the sum of the symbol rate, MODCOD, and target E_s/N_0 . This value becomes the mathematical pivot point from which all other power is calculated. For example, if the power reference measurement was taken during a 6 dB rain fade with terminal margin of 5 dB, the power control algorithm would re-adjust as the fade clears (leaving a -6 dB power delta) but the overall terminal margin is not affected, still providing fade increase of up to -1 dB. The only notable problem with calibrating during a fade is that the DPC delta reading is always at some offset from 0 dB, which represents clear-sky.

Power Reference also provides the point from which all dSCPC switch commands are calculated for new power adjustments. Without DPC, the VMS switching engine uses home state values to determine the power value to send to the modulator during a symbol rate/MODCOD change. When using DPC, the power reference value is used to determine the modulator power, instead. In this case, VMS power is ignored and internal power calculation uses the following:

Calculate Power:

- Power Reference Base = Tx Power, MODCOD, and Symbol Rate
- Target
- DPC Delta
- Switched Symbol Rate, and MODCOD+Switch-Point
- Beam Offset (if roaming)

Reference Error Check (not to exceed maximum power):

- Equal or less than Tx Margin
- Equal or less than Rate Maximum Power
- Equal or less than Terminal Maximum Power (if known)

When you **enable** DPC, the CDM-840 waits for first or next LQRM before performing any power adjustment. Upon receipt, the CDM-840 internal Link Adaptation Manager acts in response to incoming messages, storing the data from the last LQRM. If this message contains an E_s/N_0 value greater than or less than target, power is adjusted accordingly.

When you **disable** DPC, you modify the current modulator power, adding the margin at the current rate that remains as part of all other bandwidth changes. This means that the terminal is running at fixed power margin. The corresponding demodulator is notified of the state change, stopping the DPC's fast LQRM reporting on power greater than the target power. This prevents the CDD-880 from sending messages at the fast rate for power above target window. ACM, if enabled, operates normally.

G.3.1 Adaptive Control Loop (ACL) Components

The ACL operates using separate components at both ends of the link. Each component plays a specific role in maintaining link quality during fade conditions:

- **CDD-880 Multi Receiver Router:** The CDD-880 incorporates a mechanism to maintain or adjust ACM during degraded conditions. This control uses the LQRM that is generated for each individual demodulator available within the unit, sending signal quality E_s/N_0 value to its corresponding CDM-840. Messages are sent on timed intervals: 60 seconds normally, or 0.5 second if measured BER falls below defined thresholds or MODCOD is below maximum ACM MODCOD. The DPC function reuses this messaging to adjust power in conjunction with ACM control.
- **CDM-840 Remote Router:** The CDM-840 power control has two methods to automatically modify its transmit power:
 1. ECM "Power Hunt" adjusts power depending on burst success or failure, whereby power is modified from base reference or default setting (−40 dBm) in 3 dB steps, up to a maximum 9 dB of additional power.

ECM uses an open loop mechanism because burst CDD-880s cannot provide an accurate E_s/N_0 per burst. This control is useful, during commissioning to find the initial power setting to switch to dSCPC, or during normal operation to compensate for conditions that may exceed the set power.
 2. In dSCPC, where the LQRM is used to adjust power during fade conditions and also to determine power reference during the calibration period.

G.3.1.1 Closed Loop Mechanism

DPC is defined as a closed loop mechanism using an outer and inner feedback exchange between CDD-880 lock quality and CDM-840 Tx power.

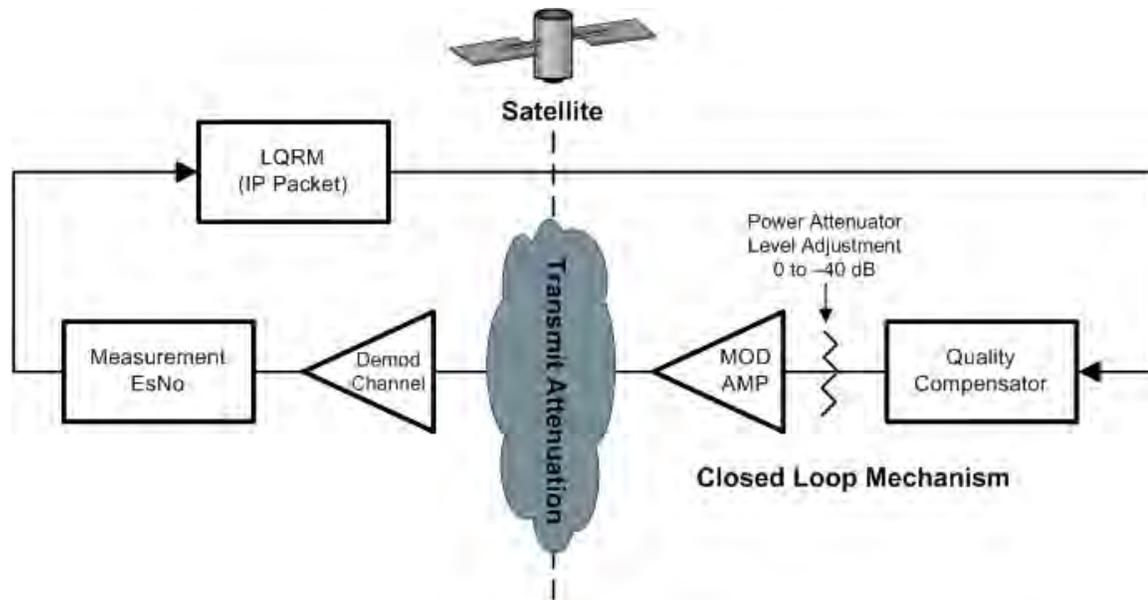


Figure G-3. Closed Loop Mechanism

As shown in the **Figure G-3** diagram, the **outer loop** requires that each CDD-880 send an LQRM (IP Packet) to a corresponding CDM-840 over the Management IP Network via the CTOG-250 Comtech Traffic Optimization Gateway w/CDM-800 Gateway Router WAN forwarding channel. The LQRM contains the demodulator's lock quality; unlocked/locked with current E_s/N_0 value and sanity check¹ conditions; threshold; Max MODCOD; DPC enable/disable state; and current symbol rate.

The **inner loop** is Tx power adjustment based on last reported LQRM with configured conditions.

The **control loop** is a constant handshake requiring certain conditions to be met before modifying power. The CDD-880 is assigned the Management IP Address of the corresponding CDM-840. Once assigned, the demodulator sends LQRM packets at either fast (500 ms) or slow (60 sec) rate; this rate depends on target window, MODCOD, and lock condition.

The decision to send the LQRM fast or slow is contingent on internal checks of E_s/N_0 value and current MODCOD. These checks modify the timer to accelerate or slow down the send rate. The main check is: If E_s/N_0 is outside of the target window ($\pm .5$ dB), and/or the MODCOD is not at maximum; then the fast timer is invoked. If MODCOD is not at maximum, the timer will remain at fast rate.

¹ The sanity check allows the CDM-840 to compare against configured parameters, sending adjustments to the CDD-880 if mismatched. This exchange synchronizes modulator settings to demodulator checks.

When you disable DPC, the CDM-840 notifies the CDD-880 and modifies the timer check logic, changing the target window to E_s/N_0 below .5 dB and/or MODCOD is not at maximum. The reason for this change is, with DPC disabled, the power level is set to Current Power+Margin Moving Power>Target Power; if not changed, the timer would be at fast rate indefinitely. This change also allows ACM to operate normally without DPC.

G.3.1.2 ACL Timers

Timers on both sides on the link are required to maintain quality and reduce hysteresis, with each end having a specific and separate function:

- **CDD-880 Messaging Timers** – CDD-880 timers are state-driven on when to send the next LQRM:
 - Every 500 ms, send E_s/N_0 data
 - Unlocked, E_s/N_0 outside target window or max MODCOD mismatch.
 - Every 60 seconds, send E_s/N_0 data, keep-alive
 - Locked, E_s/N_0 = Target (target window \pm .5 dB)
- **CDM-840 Power Adjustment Timers** – CDM-840 timers are dependent on receipt or loss of LQRM:
 - Targeting Power adjustment (ratcheted steps)
 - .3 dB every 100 ms steps \geq 1 dB
 - .1 dB targeting steps <1 dB
 - Timeout on 60-second intervals
 - Two consecutive missed messages, 120 seconds
 - Drop to BPSK, go to rated max power
 - Four consecutive missed messages, 240 seconds
 - Recovery Mode, loss of LQRM, remove **demod** from active control list
 - Stay at BPSK until next LQRM

G.3.1.3 LQRM Failure and Recovery Steps

1. If the LQRM indicates a loss of lock, the new power value is immediately set to the rated or maximum power as an attempt to regain communication.
2. Once the power value changes, a timer prevents further power value or MODCOD changes for a duration of 800 ms; this helps prevent the CDM-840 from modifying the power value on the basis of stale data.
3. If a CDM-840 hasn't received an LQRM from the CDD-880 in 120 seconds (two consecutive slow rate missed messages), it drops into recovery mode, adjusting the power value to rated or maximum adjusting MODCOD to BPSK.

4. Once in recovery mode, a timer is set for an additional 120 seconds. If that timer expires with no message from the CDD-880, the CDM-840 removes that CDD-880 from its internal control list and waits for the next LQRM. At that point, the CDM-840 is done with that particular unit and may either continue ACM and DPC to any other CDD-880 that is reporting in, or just maintain the Tx at BPSK and at the increased power level until it again hears from any CDD-880.

Figure G-4 provides the flow chart of the LQRM and Power Management Send and Adjust Logic.

