



# MM200

## TERRESTRIAL MICROWAVE MODEM FOR HIGH-SPEED APPLICATIONS



### HIGHLIGHTS

- ▶ Internal One to Four Channel Multiplexer
- ▶ Up to Four User-Selectable Data/Overhead Interfaces
- ▶ Data Rates From 1 to 175 Mbps (200 Mbps optional)
- ▶ 4, 16, 32, 64, and 128 QAM (256 QAM Optional)
- ▶ Diversity Option
- ▶ Ideal for OEM, New Microwave Links, Upgrades or Retrofits
- ▶ High Resistance to Fading
- ▶ Wayside and/or Overhead Options

### OVERVIEW

The MM200 Microwave Modem is an innovative and highly flexible platform configurable for data rates between 1 and 175 Mbps. The unit allows complete control over modulation density and channel bandwidth for efficiencies up to 5.3 Bps/Hz. The unique architecture of the MM200's IF allows large improvements to fading and multipath via multiple digital equalizers.

### BENEFITS

The MM200 is an ideal solution for both new and retrofit microwave link installations. Maximum flexibility is achieved by an internal data multiplexer that combines up to four user-selectable data paths into a single data stream. Interface choices for each include OC-3 Optical, DS3, E3, STS-1, STM-1, SMPTE 310M, DVB ASI, DVB SPI, 10 Base-T, E2,

Overhead and T1/E1(Wayside). The IF can be configured with 1 to 4 channels providing total flexibility. Each channel can operate up to 7 Mbaud. The 2RU chassis can be configured for simplex or duplex. Two receivers can be connected with the internal Diversity option to further increase performance through Space or Frequency Diversity.

### RELIABILITY

The MM200 series of microwave products are rich with features designed to maximize the integrity of your data service. Redundant switching is available through our series of redundancy switches. The Reed-Solomon decoder provides superior error correction while the adaptive equalizers provide superior protection from frequency selective fading and multipath.

Optional space diversity switching can provide higher than normal protection via the unit's ability to *hitless switch* to the redundant path before data errors occur.

Additional features include the choice of remotely interfacing through one of three onboard connections: Ethernet (SNMP), RS-485 or an externally-controlled RS-232 terminal. The familiar Radyne front panel offers push-button control of all features and a backlit LCD display. Menus are specifically designed for ease of use and quick online operation as well as changes in configuration.



# MM200 TERRESTRIAL MICROWAVE MODEM FOR HIGH-SPEED APPLICATIONS

## SPECIFICATIONS

Total Data Rate: Variable From 1 to 175 Mbps Total in 1 bps Steps\* (1 to 200 Mbps Optional)\*

Note: Interface selection may limit maximum data rate.

Total Baud Rate: 1 to 7, 1 to 14, 1 to 21, or 1 to 28 Mbaud  
Depending Upon Number of IF Channels Installed

IF Channels: 1 to 4

IF Channel Baud Rate: 1 to 7 Mbaud Per Channel

IF Channel Spacing: 1.15 to 1.4 Times Channel Baud Rate  
1.25 Nominal\*

Mux/Demux: One to Four\* Data Channels DVB-Compliant

Modulation: 4, 16, 32, 64, 128 QAM  
256 QAM - Consult Factory\*

FEC: 204/188 Reed-Solomon

FEC/Mux Overhead: 204/184 (204/188 for DVB Framed Interface)

Adaptive Equalizer: 12 Tap DFE and 8 Tap FFE (One Per IF Channel)

IF Range: 50 to 90 MHz\*

IF Return Loss: 20 dB

Tx Output Power: 0 to -25 dBm in 0.1 dB Steps\*

Spurious Output: -55 dBc In-Band

Rx Input Power: 0 to -25 dBm

Frequency Stability: 40 ppm

Carrier Acquisition: Lesser of  $\pm 400$  kHz or  $\pm 10\%$  of Channel Baud Rate

Rx Data Buffer: 0 to  $\pm 2$  Mbits

Remote Control: SNMP - 10 Base-T

RS-485/-232

Modem Drives External Terminal

Chassis Size: 2 RU (3.5")

Power: 85 to 264 VAC, 50/60 Hz

Environmental: 0 to 50°C

Compliance: CE Mark

## BER SPECIFICATION

C/N Required For an Interface BER of  $1 \times 10^{-9}$  at 7 Msps, Single IF Channel:

QAM4	12.5 dB
QAM16	20.2 dB
QAM32	23.3 dB
QAM64	27.3 dB
QAM128	31.0 dB

## OPTIONS

48 VDC

24VDC

Simplex Configuration, Modulator Only

Simplex Configuration, Demodulator Only

Space Diversity, Demodulator Only

Additional Mod IF Channels, Up To 4 Per Chassis

Additional Demod IF Channels, Up To 4 Per Chassis

## OPTIONAL DATA

### INTERFACES:

G.703 T3, E3 or STS-1\*

G.703 E2

DVB ASI (Normal or Advanced)

DVB SPI, M2P\*

LVDS Parallel\*

OC-3 Optical, STM1/ STS3 Electrical\*

SMPTE 310M

10 Base-T

Other Interfaces Available Upon Request

Note: Up to 4 interfaces per chassis. Any combination can be installed and operated by front panel control.

## OPTIONAL DATA

### INTERFACES:

Orderwire - Can Be Configured for Eight DS0s or

Seven DS0s Plus one Audio\*

Wayside -T1 or E1\*

\*Front panel selectable.

## HOW TO CALCULATE 3 dB BANDWIDTH OF MM200 MODULATED CARRIER.

1. Find combined interface data rate:

$$DRC = \text{Interface 1 Data Rate} + \text{Interface 2 Data Rate} + \text{Interface 3 Data Rate} + \text{Interface 4 Data Rate}.$$

2. Find Total Data Rate plus R/S and mux overhead:  $DRT = DRC \times (204/184)$ .

3. Find Channel Baud Rate:  $BRC = DRT / (QAM \times NC)$ :

Where NC = number of channels (one to four)

and QAM = 2 for 4 QAM

4 for 16 QAM

5 for 32 QAM

6 for 64 QAM

7 for 128 QAM

8 for 256 QAM.

4. Select Channel Spacing: CS = from 1.15 to 1.4 times channel baud rate.

This number is normally 1.25 but can be set to any number between 1.15 and 1.4.

5. Total 3 dB bandwidth =  $BRC \times CS \times (NC - 1) + BRC$ .

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