

# MDM9000 Satellite Modem

## For Intelligence Gathering, WGS and Milsatcom Networks



### Description

The WGS certified MDM9000 Satellite Modem is the versatile modem that allows service providers and government operations to increase the amount of services or the customer base within the same bandwidth. At the same time it introduces ways to reduce OPEX costs and increase the profitability of your operations at maximum efficiency and optimum availability.

The MDM9000 is optimized for a wide range of fixed and mobile government and defense applications over satellite. The MDM9000 modem is typically installed at both ends of a point-to-point satellite link or at the remote sites of a star network. The unit can act as a modulator, demodulator or modem depending on the network configuration and integrates seamlessly with terrestrial networks and equipment. The modem is in full compliance with the DVB-S2 and the DVB-S2X standard while being backward compatible with our S2 Extensions mode, all in order to achieve barrier-breaking efficiency at maximum service availability. In receiver mode, the MDM9000 serves as demodulator with dedicated intelligence gathering features.

### Markets

Government / Defense

#### Main Features:

- SCPC up to 133 Msp
- DVB-S2 and DVB-S2X (QPSK up to 256APSK)
- S2 Extensions (up to 64APSK) for closed network operation
- Dedicated intelligence gathering features
- WGS certified

SCPC MODEMS

DIALOG



## Efficiency at the Core

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The MDM9000 Satellite Modem combines a number of innovative elements to improve current market available efficiencies, thereby lowering the overall Total Cost of Ownership.

Modulation and Forward Error Correction (FEC) codes up to 256APSK in the DVB-S2X standard in combination with innovative technologies such as 133 Msps, Clean Channel Technology®, Bandwidth Cancellation (BWC), Automatic Uplink Power Control (AUPC), FlexACM®, QoS, and Equalink® 3 are embedded in the modem and bring the satellite link to full efficiency. The performance can be increased even more by adding our network optimization technologies such as acceleration, compression, shaping and bandwidth management.

By increasing the amount of data that can be transferred per transponder the MDM9000 modem caters for data and video hungry applications such as ISR, MWR, data backhaul, strategical links and disaster recovery networks.

## Optimal Availability

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Our auto-adaptive technology FlexACM is incorporated in the MDM9000 modem by default and deals with fading conditions (rain, dust, interference) and inclined orbit satellites with varying throughput. Thanks to FlexACM these fading conditions will no longer interrupt the transmission between the hub and remote sites nor result in loss of data. The maximum possible throughput can be achieved at all times. Additionally the Automatic Uplink Power Control mechanism can ensure maximum use of the linkbudget at all times. In case of link loss due to full shadowing effects, the quick reacquisition feature inside the MDM9000 modem will reactivate the transmission in milliseconds after the satellite link becomes available again.

## Flexibility and Scalability Matching Market's Business Models

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An extensive set of encapsulation/decapsulation methods (MPE, XPE, GSE, ULE, Raw Base Band Frame, data piping) allows government and defense agencies to efficiently acquire satellite traffic and demodulate the signal for further processing. The MDM9000 also has a raw baseband data output that can be further processed by intelligent engines while some specific features for intelligence gathering were included in order to detect and capture hidden data in regular Satcom transmissions.

The built-in spectrum analyzer and constellation diagram viewer aid in link analysis.

The built-in bandwidth canceller completely operates in the digital domain providing unsurpassed performance with the lowest possible residual cancellation noise resulting in the highest spectral efficiency.

The Satellite Modem can be easily monitored and controlled via a comprehensive front panel menu, advanced web GUI as well as via SNMP protocol. This enables easy integration into any industry-standard EMS/NMS system.

# Specifications

## Key Features

- WGS Certified
- Suitable for low, medium and high speed applications, symbol rates up to 133 Msps to handle all common transponder sizes
- Clean Channel Technology for additional bandwidth efficiency gains by allowing optimal carrier spacing
- DVB-S2 and DVB-S2X (QPSK upto 256APSK)
- S2 Extensions (up to 64APSK) for closed network operation
- Optional Equalink 3 for linear and non-linear pre-distortion
- Reduce impact of RF Interferences (RFI) by enabling the optional DVB RF Carrier ID (DVB-CID)
- Default IF and L-band on TX and RX for ease of operation
- All MODCODs and symbol rates default enabled for flexible and optimal operation of the network

## Support Services for your Professional Equipment

Care Pack Basic and Care Pack Enhanced are the service and support packages protecting your MDM9000 equipment over a three-year period.

## Architecture

The MDM9000 Satellite Modem can be used at both ends of a point-to-point network or at the remote site of a star network. Depending on the configuration the unit can be used as modulator, demodulator or modem.