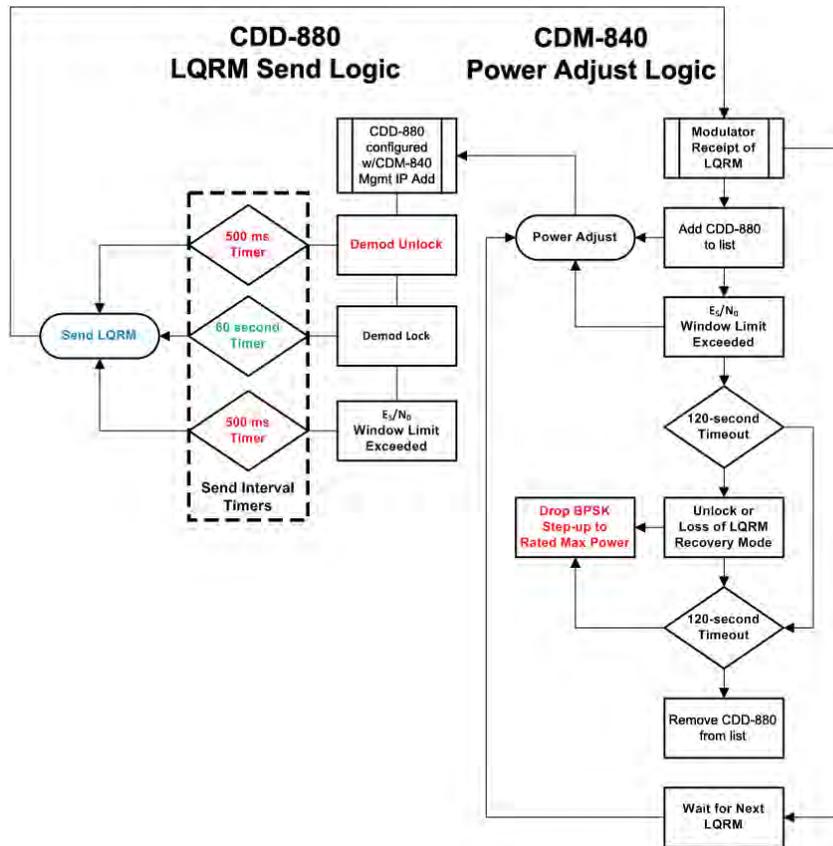


Figure G-4. LQRM / Power Management Flow Diagram

G.3.2 DPC with ACM

DPC and ACM function independent of one another, whereby power is modified first or second in combination with ACM. Depending on conditions, DPC and ACM can be operated exclusively or in combination, sharing the same resources for checks and balances. When DPC and ACM are operating in combination, the CDM-840 receives the LQRM comparing value to current settings and depending on conditions adjusts power or modifies MODCOD.

- As Carrier-to-Noise Ratio (C/N) is decreased, output power is increased until rated maximum power margin is achieved, clamping power change.
- As C/N continues to decrease, the ACM function commences to reduce MODCOD.

- Further, as C/N increases, MODCOD is adjusted, first leaving power at maximum until quality indicates reduction in power. Such reduction represents the terminal power control operating without hub backoff information, preventing power from increasing beyond margin.

Figure G-5 depicts Dynamic Power Control operating with ACM.

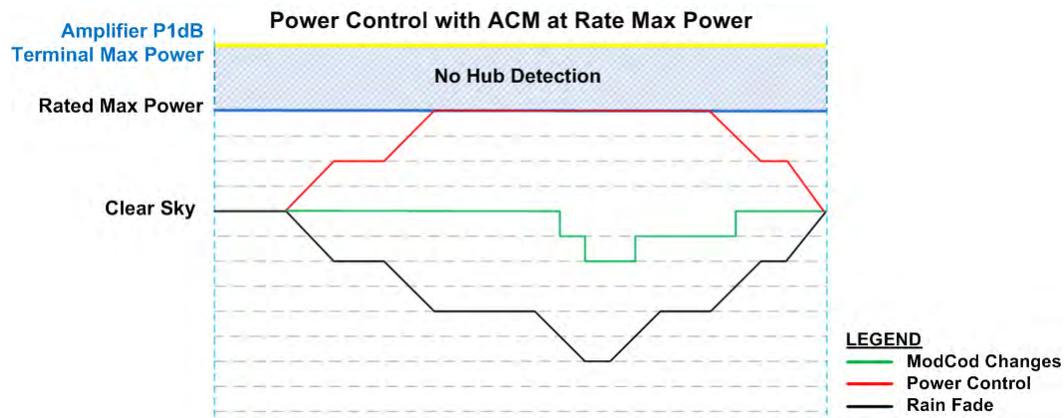


Figure G-5. DPC with ACM at Rate Max Power

G.3.2.1 Terminal Maximum Power

Terminal Maximum Power is achievable only if the remote terminal has information on the hub end environmental conditions, and the remote end’s gain compression point (P1dB) is determined. If the hub can relay downlink information for clear-sky or degraded signal quality, the remote terminals are allowed to increase their power beyond the Rate Maximum Power setting.

Terminal Maximum Power Control operates using a hub-generated outbound Universal Announcement (UA) message, which is broadcast to all listening remotes on timed intervals. The UA message that is generated and sent by the CTOG-250 contains an attenuation value and other network routing information. This attenuation value is a number from 0 to 799, with the CDM-805 indicating invalid/”no attenuation” information. Each remote operating in DPC mode cannot increase power greater than Rate Maximum Power unless the hub’s attenuation message represents a value less than or equal to the Terminal Maximum Power setting.

For example, see **Figure G-6**. If the remote Rate Maximum Power is -15 dBm with a Terminal Maximum Power setting of -5 dBm and the hub attenuation is 0 dB, then the remote may increase its power up to $+10$ dB without violating its PEB or link budget Service Level Agreement (SLA). This is possible because, if the hub is indicating clear-sky (UA= 0 dB), the only contribution of reported low E_s/N_0 is Attenuation ‘A’ (between the remote transmit uplink and the satellite).

If the UA were to indicate a value other than 0 dB, then for Attenuation ‘B’ at the downlink, the terminal would add this value to the GCP backoff, reducing the terminal maximum power. *Note that terminal maximum power is with MODCOD backoff applied.*

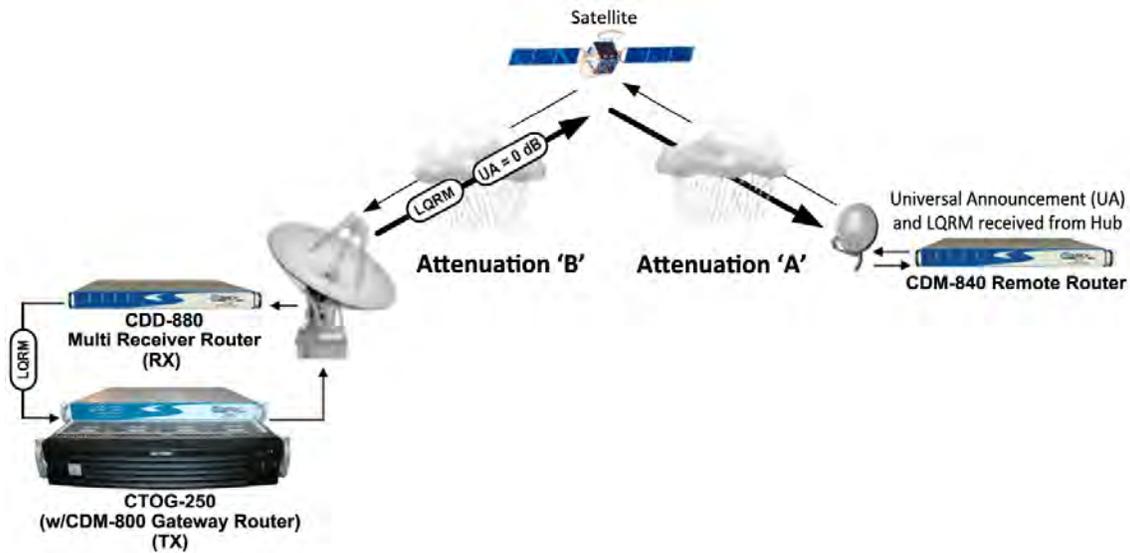


Figure G-6. Hub Rain Fade

G.3.2.2 DPC with ACM and Hub Backoff

If hub fade is known, the transmit power is allowed to increase beyond rated maximum power and up to backoff power, possibly preventing degraded performance by not modifying MODCOD under ACM control.

The **Figure G-7** graph depicts DPC with hub backoff:

- As C/N decreases, output power increases until terminal maximum power or backoff limit is achieved, clamping power change.
- Depending on the amount of fade, the MODCOD may not change.

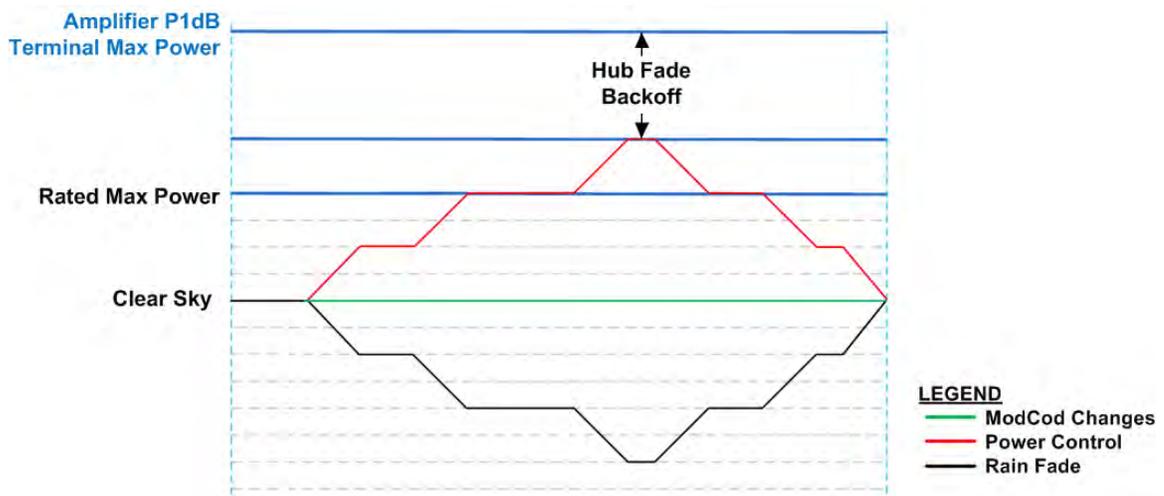


Figure G-7. DPC w/ACM with Hub Backoff

G.3.2.3 Hub Fade Control

The hub attenuation information fully optimizes power control, allowing the remote terminal to use all of available amplifier power to sustain data throughput without jeopardizing SLA. However, it can be difficult to determine if the hub downlink is in a fade condition. The problem involves measuring link quality variations from clear-sky to degraded performance, if the hub cannot receive its own uplink carrier or if the servicing satellite does not provide a beacon signal.

Hub downlinks with satellite beacon signals provide the most reliable and accurate reference for realizing if the carriers from the satellite to the hub are being attenuated. A beacon receiver can measure the satellite signal and provide C/N; by reading this level, the system can set a reference of clear-sky. With a reference point established, any reduction of that signal is distributed to all receiving remotes in the service area network.

