DT7000

Digital Earth Station

A very low cost earth station for point-to-point, or point-to-multipoint SCPC/MCPC satellite communications

HIGHLIGHTS

- Single-source RF unit / Indoor unit combination
- Includes outdoor RF unit - 5-watt C-band SSPA, variable rate modem/indoor unit. Antenna/cabling packages available as an option
- Truly integrated earth station
- Designed as indoor/outdoor combination where indoor unit controls RF power level, frequency synthesis control, and fault monitoring of outdoor unit from IDU
- Error-free setup and operation
- Built-in BERT and automatic self-test/diagnostics all digital filtering, synthesis, and demodulation VLSI implementation for exceptional reliability

DT7000 SINGLE-SOURCE RF UNIT/INDOOR UNIT COMBINATION

The Radyne ComStream DT7000 Earth Station provides both indoor and outdoor electronics in an intelligently designed combination.

This earth station meets the requirements of virtually any point-to-point application through its high performance, built-in versatility, integrated monitor and control, and easy-to-add options.

These features combined with programmable operating parameters make it possible to use the DT7000 anywhere in the world.

The indoor unit is based on the modular architecture of the Radyne ComStream CM701 modem. These 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 IDU, much like the circuit cards in a PC.

Each module contains its own microprocessor and nonvolatile memory, allowing it to store individual configuration and run comprehensive self-test operations. An RF interface module (RFIM) is added to the modem to provide earth station operation.

The C-band RF unit contains a solid state power amplifier, low noise amplifier, and up- and downconverters. The unit mounts on the feed arm, or back of the antenna.

The earth station is configured with a 5-watt C-band transceiver.

Programmable power levels and operating parameters can compensate for low signal levels near the fringes of a satellite beam, varying or extreme weather conditions, or other location variables.

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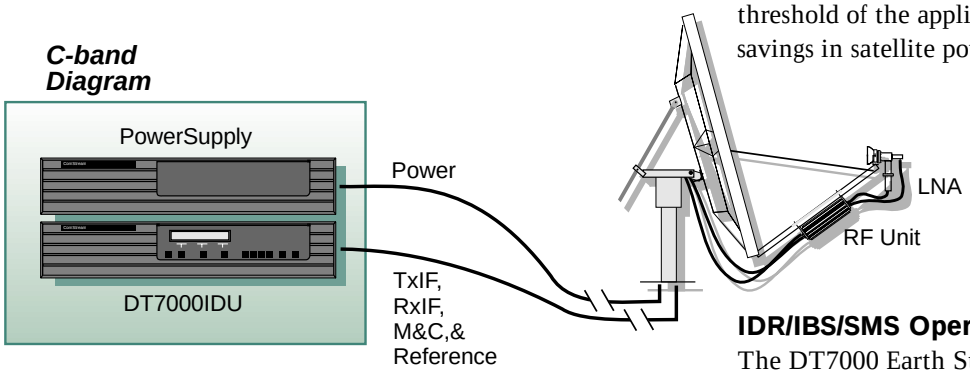
TRULY INTEGRATED EARTH STATION

The DT7000 is the first SCPC earth station that is truly integrated. Most SCPC earth stations are standard modems combined with off-the-shelf RF transceivers. They involve many separate boxes, and don't provide an integrated monitor and control link, and duplicate many functions among the separate components.

Radyne ComStream designed and built the DT7000 indoor (modem) and outdoor (RF transceiver) electronics as a combined system.

C-band Diagram



Several advantages result from this design:

► The indoor unit demodulates the IF signal directly from L-band frequencies (950-1700 MHz) for cost savings by eliminating a second level of downconversion.

► The transmit signal is at a different frequency band than the receive signal so both signals can share the same IFL cable for further cost savings.

► A high-quality frequency reference is supplied to the system from the indoor unit, saving this output from the extreme temperature and environmental conditions of the ODU.

► The IDU continuously communicates monitor and control information to the ODU. This allows you to set ODU parameters such as RF frequency and power levels from the IDU, and have a single monitor point for all system faults.

► The indoor unit provides power to the outdoor unit, eliminating the need for AC power outdoors.

MODULAR DESIGN FOR VERSATILITY

The DT7000 modulator, demodulator, RFIM, data interfaces, and options are completely independent modules, or Stand Alone Modules (SAMs), that work together as a system.