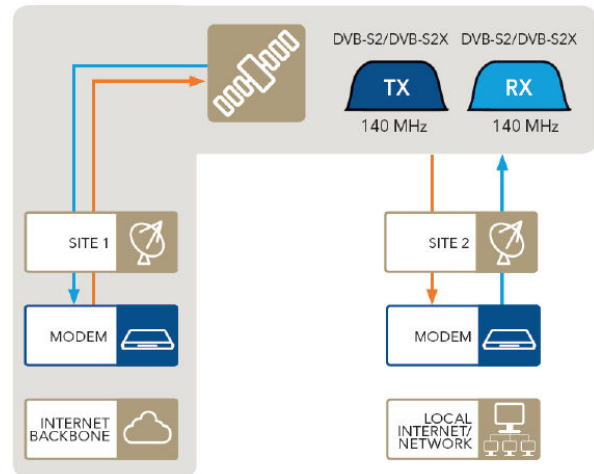
## Related Products

HUB6000	Satellite Hub
MDM6100	Broadcast Satellite Modem
BWC0900	Bandwidth Canceller
NOP183x	PEP Gateways
NOP184x	PEP Servers
USS02x2	Redundancy Switch
FRC07x0	Frequency Converters Portfolio
DIALOG	Dialog® platform

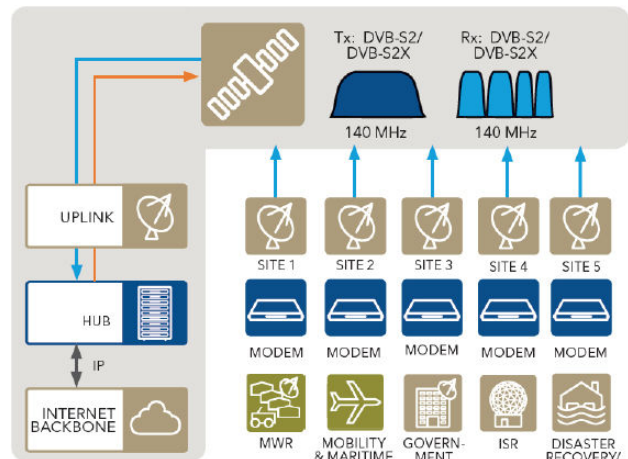
## Related Bandwidth Efficiency Technologies

Clean Channel Technology  
 Equalink 3  
 DVB-S2 and DVB-S2X  
 FlexACM  
 Bandwidth Cancellation

- FlexACM and quick re-acquisition times for increased availability in mobility applications
- Intelligent Uplink Power Control
- Built-in Spectrum Analyzer and Constellation Diagram Viewer
- FlexACM for adaptive environments like variable interferences from rain and dust or for inclined orbit operation
- Standard GSE encapsulation for minimal overhead
- Support for MPE, ULE and XPE for working with legacy equipment
- Adaptive traffic shaping and bandwidth management allowing maximal SLA adherence even in case of ACM
- Advanced Quality of Service (QoS)
- AES encryption (64/128 or 256)
- Easy operation through secure frontpanel, SNMP, HTTP and CLI interfaces
- Modified OpenAMIP support to interwork with stabilized antennas from different vendors
- Fitted with dedicated intelligence gathering features



Point-to-point



Point-to-multipoint

## Input Interfaces

- Auto switching 10/100/1000 Base-T Ethernet interfaces
- GSE Encap/Decap performance
  - Imix (avg 340 byte)
    - TX only: 300 Mbps
    - RX only: 360 Mbps
    - RX + TX: 523 Mbps
  - Max PPS (46 byte)
    - TX only: 120 kpps
    - RX only: 150 kpps
    - RX + TX: 220 kpps
- Maximum Data Rate
  - 425 Mbps simplex, 850 Mbps duplex
- Layer 2 bridge function: Ethernet over satellite (IPv6/VLAN/MPLS compatible)
- Layer 3 static router function: IPv4 packets over satellite
- Supports Jumbo frames (9216 bytes)
- Up to 100 routes
- Advanced QoS features
  - Adaptive Traffic Shaping on bitrate or symbolrate according to PIR/CIR
  - Flexible traffic classification on VLAN/MPLS/ IPv4/IPv6
- GSE, MPE, XPE or ULE Encapsulation/Decapsulation of IP/Ethernet frames in DVB-S2, DVB-S2X and S2 Extensions
- Data filtering (downlink):
  - Up to 64 receive filters