To accomplish this control, the CTOG-250 sets up SNMP polling to the beacon receiver that is measuring the satellite's downlink carrier for C/N. The periodic polled value is first stored in the CTOG-250's reference snapshot of clear-sky condition, which sets the minimum attenuation in the UA messaging. From that "zero point" reference, any variation is updated and broadcast to all receiving remotes, providing an additional backoff value from terminal maximum.

An alternate method is a collaborative approach, whereby outbound ACM remote LQRMs are collected at the corresponding CTOG-250 and stored in a table that is periodically updated. The link quality values formulate a variation in power using a statistical averaging algorithm, which the system uses to determine hub downlink fade.

G.3.2.4 Roaming with DPC

The Roaming Oceanic Satellite Server (ROSS) is an integrated location server that works in conjunction with Comtech EF Data's Vipersat Management System (VMS) to facilitate on-the-move satellite communications for oceanic vessels. With the support of ROSS, the modem power margin is modified depending on the Effective Isotropic Radiated Power (EIRP) value. ROSS stores multiple contours per service area, with each beam contour assigned a number (0 to 255) in order of power, high to lower gain.

Roaming DPC provides additional control within a service area with multiple beam contours. As the vessel roams between beam contours, the power difference from beam-to-beam is applied to the CDM-840 DPC beam offset control, adjusting the terminal's power margin by adding or subtracting the beam power differences. The net effect on power is that the maximum power scale is increased or decreased, depending on the vessel's location within that satellite service area.

The beam offset plays a very important role in maintaining power during beam contour transitioning. If the power control is operated without this additional adjustment, the uplink power may exceed budget, or the vessel could drop communication all together because of insufficient margins.



For more information about ROSS, please see adjunct Comtech EF Data publication MN/13070 ROSS Roaming Oceanic Satellite Server Installation and Users Guide.

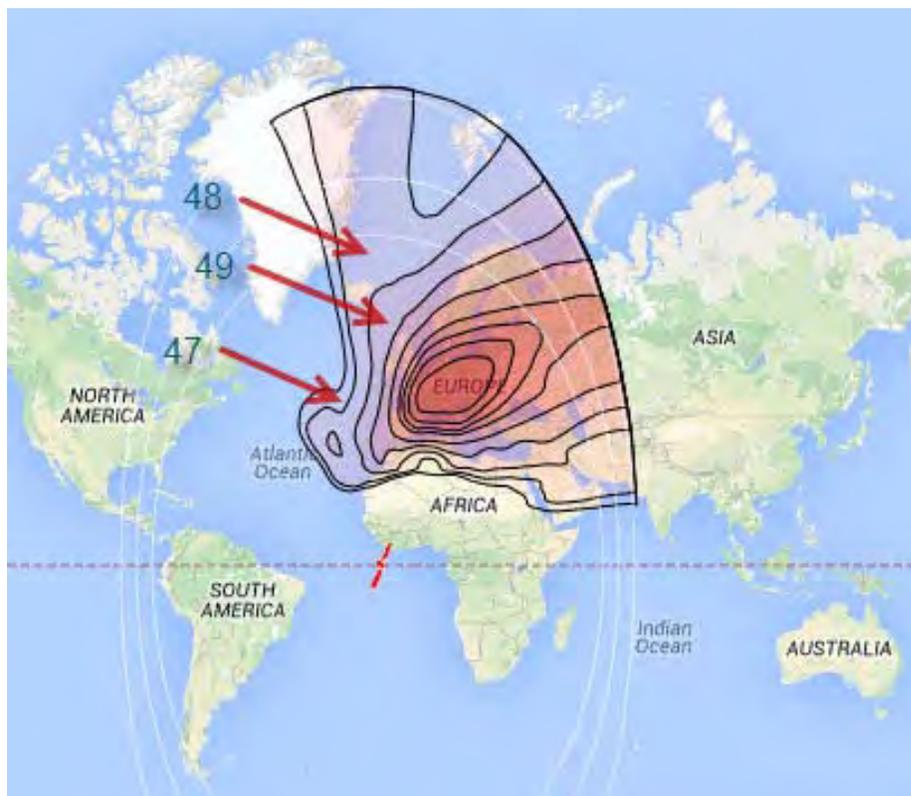


Figure G-8. Roaming DPC

G.4 Using Dynamic Power Control



For detailed information, see:

- Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in this manual
- Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT in this manual
- Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT and Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT in the CDM-840 or ODM-840 Installation and Operation Manuals (CEFD P/N MN-CDM840 or MN-ODM840)
- VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

The CDD-880 and CDM-840 provide several means for configuring Dynamic Power Control operation via Remote Product Control with a user-supplied PC:

- CDD-880 and CDM-840 HTTP (Web Server) Interfaces using a compatible Web browser. See **Sect.G.4.1.**

- Ethernet-based Simple Network Management Protocol (SNMP) using a Network Management System (NMS) and Management Information Base (MIB) File Browser.
- Serial-based Remote Control Interface using a terminal emulation program or Windows Command-line.



COMTECH EF DATA RECOMMENDS USE OF THE ETHERNET-BASED SNMP INTERFACE AND SERIAL-BASED REMOTE CONTROL INTERFACE ONLY FOR ADVANCED USERS. COMTECH EF DATA STRONGLY ENCOURAGES USE OF THE CDD-880 AND CDM-840 HTTP INTERFACES FOR MONITOR AND CONTROL (M&C) OF THE CDD-880 OR CDM-840.

THE HTTP INTERFACE FIGURES FEATURED THROUGHOUT THIS APPENDIX ARE INTENDED FOR USER REFERENCE ONLY AND ARE SUBJECT TO CHANGE. THE FIRMWARE INFORMATION (I.E., REVISION LETTERS, VERSION NUMBERS, ETC.) AS DISPLAYED MAY DIFFER FROM YOUR SETUP.

G.4.1 Dynamic Power Control Operation – HTTP Interfaces

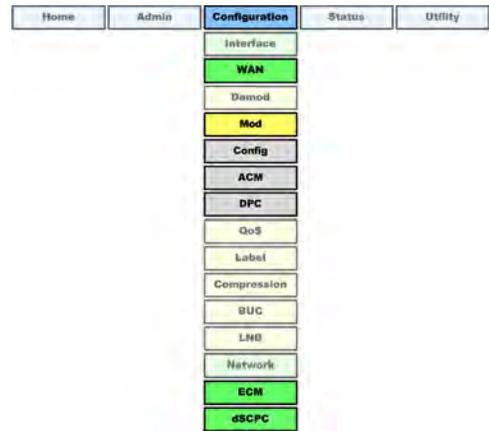
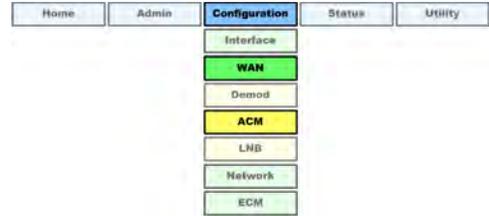


YOU MAY PROCEED WITH ETHERNET-BASED REMOTE PRODUCT MANAGEMENT (HTTP OR SNMP), ASSUMING THAT:

- **YOU ARE OPERATING THE CDD-880 WITH THE LATEST VERSION FIRMWARE FILES.**
- **YOU HAVE CONNECTED THE CDD-880 TO A USER-SUPPLIED, WINDOWS-BASED PC AS FOLLOWS:**
 - **THE PC SERIAL PORT IS CONNECTED TO THE CDD-880 REAR PANEL ‘CONSOLE’ PORT WITH A USER-SUPPLIED SERIAL CABLE.**
 - **THE PC ETHERNET PORT IS CONNECTED TO THE CDD-880 REAR PANEL ‘ETHERNET | TRAFFIC/MANAGEMENT | GE’ ETHERNET M&C PORT WITH A USER-SUPPLIED HUB, SWITCH, OR DIRECT ETHERNET CABLE CONNECTION.**
 - **THE USER PC IS RUNNING A TERMINAL EMULATION PROGRAM (FOR OPERATION OF THE CDD-880 SERIAL INTERFACE) AND A COMPATIBLE WEB BROWSER (FOR OPERATION OF THE CDD-880 HTTP (WEB SERVER) INTERFACE).**
- **YOU HAVE NOTED THE CDD-880 MANAGEMENT IP ADDRESS USING THE CDD-880 SERIAL INTERFACE.**
- **YOU HAVE INSTALLED AND ENABLED THE OPTIONAL VIPERSAT MANAGEMENT SYSTEM (VMS).**

Figure G-9 shows the CDD-880 and CDM-840 HTTP Interface “splash” pages, and the menu tree diagrams for accessing DPC operation. Page functionality not specific to DPC operation appears dimmed in these diagrams.

Dynamic Power Control and ACM work independent of one another. This gives you the option to run DPC with or without ACM. This section assumes all other operational parameters have been previously configured.