This modularity also simplifies sparing, since only individual SAMs need to be changed on a failed unit. A brief description of some options follows.

High Performance Reed-Solomon Coding

This option module provides a Reed-Solomon encoder/ decoder that concatenates with the Viterbi coding supplied by the standard DT7000. The user will add an extra 1 to 3 dB coding gain, depending on the bit-error-rate threshold of the application, which can mean a 20 to 50% savings in satellite power.

IDR/IBS/SMS Operation

The DT7000 Earth Station with a framing unit option module meets all INTELSAT IDR(IESS-308) and IBS (IESS-309) specifications as well as EUTELSAT SMS (EESS-501) specification. The signal shape, scrambling formats, and code rates are all programmable so one button can change the modem from one type of service to another.

Data Interfaces

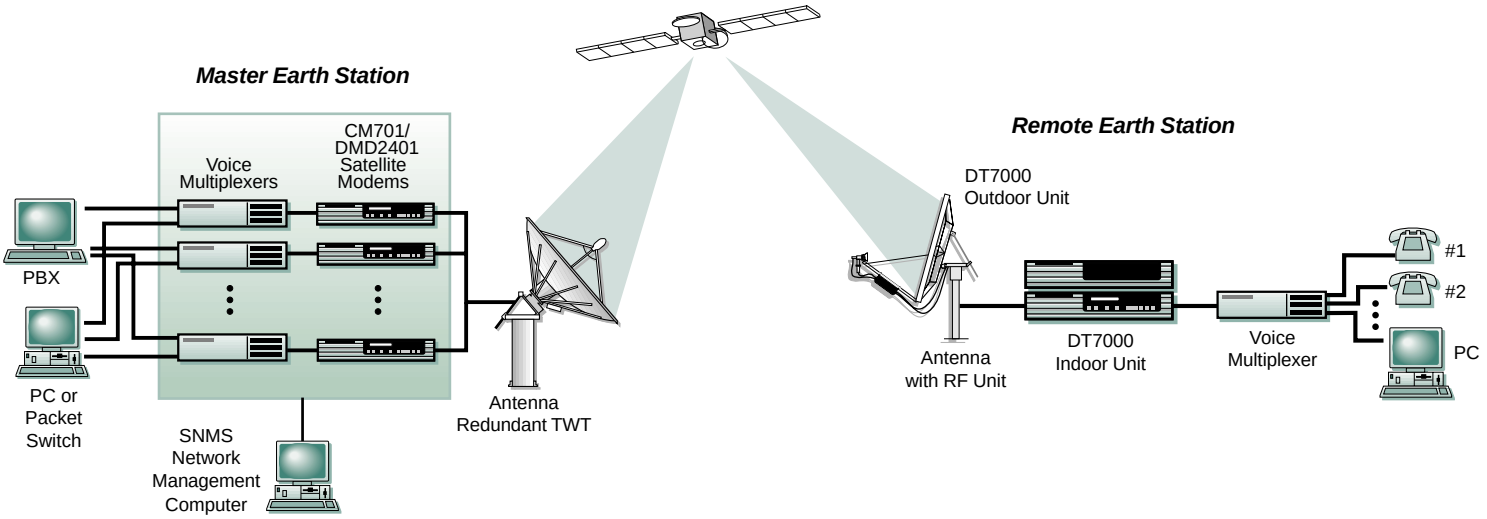
The DT7000 can have multiple interface (I/0) modules installed at one time. Using multiple I/0 modules means transmit and receive data can be in different formats or one earth station can be moved from one application to another. The active interface is selected by front panel or remote control commands.

Interface modules support the following standards: RS-449, V.35, G.703, DS-1 and RS-232.

Satellite Control Channel

The satellite control channel is a low rate data stream that is multiplexed onto the main 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 a 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.



Typical phone/data network using the DT7000

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 earth stations at a single site. The buffer features programmable depths from 0 bits to ±512 kbps.

Other Options

Burst transmission, and additional modulators or demodulators can all be provided by adding other DT7000 option modules either available now or in development.

