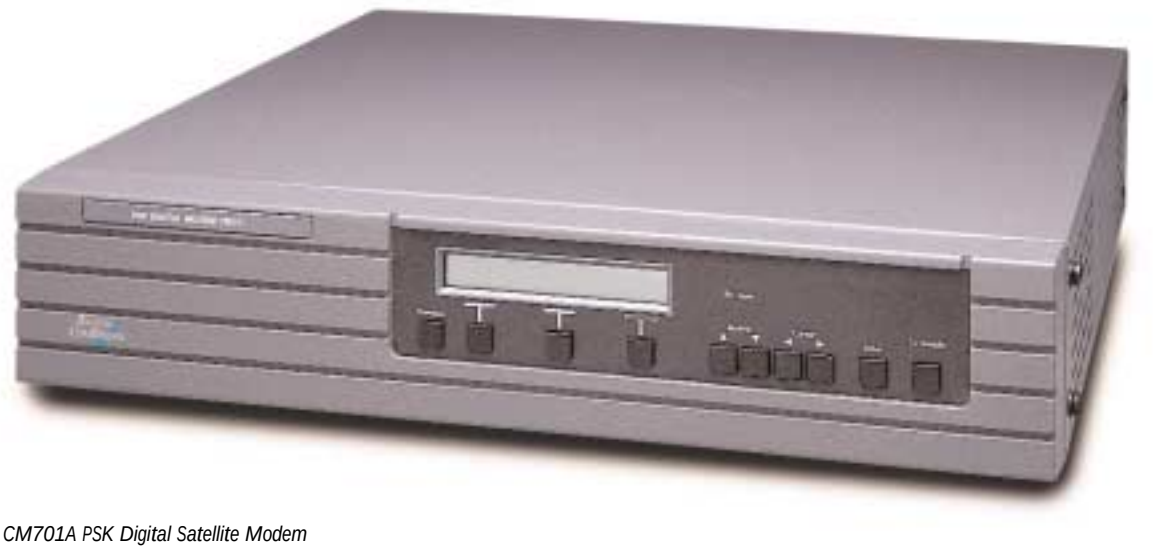
CM701A

PSK Digital Satellite Modem



CM701A PSK Digital Satellite Modem

HIGHLIGHTS

- Modular architecture for quick, on-site configuration
- Supports BPSK and QPSK modulation
- 9.6 kbps to 4.375 Mbps data rates, 512 Kbps (LS) optional
- Closed network or IDR/IBS/SMS operation
- Modem Card and options are field-replaceable modules
- Error-free setup and operation; two-year warranty
- Built-in BERT and automatic self-test/diagnostics
- All-digital filtering, synthesis, and demodulation
- VLSI implementation for high reliability
- Optional high-performance Reed-Solomon coding
- Optional high-performance Turbo Codec coding
- Optional Bandwidth efficient inband Async control channel

OVERVIEW

The Radyne ComStream CM701A modem is designed as a modular system. The Modem Module is comprised of the Modulator, Demodulator, Universal I/O and Doppler Buffer. The modem, data interfaces, and options are completely independent modules, or Stand Alone Modules (SAMs), that work together as a system.

The modules are installed or changed by simply sliding them in and out of the chassis at the rear panel. The modules plug into a backplane within the modem, much like circuit cards in a PC. The modem will then automatically sense the new module allowing the user access to the new commands and functions.

Each module contains its own microprocessor and non-volatile memory, allowing it to store individual configurations and run comprehensive self-test operations. Modems in the field may be upgraded by installing another module. To upgrade a standard modem to full IDR/IBS/SMS compatibility, simply add the framing unit module.

The modularity simplifies sparing since only individual SAMs need to be changed. System changes or upgrades are simple to manage because units are universal; they can be reconfigured to fit any application.

Add a framing unit card and a standard, closed-network modem becomes an IDR/IBS/SMS open-network modem. Push a button and an IDR modem becomes an IBS modem. You no longer need a specific inventory of modems for different applications because a CM701A modem can be configured to meet any situation.

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To add an option, change an interface, or repair a failed unit, simply slide in a new circuit card module. The modem senses the new module and allows access to the new functions and commands

KEY FEATURES

- Standard data rates available from 9.6 kbps to 4.375 Mbps, 512 Kbps (LS) optional
  - Programmable data rates in 1-bps steps
- BPSK and QPSK operation
- Front panel and remote control programmability
- Programmable code rates and decoder types
  - Viterbi rate 1/2, 3/4, 7/8
  - Sequential rate 1/2, 3/4
- Full digital processing
  - Digital synthesis, filtering, and loop control
- Programmable IF frequency (10 Hz steps)
  - 52 to 88 MHz
  - 104 to 178 MHz
- Programmable power levels
  - -5 to -25 dBm in 0.1-dB steps
- Complete range of data interfaces
  - RS-449, V.35, RS-232 standard
  - Others available; G.703, DS-1
  - Multiple interface capability
- Built-in BERT
  - Useful for network setup and fault diagnosis
- Self-test capability
  - Runs full self-test and fault isolation
- Real-time clock
  - Time-stamping of fault indications
- Completely independent transmit and receive
  - Modulator-only or demodulator-only operation

Built-in BERT and Self Diagnostics. The CM701A simplifies the installation of satellite networks. Each unit has a built-in BERT and extensive system diagnostics to aid in the network checkout and problem solving. The BERT reports BER, errors, number of bits, blocks, and block error rates with programmable data patterns. The modem and each module also contain extensive self-test capabilities to verify proper operation and calibration. A real-time clock time-stamps fault indicators to help track system problems.