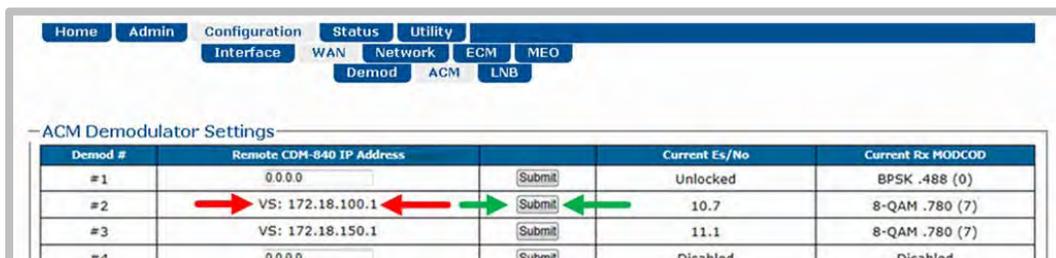
(TOP) CDD-880 HTTP Interface
(BOTTOM) CDM-840 HTTP Interface

Figure G-9. HTTP Interfaces – Splash Pages and DPC Operation Menu Trees (FW Ver. 1.6.2.X)

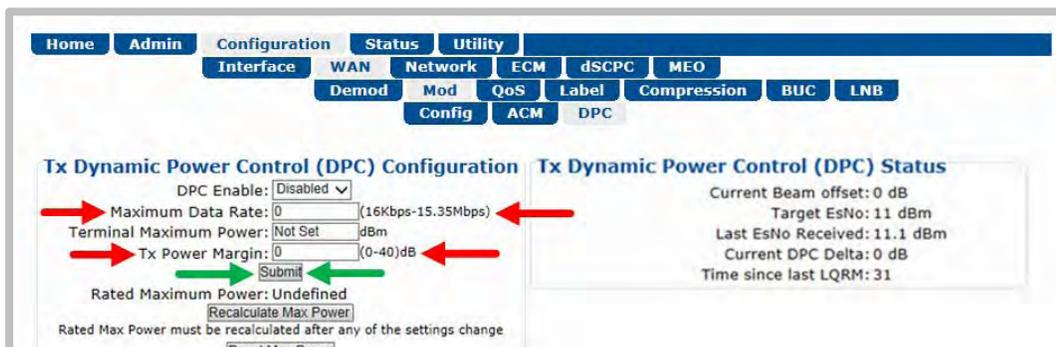
G.4.1.1 Configure DPC

Do these steps:

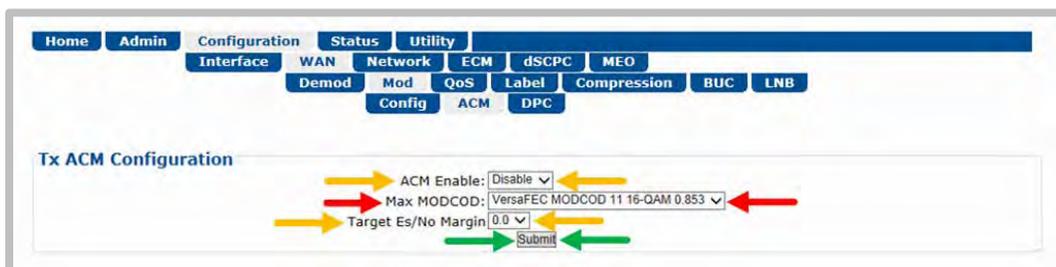
1. In the **ACM Demodulator Settings** section of the **CDD-880 HTTP Interface Configuration | WAN | ACM** page, set the corresponding CDM-840 Management IP Address. If the system is running dSCPC, this address is set automatically. Once you set this address and click **[Submit]**, the CDD-880 begins to send LQRMs.



2. In the **Tx Dynamic Power Control (DPC) Configuration** section of the **CDM-840 HTTP Interface Configuration | WAN | Mod | DPC** page, use your network's link budget information to enter the terminal's **Maximum Data Rate** and the **Tx Power Margin**. Click **[Submit]** when done.



3. **If operating with ACM:** Use the drop-down list in the **Tx ACM Configuration** section of the **CDM-840 HTTP Interface Configuration | WAN | Mod | ACM** page to select the desired **Max MODCOD**. Click **[Submit]** when done.





- It is not important to enable ACM at this time.
- Leave the Target Es/No Margin at 0.0.
- Dynamic Power Control provides additional power margin for all of the MODCOD switch-points. Adding any ACM margin will deduct from the DPC power margin, which is a one-for-one subtraction.
- When operating in dSCPC, the Max MODCOD is set automatically from the Site Default MODCOD setting. The Max MODCOD drop-down list is therefore dimmed, allowing no selection.

4. Use the drop-down list in the **Tx Dynamic Power Control Configuration** section of the **CDM-840 HTTP Interface Configuration | WAN | Mod | DPC** page to enable DPC. Click **[Submit]** when done.



- ACM is not required for DPC operation.
- Terminal Maximum Power is left at “Not Set” at this time and will not be applied until hub fade detection is available.

G.4.1.2 Power Reference in DPC Operation

Once DPC is configured, the power reference setting is vital to the overall operation of DPC. The reference setting is an automatic feature that requires a dSCPC transmission link between a CDM-840 and its corresponding CDD-880 at the hub; outbound communication is assumed. The link can be statically or dynamically established, and at any data rate at or below budget maximum.

When calibrating the reference, the system uses the ACL to adjust power until it reaches the optimal target value. This is accomplished through an exchange of messaging between units at a fast rate – taking the set values, adjusting power, and comparing against limits before allowing the reference set to complete.

G.4.1.3 Set Reference

To set the reference, the remote must be operating with an established link in dSCPC. The link data rate can be anywhere between remote site minimum or maximum, and MODCOD is at (default) maximum.

1. If the link is established **statically**, use the CDM-840 HTTP Interface to do these steps:
 - a) Use the **Configuration | WAN | Mod | Config** page to establish the communications link, set the Modulator Frequency, and select the MODCOD, Symbol Rate and Data Rate.

The first screenshot shows the **Modulator** configuration page. It includes fields for Data Rate (200 Kbps), Symbol Rate (141.734 Ksps), FEC Type (VersaFEC), Tx Frequency (1205 MHz), MODCOD (VersaFEC MODCOD 3 QPSK 0.706), Tx Scrambler (Normal), Roll Off (35%), Spectrum Invert (Normal), Power Level (-15 dBm), and Carrier State (Off). Each field has a 'Submit' button.

The second screenshot shows the **Modulator Frequency** configuration page. It includes fields for Tx RF Frequency (0 MHz), BUC LO Mix (Low (-)), BUC LO Frequency (0 MHz), and Tx L-Band Frequency (1205 MHz). A note states: "Note: BUC will not be uploaded. BUC control can be found [here](#)". Each field has a 'Submit' button.

- b) Manually adjust the modulator power until the return path demod locks with good data (pings).
- c) Use the drop-down list in the **Tx Dynamic Power Control Configuration** section of the **Configuration | WAN | Mod | DPC** page to enable DPC. Click **[Submit]**, then allow power to target (ACM operation is not required).

The first screenshot shows the **Tx Dynamic Power Control (DPC) Configuration** page. It includes a DPC Enable dropdown (set to Disabled), Maximum Data Rate (0 Mbps), Terminal Maximum Power (Not Set dBm), Tx Power Margin (0 dB), Rated Maximum Power (Undefined), and buttons for Recalculate Max Power, Reset Max Power, Turn All DPC Settings Off, and Reset All Parameters to Factory Default.

The second screenshot shows the **Tx Dynamic Power Control (DPC) Status** page. It displays: Current Beam offset: 0 dB, Target EsNo: 14.3 dBm, Last EsNo Received: Not locked, Current DPC Delta: 0 dB, and Time since last LQRM: 4592.

The third screenshot shows the **Power Reference** page. It displays: Reference Tx Power: 0 dBm, Reference MODCOD: undefined, Reference Symbol Rate: 0 ksps, and a Set Reference button. A note states: "Note: Setting references will force a reload of the page when successful".

Tx Dynamic Power Control (DPC) Configuration

DPC Enable: (16Kbps-15.35Mbps)

Maximum Data Rate: (16Kbps-15.35Mbps)

Terminal Maximum Power: dBm

Tx Power Margin: (0-40)dB

Rated Maximum Power: Undefined

Rated Max Power must be recalculated after any of the settings change

- d) In the **Power Reference** section of the **Configuration | WAN | Mod | DPC** page, click **[Set Reference]**:

Power Reference

Reference Tx Power: 0 dBm

Reference MODCOD: undefined

Reference Symbol Rate: 0 ksps

Note: Setting references will force a reload of the page when successful

- e) If **[Set Reference]** fails, note the failure, correct the condition, and click **[Set Reference]** once more.
2. If the link is established **dynamically**, use the CDM-840 HTTP Interface to do these steps:
- a) Use the **Configure | ECM** page to enable ECM with correct TAP parameters:

ECM Remote Configuration

Mode:

Note: In order to take control from VMS, please disable ECM

Multicast IP:

Group ID:

Power Hunt Enable:

Rx LO Frequency: MHz

Tx LO Frequency: MHz

ECM Power:

ECM Remote Status

Cycle Length: 0 msec

Aloha State: Idle

Current Tap: 0

Home State Revert Timer: 0 seconds

Time in ECM: 0 seconds

Seconds Until Next Probe: 0 seconds

ECM Tx Statistics

Total Count: 0

Successes: 0

Failures: 0

No Detect: 0

Last Status: No Detect

Seconds since last xmit: 0 days 2 hours 19 minutes 7 seconds

- b) Either manually set **ECM Power** or enable **Power Hunt** to adjust power until the return path ECM demod locks with good data (VMS registration completes).
- c) Use the **Configuration | dSCPC** page to switch to dSCPC manually (using the **Load Switching Configuration** section) or automatically (using the **ToS Switching Configuration** section).

The screenshot shows the router's configuration interface. At the top, there are tabs for Home, Admin, Configuration, Status, and Utility. Under Configuration, there are sub-tabs for Interface, WAN, Network, ECM, dSCPC, and MEO. The main content area is divided into two sections:

- Load Switching Configuration:** This section has a 'Mode' dropdown menu set to 'Disabled'. Below it are several input fields: 'Step Up Threshold (%)' (0-100) with a value of 95, 'Step Down Threshold (%)' (0-100) with a value of 95, 'Step Up Delay (Sec)' (10-60) with a value of 10, 'Step Down Delay (Sec)' (10-60) with a value of 10, and 'Excess Capacity (%)' (0-100) with a value of 10. Each field has a 'Submit' button below it.
- ToS Switching Configuration:** This section has an 'Enable' dropdown menu set to 'Disabled' and a 'Max # of Sessions (per TOS Id)' input field with a value of 1. There is a 'Submit' button below.

At the bottom, there is a table with the following columns: Index, Name, ID, Type, SCPC Data Rate, Timeout, Change, Delete, and Add Entry. The table contains two rows:

Index	Name	ID	Type	SCPC Data Rate	Timeout	Change	Delete	Add Entry
0		0	0	0	0			
1								

- d) Use the drop-down list in the *Tx Dynamic Power Control (DPC) Configuration* section of the **Configuration | WAN | Mod | DPC** page to enable DPC. Click [Submit], and allow power to target (ACM operation is not required).

The screenshot shows the 'Tx Dynamic Power Control (DPC) Configuration' page. Red arrows point to the 'DPC Enable' dropdown menu, which is currently set to 'Disabled'. Below it are several input fields: 'Maximum Data Rate' (0, range 16Kbps-15.35Mbps), 'Terminal Maximum Power' (Not Set, dBm), and 'Tx Power Margin' (0, range 0-40)dB. A green arrow points to the 'Submit' button. Below the 'Submit' button, there is a 'Rated Maximum Power' field set to 'Undefined', a 'Recalculate Max Power' button, and a 'Reset Max Power' button. A note states: 'Rated Max Power must be recalculated after any of the settings change'.