## Modulation and Demodulation

- DVB-S2 (acc. ETSI EN 302 307 v1.2.1 for DVB-S2)
  - Outer/Inner FEC: BCH/LDPC
  - 52 MODCODs (short & normal frames):
    - QPSK: from 1/4 to 9/10
    - 8PSK: from 3/5 to 9/10
    - 16APSK: from 2/3 to 9/10
    - 32APSK: from 3/4 to 9/10
- S2 Extensions
  - Outer/Inner FEC: BCH/LDPC
  - 54 MODCODs:
    - QPSK: from 45/180 to 144/180
    - 8PSK: from 80/180 to 150/180
    - 16APSK: from 80/180 to 162/180
    - 32APSK: from 100/180 to 162/180
    - 64APSK: from 90/180 to 162/180
  - 29 Linear MODCODs:
    - 8PSK-L: from 80/180 to 120/180
    - 16APSK-L: from 80/180 to 162/180
    - 64APSK-L: from 90/180 to 162/180
- DVB-S2X standard
  - Outer/Inner FEC: BCH/LDPC
  - 53 MODCODs (normal frames):
    - QPSK: from 1/4 to 9/10
    - 8PSK: from 3/5 to 9/10
    - 16APSK: from 26/45 to 9/10
    - 32APSK: from 32/45 to 9/10
    - 64APSK: from 11/15 to 5/6
    - 128APSK: 3/4; 7/9

- 256APSK: 32/45; 3/4
- 13 Linear MODCODs (normal frames):
  - 8APSK-L: 5/9; 26/45
  - 16APSK-L: from 1/2 to 2/3
  - 32APSK-L: 2/3
  - 64APSK-L: 32/45
  - 256APSK-L: from 29/45 to 11/15
- 41 MODCODs (short frames):
  - QPSK: from 11/45 to 8/9
  - 8PSK: from 7/15 to 8/9
  - 16APSK: from 7/15 to 8/9
  - 32APSK: from 2/3 to 8/9
- FlexACM controller (optional)
- FlexACM client (optional)
- Automatic Uplink Power Control

### SYMBOL RATE RANGE

- SCPC use: 0.256 Msps – 133 Msps
- BWC use: 0.256 Msps – 72 Msps

### FRAME LENGTH

- Short frames of 16200 bits for DVB-S2 and DVB-S2X
- Normal frames of 64800 bits for DVB-S2, DVB-S2X and S2 Extensions

### CLEAN CHANNEL TECHNOLOGY

- Roll-off: 5% -10% -15% -20% - 25% - 35%

### EQUALINK 3

- Linear pre-distortion
- Non-linear pre-distortion for all MODCODs

### CARRIER INTERFERENCE REDUCTION

- DVB RF Carrier ID
  - (CID according ETSI TS 103 129 v1.1.1)
- Spread Spectrum Modulator (BPSK)
- Supports User Data
- Compliant to DVB Standard

### BANDWIDTH CANCELLATION (BWC)

- Max symbolrate: 72 Msps
- Delay range 0 to 500 ms
- Cancellation range: -10 to +10 dB local to remote carrier
- Cancellation ratio: > 30 dB
- Es/No degradation (dB) at 0 dB cancellation ratio
  - QPSK: 0.03 dB
  - 8PSK: 0.05 dB
  - 16APSK: 0.10 dB
  - 32APSK: 0.20 dB
  - 64APSK: 0.44 dB
  - 128APSK: 0.80 dB
  - 256APSK: 1.10 dB
- Monitoring: delay, frequency offset, local/remote power, local/total power, phase noise
- Fractional license for redundant modem

## Modulation Interfaces

### L-BAND

- Connector N(F), 50 Ohm (optional SMA adapter)
- Frequency 950 - 2150 MHz (10 Hz steps)
- Level -35/+7 dBm (+/- 2 dB)
- Return loss > 14 dB
- Switchable 10 MHz Reference
- Spurious performance  
Better than -65 dBc/4kHz @ +5 dBm output level and > 256 kSps  
Non-signal related: < -80 dBc @ +5 dBm output

### IF-BAND

- Connector BNC (F) - 75 Ohm (intermateable with 50 Ohm)
- Frequency 50 - 180 MHz (10 Hz steps)
- Level -35/+10 dBm ( $\pm 2$  dB)
- Return loss 50 Ohm : > 14 dB  
75 Ohm : > 20 dB
- Spurious performance  
Better than -65 dBc/4 kHz @ +5 dBm output level and > 256 kSps  
Non-signal related: < -80 dBc @ +5 dBm output

### L-BAND MONITORING

- Connector SMA (F), 50 Ohm
- Frequency Same as L-Band output frequency or 1050 MHz in case of IF output option only
- Level -45 dBm
- Return loss > 10 dB

### 10 MHz REFERENCE OUTPUT (OPTIONAL)

- Connector BNC (F), 50 Ohm
- Output level +3 dBm (+/- 2dB)

### BUC POWER (OPTIONAL)

- Max. current: 3.8 A
- Voltage: 24 V, 48 V (Software controlled)