Reliability Backed by a Two-Year Warranty. Radyne ComStream has designed digital VLSI chips that significantly increase reliability, allowing for each CM701A to be backed by a two-year warranty (see Radyne ComStream Warranty Statement for details). Virtually all processing in the CM701A is digital. Frequency synthesis, baseband filtering, phase-locked loops, and forward error correction (FEC) are all digital functions of Radyne ComStream-proprietary ICs.

IDR/IBS/SMS Operation. The Radyne ComStream CM701A modem with internal Framing Unit meets all specifications for Intelsat IDR (IESS-308) and IBS (IESS-309) as well as Eutelsat SMS (BS 7-40). The spectral shape, scrambling formats, and code rates are programmable so that the touch of a button can change the modem from one type of service to another.

IDR (Intermediate Data Rate) is an Intelsat service for digital telephony over satellite. IBS (Intelsat Business Services) is an Intelsat service, and SMS (Satellite Multiservice System) is a Eutelsat service, both for general satellite data communications.

The Framing Unit of the CM701A provides all international overhead functions as standard features. For IDR ESC operation, dual 32-kbps ADPCM audio channels are provided along with four forward alarms, four backward alarms, and the 8-kbps data channel. In IBS and IDR operation, drop and insert multiplexing is a standard feature, allowing easy selection of specific channels in a data stream.

Data Interfaces. The CM701A can have multiple interface (I/O) modules installed at one time. Using multiple I/O modules means transmit and receive data can be in different formats, or one modem can be moved from one application to another. The active interface is selected by front panel or remote control commands. The Universal I/O includes V.35, RS-232 and RS-422. Optional Interface modules supported are G.703 and DS-1.

Doppler Buffer. Doppler buffers smooth out the periodic frequency variation in the received data rate caused by satellite motion. This option module fits two primary applications: 1) with a DTE that requires exact synchronization between Tx and Rx clocks, and 2) when a high-stability clock is used to control the timing of all satellite modems at a single site. The buffer features programmable depths from 0 bits to 2^n bits, n = 6 to 18.

High-Performance Reed-Solomon Coding. This option module provides a Reed-Solomon encoder/decoder that concatenates with the Viterbi or Sequential code supplied by the standard CM701A. You will add an extra 1-to 3-dB coding gain depending on the BER threshold of the application, which means a 20 to 50% savings in satellite power. Intelsat and DVB-compatible versions are available.

High-Performance Turbo Codec. The Turbo Codec option provides superior BER performance at any given Eb/No as compared with other concatenated FEC methods. The Turbo Codec card is a combined, discrete encoder/decoder to provide the greatest flexibility when integrating this feature with both old and new hardware. In most applications, the Turbo Codec will provide an additional 1.5 dB to 2.0 dB of margin over concatenated Viterbi Reed-Solomon coding.

Satellite Control Channel. The Satellite Control Channel option is a low-rate data carrier. A user at one end of the link can monitor and control the modem (or other equipment) at the other end, while the main data signal is left undisturbed. This option can be used with Radyne ComStream's Star Network Management System (SNMS) to allow a hub site to automatically monitor and control all remote sites in a "star" (point to multipoint) network.

RF Transceiver. The CM701A can be combined with Radyne ComStream-supplied RF transceivers to create an integrated C- or Ku-band satellite earth station. These RF transceivers include an up/downconverter, low-noise amplifier, solid-state power amplifier, and integrated power supply. The RF transceivers interface at either 70 or 140 MHz and can be easily mounted onto a variety of antenna sizes and designs. Transmit power levels of 5, 10, 20, or 40 W for C-band, and 2, 4, 8, or 16 W for Ku-band are available.

Other Options. Low-Speed Modem, L-Band Demodulator, additional 70/140 MHz and DVB capable modulators are avialable.