- e) In the **Power Reference** section of the **Configuration | WAN | Mod | DPC** page, click [Set Reference].

The screenshot shows the 'Power Reference' section. It contains the following fields: 'Reference Tx Power: 0 dBm', 'Reference MODCOD: undefined', and 'Reference Symbol Rate: 0 kbps'. A green arrow points to the 'Set Reference' button. Below the button, there is a note: 'Note: Setting references will force a reload of the page when successful'. At the bottom, there is a 'Reset Power' button.

- f) If [Set Reference] fails, note the failure, correct the condition, and click [Set Reference] once more.

G.4.1.4 DPC Status Reporting

Once reference calibration is complete, the **Tx Dynamic Power Control (DPC) Status** section of the **Configuration | WAN | Mod | DPC** page provides information on the ongoing DPC state. Each received LQRM updates this status section; any changes to power are noted between **Target Es/No** and **Current DPC Delta**.

The screenshot shows the 'Tx Dynamic Power Control (DPC) Status' section. It displays the following information:

- Current Beam offset: 0 dB
- Target EsNo: 11 dBm
- Last EsNo Received: 11.1 dBm
- Current DPC Delta: 0 dB
- Time since last LQRM: 31

After the targeting of reference calibration, the DPC Delta is zeroed, and any +/- offset from this point indicates power changes due to link quality variations.



Depending on symbol rate, small rates will have variations up to ± 0.5 dB, even during clear-sky conditions.

Item	Description
Current Beam offset	Current Beam offset is modified in a roam configuration, and any +/- offset from zero either adds or subtracts from the margin or terminal maximum power backoff during a beam contour variation.
Target Es/No	Target Es/No is calculated from maximum MODCOD and will remain constant unless changed.
Last Es/No Received	This most recent reported value may change depending on link conditions.
Current DPC Delta	This represents the Adaptive Control Loop (ACL) change in power compared to the set reference, which can increase to margin or terminal maximum power. Any decrease has the full remaining range down to -40 dBm of modulator's output.
Time since last LQRM	This is the time, in seconds, from the last power report received. Under normal conditions, the status updates every 60 seconds.

G.4.2 DPC – Operational Changes

DPC operation modifies the behavior between VMS site policy home state parameters and power reference control.

Normally, the operator updates the home state parameter in the VMS to match the current settings in the CDM-840. This synchronizes the power settings between the two, providing correct power adjustments when the VMS sends a switch command to modify transmission rates.

When you enable DPC, you now modify power with the CDM-840 and ignore any power setting in the switch command; this changes the behavior of the home state settings. The home state settings remain very important for frequency domain check, but you now use the power only to limit the site's symbol rate. During each rate change, the VMS calculates a new power value, comparing this value against the Up-converter's power limit value; if the calculated power is less than or equal to this value, the requested rate is set. However, if the calculated power is greater than this value, the requested rate will be limited to the set limit.

G.5 Firmware Update



The order of firmware update is important – Comtech EF Data recommends that you first update the CDD-880, and then update the CDM-840.

Firmware update notes apply to systems running Firmware Versions 1.5.2.1 or lower that require the DPC feature.

The DPC feature is designed not to affect any current operational settings during an update of firmware. The parameter setting for power will remain the same until reference calibration in the CDM-840 is applied, meaning that system will operate normally.

G.6 Considerations

DPC is not an accurate system or absolute solution. As fading varies with time, it is not possible to keep up with changes as they occur quickly. This is particularly the case when scintillation is occurring. Scintillation – when due to either low elevation troposphere effects or to the ionosphere in tropical regions – sometimes involves changes of several dB per second. When DPC is operated in combination with ACM, the system may reduce throughput during such quick changes, but regains as the loop control catches up to resume normal operation.

Appendix H. VERSAFEC RETURN LINK ACM (ADAPTIVE CODING AND MODULATION) OPTION

H.1 VersaFEC ACM Overview



VersaFEC® is a technology that is wholly owned and developed by Comtech EF Data and Comtech AHA Enterprise Products Group. VersaFEC is a registered trademark of Comtech AHA Enterprise Products Group.

Satellite users have traditionally relied on worst-case link margin to overcome rain fade and other impairments, which leads to significant inefficiencies. ACM (Adaptive Coding and Modulation) allows modulation and code rate (MODCOD) to change on a frame-by-frame basis subject to current link conditions. As ACM converts available link margin into increased capacity, average capacity gain of 100% or more is possible. This maximizes each remote's throughput under all conditions which, in turn, maximizes network efficiency and availability.

Advanced VSAT supports ACM in the forward direction (Outbound ACM) as well as the return direction (Return Link ACM):

- With CCM (Constant Coding and Modulation) systems, severe rain fading can cause the total loss of the link, and zero throughput. ACM keeps the link up (with lower throughput) and can yield much higher system availability.
- ACM turns fade margin into increased link capacity by automatically adapting the modulation type and FEC code rate to give highest possible throughput. Gains of 100% or more are possible, compared to traditional CCM.
- ACM maximizes throughput regardless of link conditions (noise or other impairments, clear sky, rain fade, etc). After initial setup, ACM requires no further user intervention.

You may use ACM with VersaFEC for modems running Firmware Version 1.5.2.X or later.

H.2 Background

ACM has been used for some time in wireless communications, including terrestrial microwave applications and, more recently, over satellite links. The primary function of ACM is to optimize throughput in a wireless data link, by adapting the modulation order used and the Forward Error Correction code rate – both of which directly affect spectral efficiency (expressed in bits per second per Hertz) according to the noise conditions (or other impairments) on the link. Implicit in this concept is that the symbol rate (and power) of the wireless communication system *must remain constant*. This ensures that the bandwidth allocated for a particular link is never exceeded.

Given that the symbol rate does not change, if modulation and coding are changed, the data rate must therefore be modified. This is expressed in the simple equation:

$$\text{Symbol rate} = \text{bit rate} / (\text{modulation order} * \text{code rate})$$

For example, for Rate 3/4 QPSK (where modulation order = 2):

$$\text{Symbol rate} = \text{bit rate} * 0.666$$

Re-arranging:

$$\text{Bit rate} = \text{symbol rate} * \text{modulation order} * \text{code rate}$$

So, in changing to a higher modulation order or code rate, the bit rate is **increased**, and in changing to a lower modulation order or code rate, the bit rate is **reduced**. However, some important factors must be considered:

- **The digital communications system must be able to tolerate a change in bit rate.** Synchronous serial interfaces (such as G.703 E1, which operated at a fixed data rate of 2.048 Mbps) are totally unsuitable in a scheme where data rate is changing. The only practical application for this scheme is a packet-based scheme that will tolerate a change in data rate, and which has mechanisms within its protocols to recognize when increased or reduced bandwidth is available. The best example of this is Ethernet, and this discussion is limited to schemes that employ it. The CDM-840 supports both IP and E1 (internally packetized) operation with ACM.
- **The bit rate cannot be changed arbitrarily.** The link noise conditions, described in terms of Eb/No or SNR, must be able to support reliable communications for the given modulation order and code rate. This is a key point as, in fact, *the link SNR is the input that drives the adaptation.*

H.3 VersaFEC ACM

The VersaFEC family of short-block LDPC MODCODs are designed specifically for low latency and ACM applications. These MODCODs are equally well-suited to Constant Coding and Modulation (CCM) applications. By comparison, they provide performance at or very close to DVB-S2 with significantly reduced latency.

Table H-1 specifies the available VersaFEC short-block LDPC codes (MODCODs). The modulation types include BPSK, QPSK, 8-QAM, and 16-QAM. This table shows that, in order to maintain a constant number of symbols per block, the block size in bits (data + parity) must necessarily change, depending on both the modulation type (which affects the number of bits per symbol) and the code rate. For VersaFEC, the block size varies between 2k and 8.2k bits. At worst, therefore, the VersaFEC codes are 50% shorter than the ‘short’ DVB-S2 codes.

Table H-1. The VersaFEC MODCOD set

Modulation (MODCOD No.)	Code Rate	Spectral Efficiency (bps/Hz)	Block Size (kbits)	Typical Es/No for BER = 5×10^{-8}	Typical Eb/No for BER = 5×10^{-8} (dB)	Latency at 64 kbps (in milliseconds)	Data Rate, CCM Mode	
							Minimum (kbps)	Maximum (Mbps)
BPSK (00)	0.488	0.49	2	-0.70	2.4	26	16	2.2
QPSK (01)	0.533	1.07	4.1	2.49	2.2	53	17	4.81
QPSK (02)	0.631	1.26	4.1	3.70	2.7	59	20	5.67
QPSK (03)	0.706	1.41	4.1	4.89	3.4	62	22	6.34
QPSK (04)	0.803	1.61	4.1	5.87	3.8	66	25	7.24
8-QAM (05)	0.642	1.93	6.1	7.46	4.6	89	30	8.68
8-QAM (06)	0.711	2.13	6.1	8.48	5.2	93	34	9.58
8-QAM (07)	0.780	2.34	6.1	9.29	5.6	97	37	10.53
16-QAM (08)	0.731	2.93	8.2	11.17	6.3	125	46	13.18
16-QAM (09)	0.780	3.12	8.2	12.04	7.1	129	49	14.04
16-QAM (10)	0.829	3.32	8.2	12.91	7.7	131	53	14.94
16-QAM (11)	0.853	3.41	8.2	13.43	8.1	132	54	15.34

The VersaFEC codes compared with the Shannon bound are shown in **Figure H-1**. It can be seen that the performance of VersaFEC at or near the DVB-S2 performance with 16 kbit blocks.

Note that SNR is used in place of Eb/No, a convention for comparing ACM MODCODs. SNR is defined as $\mathbf{Eb/No + 10_{\log}(\text{Spectral Efficiency})}$.