## Demodulation Interfaces

### DUAL L-BAND INPUT

- Connector 2 x F-type (F), 75 Ohm
- Return loss > 7 dB (75 Ohm – F(F))
- Maximum total input power: -10 dBm
- Maximum input signal power:  $(-30 + 10\log(f))$  dBm where  $f$ =symbol rate in Msps
- Minimum input signal power:  $(-80 + E_s/N_o(\text{thr}) + 10\log(f))$  dBm where  $f$ =symbol rate in Msps and  $E_s/N_o(\text{thr}) = E_s/N_o$  value in dB for QEF reception
- Frequency 950 - 2150 MHz
- Adjacent signal <  $(C_o + 7)$  dBm/Hz with  $C_o$  = signal level density

### IF-BAND INPUT

- Connector BNC (F) - 75 Ohm
- Return loss > 15 dB
- Level See L-band input level spec above +10 dBm
- Frequency 50 - 180 MHz
- Adjacent signal <  $(C_o + 7)$  dBm/Hz with  $C_o$  = signal level density

### LNB POWER AND CONTROL

- Max. current 350 mA (on selected IFL input)
- DiSeqC control

## Internal 10 MHz Reference Frequency

### STANDARD STABILITY

- Stability: +/- 2000 ppb over 0 to 70°C
- Ageing: +/- 1000 ppb/year

### VERY HIGH STABILITY (OPTIONAL)

- Stability: +/- 2 ppb over 0 to 65°C
- Ageing: +/- 500 ppb/10 year

## Generic

### MONITOR AND CONTROL INTERFACES

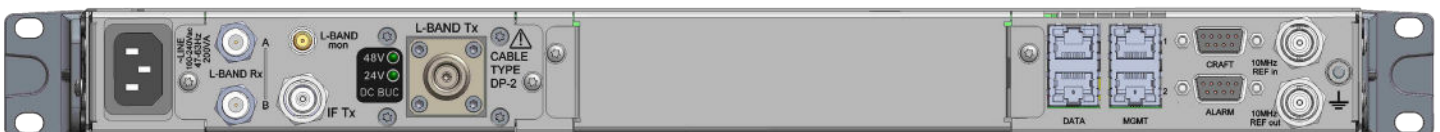
- M&C connectivity via separate Ethernet links
- Web server GUI (HTTP) via web browser
- Diagnostics report, alarm log (HTTP)
- SNMP v2c
- Modified OpenAMIP protocol to control stabilized antenna from modem

### ALARM INTERFACE

- Electrical dual contact closure alarm contacts
- Connector 9-pin sub-D (F)
- Logical interface and general device alarm

## Physical

- Height 1RU, width: 19", depth 51 cm, 5.8 kg
- Power supply:  
90-130 & 180-260 Vac, 125 VA, 47-63 Hz  
or 36-76 VDC, 160 W
- Temperature:  
Operational: 0°C to +50°C / +32°F to +122°F  
Storage: -40° to +70°C / -40°F to +158°F
- Humidity: 5% to 85% non-condensing
- CE label and UL



MDM9000 Satellite Modem Release 3.3		Ordering n°
<b>Configuration Options Category</b>		<b>MDM9000</b>
Hardware Platform	Chassis Version 03 (Modem)	CH-03
Operating Software	MDM9000 Major Software version R3*	MS-30
Efficiency Optimization Package	DVB-S2, DVB-S2X and S2 Ext	OP-04
For a modem or demodulator, select 1 option		
Demodulator Hardware	Class 3 (wide band up to 133 MSps)	DH-03
For a modem or modulator, select 1 option		
Modulator Output Interface	IF+ L-band with switchable 10 MHz out*	OU-02
	IF+L-band + 10 MHz output + 24/48 V BUC**	OU-06
Select 1 option		
Internal Reference Clock	Standard 10 MHz	IR-00
	Very High Stability 10 MHz	IR-02
Select max 1 option		
Reference Clock Output	10 MHz Reference Output (BNC)	RO-01
Select 1 option		
Mains Power Supply Unit	PSU Single AC 110/240 V	PS-00
	PSU Dual Redundant AC 110/240 V	PS-01
	PSU Single DC 48 V**	PS-10
	PSU Dual DC 48 V**	PS-11
For a modem or modulator, select 1 option		
Outbound Rates	Outbound Rate*	None, 100, 200, 300, 450 Mbit/s
<b>Additional Options Category</b>		
Select max 1 option		
Bandwidth Cancellation	Full license or fractional license*	None, 100, 200, 300, 450 Mbit/s
Select max 1 option		
Pre-distortion	Equalink 3*	AE-01
Select max 1 option		
Encryption	AES64/128 or AES256	AS-01/02
Select max 1 option		
Frontpanel	Blank panel	FP-01
<b>Services Category</b>		
Select max 1 option		
Support	Care Pack 3 Basic	GA-08
	Care Pack 3 Enhanced	GA-09