SPECIFICATIONS

SYSTEM

Configurations	Full duplex, receive-only, transmit-only
Data rates	9.6 kbps to 4.375 Mbps (standard) 512 Kbps (low-speed option)
Data rate flexibility	Variable rate (1-bps resolution)
Modulation rates	BPSK and QPSK
Code types and rates	Sequential 1/2, 3/4 Viterbi 1/2, 3/4, 7/8
Data interfaces	RS-530, V.35, G.703, DS-1, RS-232 (field/software selectable)
Scrambling	ComStream V.35 and IESS-308 (IDR)
IF frequency	52 to 88 MHz and 140 to 178 MHz
Step size	10 Hz
Impedance	75 Ohms
Return loss	>20 dB typical, ≤15 dB minimum
Channel spacing	<0.1 dB degradation for like carriers spaced 1.3 x symbol rate apart
Reference stability	± 1 ppm per year
Modem performance	BPSK <0.8 dB from theory (0.2 dB typical) QPSK <0.9 dB from theory (0.3 dB typical)
Decoder performance	(exclusive of Modem)
Seq. R=1/2 at 64 kbps	4.6 dB E_b/N_0 for 10^{-7} BER
Seq. R=1/2 at 2 Mbps	5.4 dB E_b/N_0 for 10^{-7} BER
Seq. R=3/4 at 64 kbps	5.4 dB E_b/N_0 for 10^{-7} BER
Seq. R=3/4 at 2 Mbps	6.0 dB E_b/N_0 for 10^{-7} BER
Viterbi R=1/2	5.7 dB E_b/N_0 for 10^{-7} BER
Viterbi R=3/4	7.0 dB E_b/N_0 for 10^{-7} BER
Viterbi R=7/8	8.0 dB E_b/N_0 for 10^{-7} BER
System performance	Decoder performance + modem performance + 0.4 dB (scrambling and differential)

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SPECIFICATIONS *(continued)*

MODULATOR

Transmit power	-5 dBm to -25 dBm	
	Resolution	0.1-dB steps
	On/Off isolation	>60 dB
Spurious	In-band	
	(in transponder)	< -55 dBc
	Out-of-band	< -45 dBc
	(outside transponder)	
Spectral shape	Radyne ComStream closed-network, IESS 308/309 (IDR/IBS), or BS 7-40 (SMS)-selectable	
Modulator timing	Internal and external	
	Stability	±1ppm for internal
Dejitter	Standard	±10%
	Peak	± 2 unit intervals
	DS-1	per Bell tech pubs 41451
	CEPT	per G.832

DEMODULATOR

Receive level	-10 dBm to -55 dBm	
	Aggregate	0 dBm
Acquisition range	Programmable	
	Carrier	± 30 kHz (default)
	Clock	± 100 ppm (standard)

FRAMING UNIT OPTION

IDR

Operational modes	IDR, transparent
Overhead rates	96 Kbps for 1544 to 4096 kbps in 8-kbps steps; 96 Kbps for 4096 to 8446 kbps in 24-kbps steps; 1/15 data rate for 64, 128, 256, 384, 512, 786, 1024, 1536 kbps 0 kbps for 4.8 kbps to 10 Mbps in 1-bps steps
Voice/data channels	2 to 32 kbps ADPCM channels
Analog interface	4-wire on a DB-9 connector
Data channel	8 kbps
Interface	RS-422 on a DB-15 connector
Backward alarms	4 form-C relay contact closures
Interface	DB-15 connector

IBS and SMS

Operational modes	IBS, G.732, G.733, transparent	
Overhead rates	1/15 of data rates	
Drop and insert	Data interface	1.544 Mbps (G.733) 2.048 Mbps (G.732)
	Satellite channel	*n* x 64 kbps (plus overhead) for *n* = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 18, 20, 24, and 30
Independence	Independent transmit and receive	
Earth station channel data interface	RS-422 on a DB-15 connector	
Backward alarms	1 form-C relay contact	
Interface	DB-15 connector	

OTHER OPTIONS

Data Interfaces G.703, V.35, RS-232, RS-449, DS-1

High-Performance Reed-Solomon Coding	Doppler Buffer
Satellite Control Channel	High-Performance Turbo Codec
Low-Speed Modem	L-Band Demodulator

MONITOR AND CONTROL

All features are software-selectable using front panel or remote control port:

Modulation type	Code rate	Symbol rate
Transmit power level	IF frequency	Data rate
Automatic acquisition	Parameter display	Int/Ext timing
Automatic transmit enable	E_b/N_0	Spectral inversion
AGC level	Transmit enable	Pure carrier
Fault mask	Fault history	Ber estimate
Acquisition range	Present status	Receive freq. offset
Baud rate	Modem ID	Scrambling
Channel error rate	Data loopback	Clock measurement
Differential coding	Loop timing	Self-test mode
RS-232/RS-485	M&C	System reset
Data control lines	Data interface port	Real-time clock

Nonvolatile storage of parameters

MECHANICAL/ENVIRONMENTAL

Width	48 cm (19 in) rack-mountable	
Height	8.9 cm (3.5 in) (2 rack units)	
Depth	43 cm (18 in)	
Weight	11.5 kg (25 lbs)	
Temperature	Operating	0˚C to +50˚C
	Nonoperating	-20˚C to +70˚C
Humidity	Operating	5% to 95% noncondensing
	Nonoperating	0% to 100% noncondensing
Altitude	3,050 m (10,000 ft)	
Power	AC input	90 to 264 V, 47 to 63 Hz (autoranging)
	Usage	40W (typical)

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