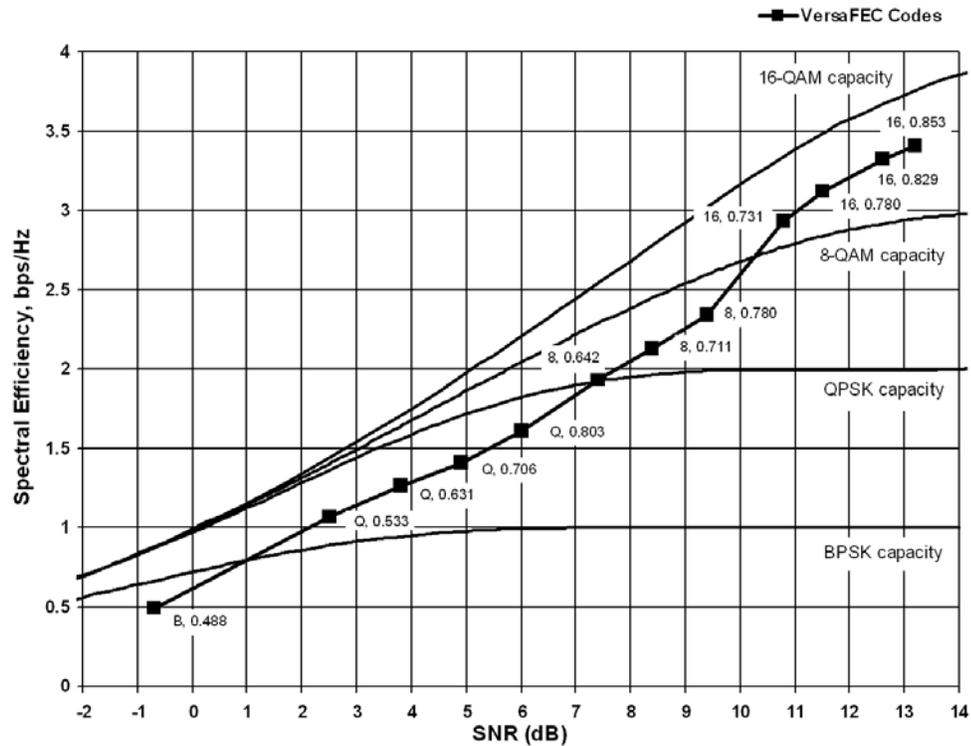


Figure H-1. VersaFEC Codes vs. Constrained Capacity

H.3.1 VersaFEC ACM Latency

Examining the data in **Table H-2**, latency for each MODCOD is shown for the example of VersaFEC ACM at a fixed 100 ksymbols/second rate. Of particular note is that even though the MODCODs span a 7:1 variation in throughput, the latency is only varying between 25 and 34 milliseconds. In the example shown the worst-case latency for this ACM scheme is 34 milliseconds.

Table H-2. Example Case – VersaFEC Implementation of ACM (100 ksymbols/sec)

Modulation (MODCOD No.)	Code Rate	Spectral Efficiency (bps/Hz)	Bit Rate (Throughput) (in kbps)	Minimum Latency (in milliseconds)
BPSK (00)	0.488	0.49	49	34
QPSK (01)	0.533	1.07	107	32
QPSK (02)	0.631	1.26	126	30
QPSK (03)	0.706	1.41	141	28
QPSK (04)	0.803	1.61	161	26
8-QAM (05)	0.642	1.93	193	30
8-QAM (06)	0.711	2.13	213	28
8-QAM (07)	0.780	2.34	234	27
16-QAM (08)	0.731	2.93	293	27
16-QAM (09)	0.780	3.12	312	26
16-QAM (10)	0.829	3.32	332	25
16-QAM (11)	0.853	3.41	341	25

OVERALL SYSTEM LATENCY = Worst-case MODCOD (MODCOD 00)
Latency = 34 milliseconds, NOT INCLUDING WAN BUFFER OR SATELLITE PATH

H.4 Managing VersaFEC ACM Operation

The configuration of routes between the CDD-880 and the CTOG-250 is accomplished with the CDD-880 HTTP Interface. Configuration of Return Link VersaFEC ACM operation is performed on the CDM-840 HTTP Interface. With a user-supplied, Windows-based PC, both products:

- Require a compatible web browser for use of the HTTP Interfaces.
- Require a Network Management System (NMS) and a Management Information Base (MIB) File Browser for use of Ethernet-based Simple Network Management Protocol (SNMP).



For detailed information, see:

- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT** in this manual.
- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT** in the Comtech EF Data CDM-840 REMOTE ROUTER INSTALLATION AND OPERATION MANUAL (CEFD P/N MN-CDM840).
- **Chapter 6. QUICK START GUIDE** in the Comtech EF Data CTOG-250 COMTECH TRAFFIC OPTIMIZATION GATEWAY WITH CDM-800 GATEWAY ROUTER INSTALLATION AND OPERATION MANUAL (CEFD P/N MN-CTOG250).

H.4.1 VersaFEC ACM Operation Using the HTTP Interfaces



COMTECH EF DATA RECOMMENDS USE OF THE ETHERNET-BASED SNMP INTERFACES AND THE SERIAL-BASED REMOTE CONTROL INTERFACES FOR ADVANCED USERS ONLY. COMTECH EF DATA STRONGLY ENCOURAGES USE OF THE PERTINENT HTTP INTERFACES FOR MONITOR AND CONTROL (M&C) OF ADVANCED VSAT PRODUCTS. You may proceed with Ethernet-based Remote Product Management (HTTP or SNMP), assuming that:

- Your Advanced VSAT products are operating with their latest version firmware files.
- Your Advanced VSAT products are connected to a user-supplied, Windows-based PC as follows:
 - The PC serial ports are connected to the CDD-880 and CDM-840 rear panel 'CONSOLE' ports with user-supplied serial cables.
 - The PC Ethernet ports are connected to the CDD-880 rear panel 'ETHERNET | TRAFFIC/MANAGEMENT | GE' and CDM-840 rear panel 'ETHERNET | MANAGEMENT | FE' Ethernet ports with user-supplied hubs, switches, or direct Ethernet cable connections.
 - The PC is running a terminal emulation program (for operation of the Serial Interfaces) and a compatible web browser (for operation of the HTTP Interfaces).
- You have noted the CDD-880 and CDM-840 Management IP Addresses using the pertinent Serial Interfaces.
- The HTTP interface figures as featured throughout this appendix are intended for user reference only and are subject to change. The firmware information (i.e., revision letters, version numbers, etc.) as displayed may differ from your setup.

Figure H-2 shows the CDD-880 HTTP Interface “splash” page, and the menu tree for accessing route configuration and BERT operations. **Figure H-3** shows the CDM-840 HTTP Interface “splash” page, and the menu tree for accessing VersaFEC ACM and BERT operations.

Page functionality that is not specific to the operations described in this appendix appear dimmed for both figures.

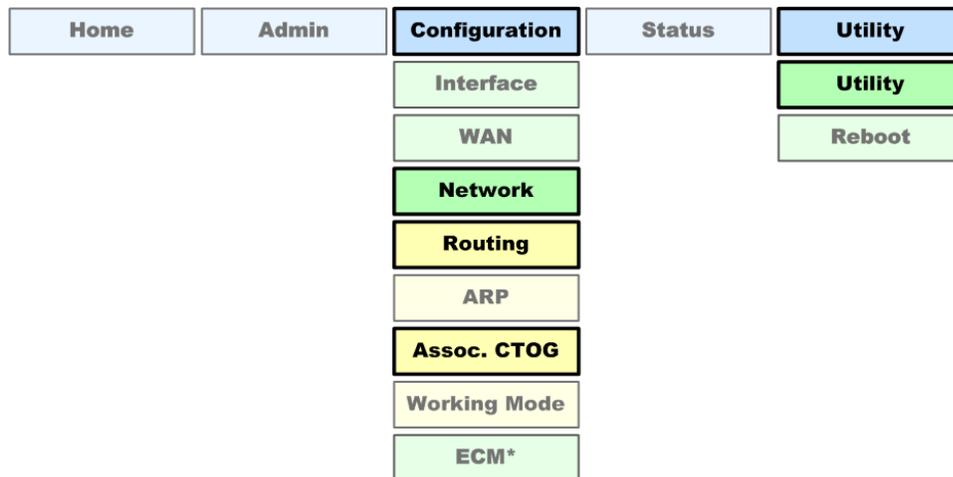
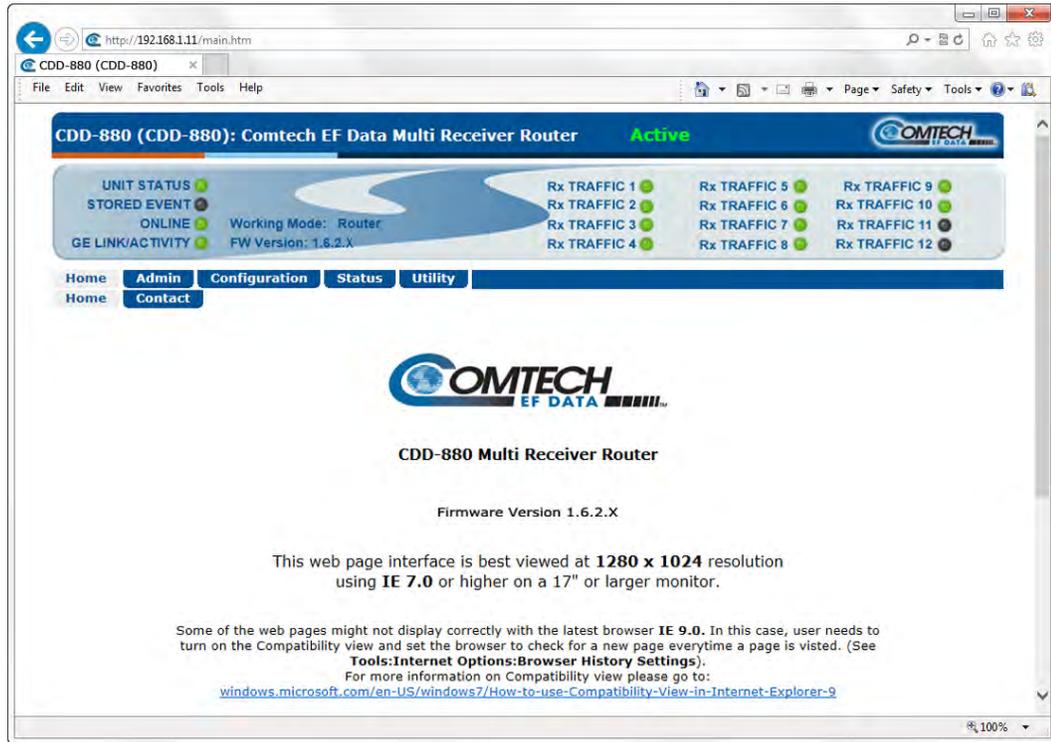


Figure H-2. CDD-880 HTTP Interface and Menu Tree – Route Creation, BERT Operations (FW Ver. 1.6.2.X)

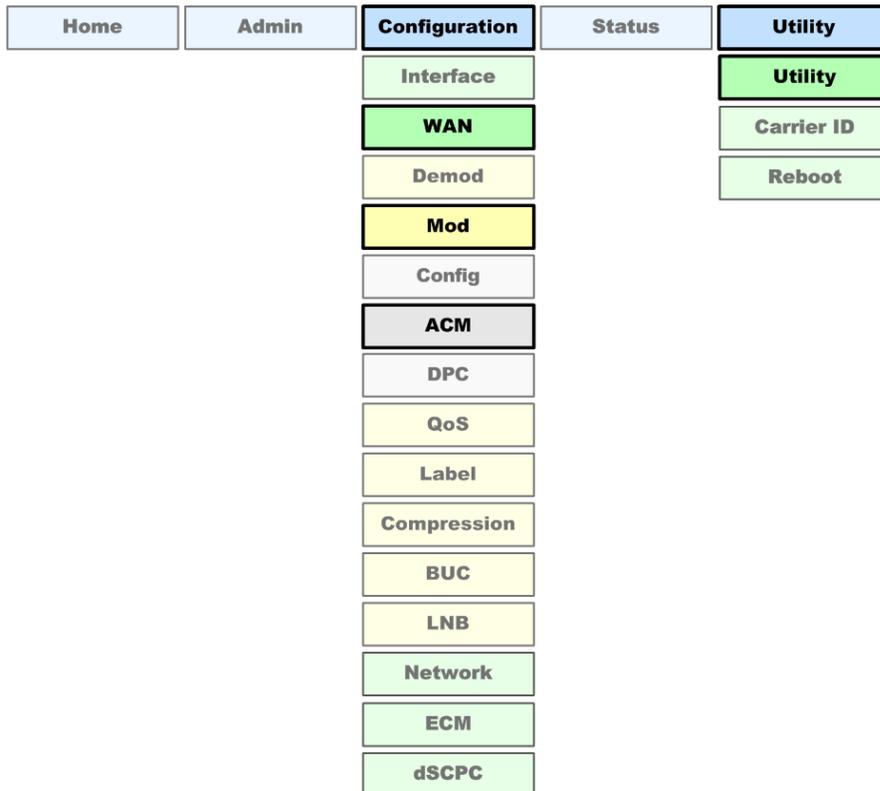
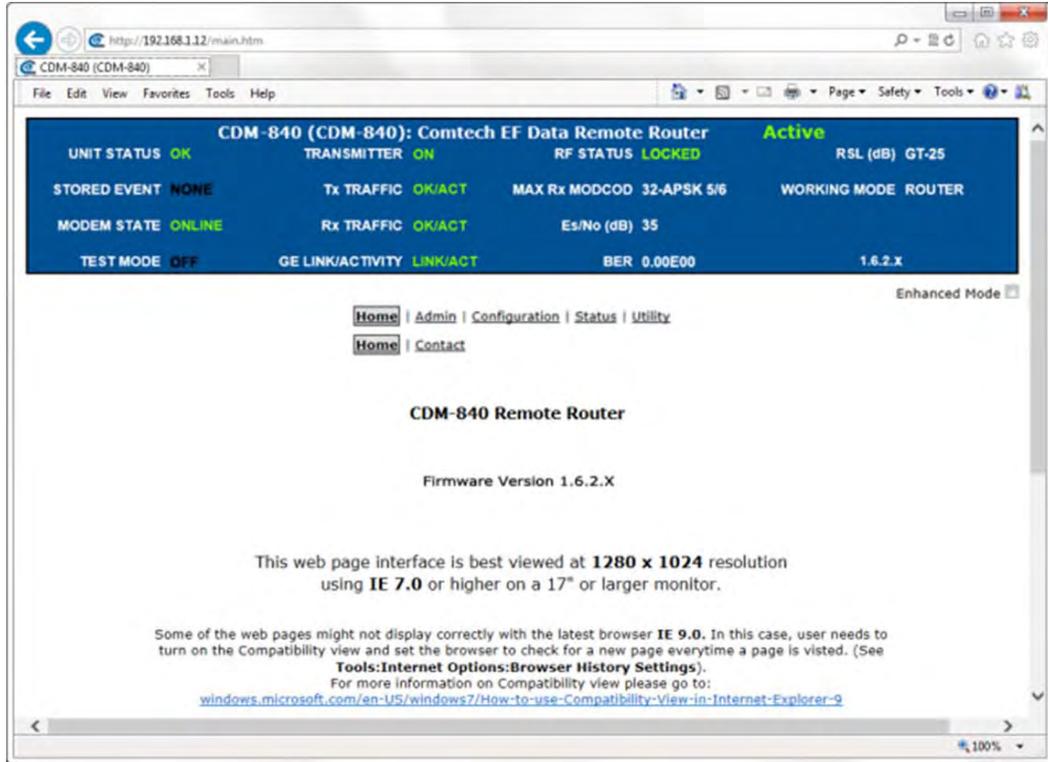


Figure H-3. CDM-840 HTTP Interface and Menu Tree – VersaFEC ACM, BERT Operations (FW Ver. 1.6.2.X)

Do these steps to configure VersaFEC ACM operation from the specified HTTP Interfaces:

1. Using the CDD-880 HTTP Interface (Figure H-4):

- Use the “**Configuration | Network | Assoc. CTOG**” page as needed to establish the link for the CTOG-250 available within the active Advanced VSAT Network.
- Use the “**Configuration | Network | Routing**” page as needed to configure (add) a route from the CDD-880 to the CTOG-250 for the Management IP Address of the CDM-840.

Be sure to click [**Submit**] on each page as needed to save your settings.

Index	Route Description	Dest. Network IP/Mask	Interface	Next Hop IP
2	<input type="text"/>	<input type="text"/>	toLAN	<input type="text"/>

Index	Description	Dest. Network IP/Mask	Interface	Next Hop IP	Submit Changes
1	LQRM to 840	192.168.1.0/24	toLAN	192.168.2.51	<input type="button" value="Submit Changes"/>

Index	Description	Dest. Network IP/Mask	Filter Map
0			

Figure H-4. CDD-880 HTTP Interface – Configuration | Network | Assoc. CTOG and Configuration | Network | Routing Pages

- 2. Using the CDM-840 HTTP Interface “Configuration | WAN | Mod | ACM” page (Figure H-5), click the “List all 880s” hyperlink (located in the header of the “Tx ACM Status” section on the page) to display all CDD-880s recognized within the active Advanced VSAT Network.**

3. In the **“Tx ACM Configuration”** section on the page, use the drop-down lists to configure the **“Target Es/No Margin”** and the **“Max MODCOD”**. Click **[Submit]** to save your settings.



- 1) Select, at minimum, **0.5db** as the recommended value for the **“Target Es/No Margin”** in order to maintain the link at Ku.
- 2) The **“Max MODCOD”** should be configured to the maximum MODCOD that this terminal can achieve given the link budget, antenna, look angle, BUC power, etc.

4. Use the **“ACM Enable”** drop-down list in the **“Tx ACM Configuration”** section on the page to **“Enable”** ACM. Click **[Submit]** to save your settings.

The screenshot shows the 'Tx ACM Configuration' page. At the top, there are navigation tabs: Home, Admin, Configuration, Status, Utility. Under Configuration, there are sub-tabs: Interface, WAN, Network, ECM, dSCPC, MEO. Under WAN, there are sub-tabs: Demod, Mod, QoS, Label, Compression, BUC, LNB. Under Mod, there are sub-tabs: Config, ACM, DPC. The main configuration area has three dropdown menus: 'ACM Enable' (set to 'Disable'), 'Max MODCOD' (set to 'VersaFEC MODCOD 11 16-QAM 0.853'), and 'Target Es/No Margin' (set to '0.0'). A 'Submit' button is below these. Below the configuration is the 'Tx ACM Status (List all 880s)' section with a table:

Seconds since last LQRM:	Max Seconds since last LQRM:	IP Source of last LQRM:	Last Reported Es/No:	Current Modcod	Current DataRate
ACM Disabled	13313	Not yet received first msg	Unlocked	QPSK .706 (3)	200 Kbps

Below the status table is the 'Tx ACM Events' section with a table:

Date	Time	Reported Es/No	New ModCod	New Tx DataRate	880 IP
		0	0	0	0.0.0.0

A 'Clear ACM Events' button is located at the bottom of the events table.

Figure H-5. CDM-840 HTTP Interface – Configuration | WAN | Mod | ACM Page

H.4.2 Troubleshooting

Referring to the CDM-840 HTTP Interface **“Configuration | WAN | Mod | ACM”** page (Figure H-5):

- Confirm that the **“Seconds since last LQRM”** column (found in the **“Tx ACM Status”** section on the page) periodically resets to ‘0’ – this indicates that the LQRMs are being received by the CDM-840.
- Confirm that the proper Management IP Address appears in the **“880 IP”** column. It will be populated automatically.

H.4.3 Monitoring ACM Performance

The CDM-840 provides several ways to determine the current state of the ACM system.

Referring to the CDM-840 HTTP Interface **“Configuration | WAN | Mod | ACM”** page (Figure H-5), the **“Tx ACM Status”** table on the page contains many useful reported fields:

- **Seconds since last LQRM** – This is how long in seconds it has been since this unit received an Es/No report from the CDD-880.
- **Max Seconds since last LQRM** – This is useful to understand if there are long durations of not seeing the report messages.
- **IP Source of last LQRM** – This is the Management IP address of the CDD-880 which is sending this unit LQRMs.
- **Last Report Es/No** – This the Es/No measured at the CDD-880 and sent to the CDM-840.
- **Current MODCOD** – This is the MODCOD that this unit is currently sending.
- **Current Datarate** – The Current Datarate will update as the MODCOD changes in order to maintain the link.

Alternately, if you have access to an Oscilloscope in X-Y mode, the **'ALARMS'** connectors, located on the rear panel of the CDD-880 or the CDM-840, provide analog voltages to monitor the constellation. This permits you to view a change in modulation type instantaneously.

If you wish to verify that link performance is meeting the required level, the CDD-880 and CDM-840 HTTP Interface **"Utility | Utility"** pages (**Figure H-6**) feature a BERT function. It is not an easy matter to verify BER performance using the HTTP Interface. The internal BERT not only verifies BER performance, it also tolerates the change in bit rate that accompanies the change in MODCOD. Use BERT to confirm that there are no sync losses or bursts of bit errors when a MODCOD changes.

The screenshot displays the 'Utility | Utility' page for the CDD-880. The navigation bar includes 'Home', 'Admin', 'Configuration', 'Status', 'Utility', and 'Reboot'. The 'Utility' section is active, showing several configuration panels:

- Modem:** Unit Name: CDD-880; System Contact: cdmipsupport@comtech; System Location: (480) 333-4357; Set Time: 13:33:17; Set Date: 06/02/15; Adjustment for Internal 10 MHz Reference: -336.
- Save/Load Configuration:** Select Location: 1; Save Configuration; Load Configuration.
- Redundancy:** Current Redundancy State: Offline; Force Redundancy Switch.
- BERT:** Tuner Select: 1; Submit Changes.
- BERT Config:** Rx Bert State: Off; Rx Bert Pattern: 2^23-1; Submit.
- BERT Monitor:** Rx Bert Pattern Sync: N/A; Loss of sync since last restart: N/A; Total Errors: N/A; Total Bits: N/A; BER: N/A; Restart; Update.

Figure H-6. HTTP Interface – Utility | Utility Page (CDD-880 Shown)

H.4.4 MODCOD Switch Points

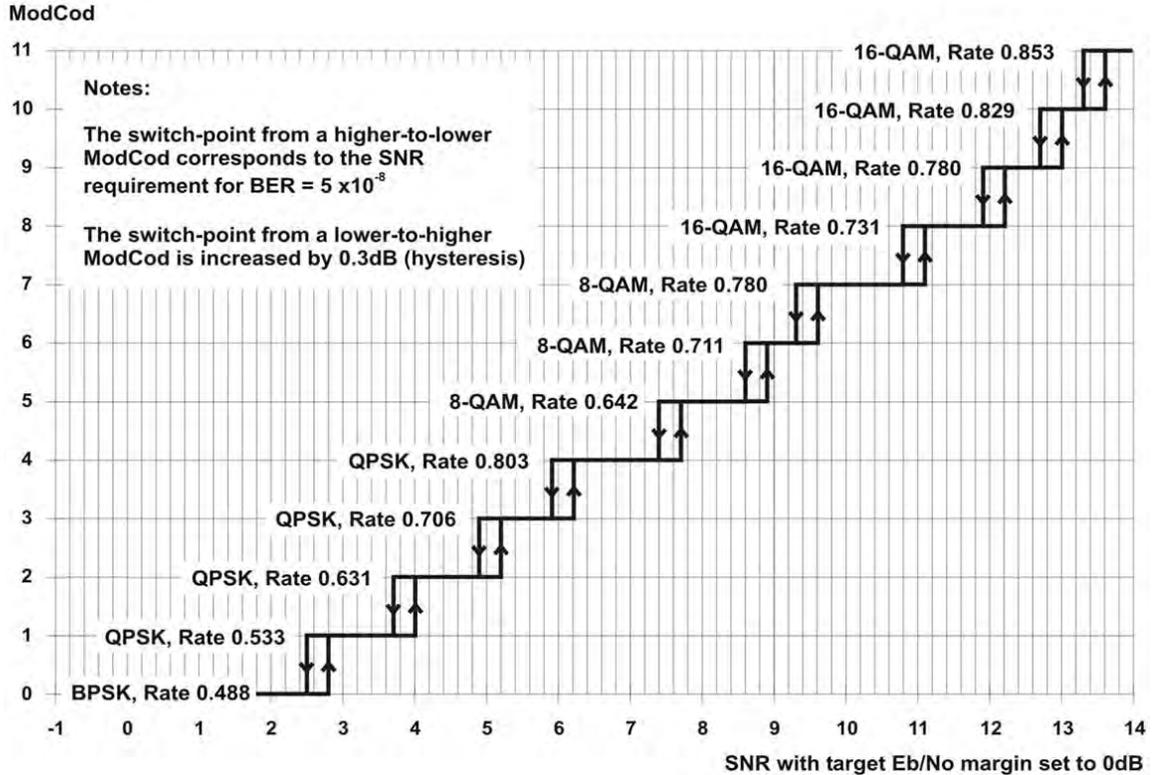


Figure H-7. CDM-840 – ACM MODCOD Switch Points

The **Figure H-7** graph shows the switch points with the Target Eb/No margin set to 0dB. However, the switch points can be moved (increased) by configuring the Target Eb/No margin parameter, which can vary from 0 to 4.5 dB, in 0.5dB steps. In a fading environment, it is strongly recommended to add sufficient margin to maintain an adequate link quality (and to maintain demod lock) during the interval between the Eb/No degrading and the ACM controller responding by lowering the MODCOD. See **Section H.6 Notes and Recommendations**.

H.5 ACM Congestion Control

When the ACM controller switches from a lower to a higher MODCOD the bandwidth of the Ethernet link is instantaneously increased. This is not a problem, and the link will adapt to push more packets/second through the link.

Conversely, when the ACM controller switches from a higher to a lower MODCOD the bandwidth of the WAN link is instantaneously reduced. If the MODCOD changes down, the datarate will be reduced and the system will continue to send the highest priority traffic first. If the traffic demand exceeds the available bandwidth, the system will start dropping packets in the lowest QoS Priority / non-CIR protected QoS qes first.

H.6 Notes and Recommendations

- ACM constitutes a closed-loop control system and it should be remembered that like all control systems, the speed at which the system can react is governed by a number of factors, including the time taken to estimate SNR to the required accuracy, and the transport delay over the satellite. Realistically, it can cope with fading and other link impairments that do not exceed 1 dB/second (more if Target Eb/No margin is increased).
- The ACM controller algorithm that resides in the CDM-840 modem exhibits a different response depending on whether SNR is increasing or decreasing. If the SNR is improving, the ACM controller switches to higher MODCODs sequentially until the highest possible MODCOD has been reached. It may, therefore, take several seconds for the link to reach maximum throughput. Conversely, if SNR is degrading rapidly (in a fade) then it can change, if needed, directly from MODCOD 11 to MODCOD 00 (VersaFEC example). This gives the fastest possible response and helps keep the link intact under fast fading events.
- While ACM can do remarkable things, the fundamentals still apply. Don't expect the demod to run at a 16-ARY MODCOD if the SNR instantaneously drops to 0 dB – the demod will lose lock and the system will recover by switching to MODCOD 00 (if so configured, in VersaFEC).



To achieve the most robust link performance, Comtech EF Data strongly recommends that you set the Minimum MODCOD to 00 (the MODCOD of last resort), and set the Unlock Action to 'Go to minimum MODCOD'.

- Running the ACM link with the Target Es/No Margin set to 0 dB will give the best utilization of link power, but in conditions of fast fading may cause demod unlock events, or highly degraded BER just prior to the switch to a lower MODCOD. In order to mitigate this, we recommend a Target Es/No Margin of at least 0.5 dB – more if the fading events are particularly severe and/or frequent.
- Es/No is the preferred metric for driving the adaptation – this is the value displayed on the monitor screens. If you want to convert this to Eb/No then remember that the relationship is simply $E_b/N_o = E_s/N_o - 10_{\log}(\text{Spectral Efficiency})$.
- All IP features that are available in the CDM-840 (VLAN, QoS, etc) are available while in ACM mode.
- ACM maximizes throughput not only when Eb/No varies due to atmospheric conditions, but will also mitigate the effects of other impairments, such as antenna pointing error, excessive phase noise and certain types of interference. However, rapidly fluctuating impairments (i.e., ~ less than 1 second) such as scintillation at low antenna look-angles at C-band will generally not be improved by ACM.

H.7 Summary of Specifications

System Type		Adaptive Coding and Modulation, using BPSK, QPSK, 8-QAM, 16-QAM and VersaFEC short-block LDPC coding – total of 12 MODCODs (00 through 11)			
Symbol Rate Range		16 ksps to 4500 ksps			
Interface		10/100 BaseT Ethernet, with auto-negotiated Congestion Control			
Remote Es/No Teporting		Automatically reported by the CDD-880 and sent to the CDM-840 Management IP Interface.			
Max Span of Data Rate		7:1 over range of adaptation			
Switch Point (Decreasing SNR)		Corresponds to SNR (Es/No) that gives BER = 5×10^{-8} (margin set to 0 dB)			
Switch Point Hysteresis		0.3 dB			
Max Fading Rate		Approximately 1 dB/second (higher if Target Eb/No margin > 1 dB)			
Max MODCOD Update Rate		One update every 0.5 seconds during fast fade conditions, and every 30 seconds when the measured Es/No is stable.			
Configurable Parameters		<ul style="list-style-type: none"> Maximum MODCOD (MODCOD 00 through MODCOD 11) Target Es/No margin (0.0 to 4.5 dB, 0.5 dB steps) 			
System Latency		34 milliseconds max (not including WAN buffer, or satellite path)			
Monitored Parameters		<ul style="list-style-type: none"> Tx and Rx MODCODs CDD-880 Es/No (-3.0 dB to +22.0dB, 0.1dB resolution, ± 0.5 dB accuracy) Config and monitor menus displaying data rate, modulation and code rate update dynamically with MODCOD 			
Modulation (MODCOD No.)	Code Rate	Spectral Efficiency, bps/Hz	Typical Eb/No, for BER = 5×10^{-8} (dB)	Data Rate, ACM Mode	
				Minimum (kbps)	Maximum (Mbps)
BPSK (00)	0.488	0.49	2.4	16	2.2
QPSK (01)	0.533	1.07	2.2	17	4.81
QPSK (02)	0.631	1.26	2.7	20	5.67
QPSK (03)	0.706	1.41	3.4	22	6.34
QPSK (04)	0.803	1.61	3.8	25	7.24
8-QAM (05)	0.642	1.93	4.6	30	8.68
8-QAM (06)	0.711	2.13	5.2	34	9.58
8-QAM (07)	0.780	2.34	5.6	37	10.53
16-QAM (08)	0.731	2.93	6.5	46	13.18
16-QAM (09)	0.780	3.12	7.1	49	14.04
16-QAM (10)	0.829	3.32	7.7	53	14.94
16-QAM (11)	0.853	3.41	8.1	54	15.34



2114 WEST 7TH STREET TEMPE ARIZONA 85281 USA
480 • 333 • 2200 PHONE
480 • 333 • 2161 FAX