Capability Summary

- Programmable data rates from 9.6 kbps to 2.3 Mbps
- Programmable RF frequency
  - Access to full satellite band
  - Independent Tx and Rx synthesis
- Programmable power levels at C-band up to +37dBm (5 watts)
- Antenna pointing signal available at ODU
- Supports multi-carrier operation
- Front panel and remote control programmability
- Programmable code rates and decoder types
  - Viterbi rate 1/2, 3/4, 7/8, and 1 (uncoded)
  - Sequential rate 1/2, 3/4, and 1 (uncoded)
- BPSK and QPSK operation
- Full digital processing
  - Digital synthesis, filtering, and loop control
- Complete range of data interface options
  - RS-449, V.35, G.703, RS-232, DS-1 standard
  - Multiple interface capability
- Built-in BERT
  - Useful for network setup, performance validation, and fault diagnosis
- Real time clock
  - Time stamping of fault indications
- Independent transmit and receive configuration

Error-free Setup and Operations

Built-In BERT and Self-Diagnostics

The DT7000 simplifies the installation of satellite networks. Each unit has a built-in BERT and extensive system diagnostics to aid in network checkout and problem solving. The BERT reports BER, errors, number of bits, blocks, and block error rates with programmable data patterns. Each module within the earth station, also contains extensive self-test capabilities to verify proper operation and calibration. A real-time clock time-stamps fault indicators to help track system problems.

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DT7000 Technical Specifications

SYSTEM

Data Rates	9.6 kbps to 2.3 Mbps (programmable in I bps steps)
Modulation Types	BPSK and QPSK
Code Types and Rates	
Viterbi	Rate 1/2, 3/4, 7/8, and I (uncoded)
Sequential	Rate 1/2, 3/4, and I (uncoded)
Frequencies	
Synthesis	Any frequency in any transponder
Stability	± 0.06 ppm over temperature
C-band	Tx: 5.925 to 6.425 GHz
	Rx: 3.7 to 4.2 GHz
Transmit Power	
C-band	Up to +37 dBm minimum (1 dB GCP)
Power Level Stability	
C-band	ALC on 1.5 dB p-p
	ALC off 6 dB p-p
Spurious	
C-band	-50 dBc (at max. power levels)

RF MODULE/OUTDOOR UNIT

C-band	
Noise Temperature	75ºK typical
IF Interface	
Tx:	790 MHz ± II MHz
Rx:	950 to 1450 MHz

Antenna/Cabling Packages Available

MODEM/INDOOR UNIT

Acquisition Range	
Carrier	programmable up to ±500 kHz
Clock	± 100 ppm max.
Data Interfaces	RS-449, G.703, V.35, DS-1, RS-232
System Performance (typical)	E_b/N_0 for 10^{-7} BER with QPSK modulation, scrambling, and differential coding
Seq. R=I /2 at 64 kbps	5.6 dB
Seq. R=I /2 at 2.048 kbps	6.4 dB
Seq. R=3/4 at 64 kbps	6.4 dB
Seq. R=3/4 at 2.048 kbps	7.0 dB
Viterbi R=I /2	6.7 dB
Viterbi R=3/4	8.0 dB
Viterbi R=7/8	9.0 dB

CERTIFICATION

Safety	UL, CSA, TUV, BZT

MONITOR AND CONTROL

Outdoor Unit	Tx Freq, Rx Freq, RF power level, Tx disable, ALC on/off, Status
Indoor Unit	Tx/Rx data rates, Tx/Rx mod type, Tx/Rx code type & rate, Acq range, Int/Ext/Loop timing, E_b/N_0, AGC Level, Status, Fault History, many others
Built-in BERT Commands	BERT Enable, pattern, insert error, BER, bits, errors, block length

ENVIRONMENTAL AND MECHANICAL

Temperature	
Indoor Unit	0 to +50ºC (operating)
	-20 to +70ºC (nonoperating)
Outdoor Unit	-30 to +50ºC (operating)
	-40 to +70ºC (nonoperating)
Humidity	
Indoor Unit	up to 95 %, noncondensing
Outdoor Unit	up to 100 % condensing
Altitude	up to 10,000 feet (operating)
	up to 40,000 feet (nonoperating)
Indoor Unit	
Modem	3.5" x 17" x 18"
Power Supply	3.5" x 17" x 8.5"
Outdoor Unit	
C-band	8.0" x 9.5" x 25"
Power	90 to 264 VAC, 47 to 63 Hz (autoranging)
Consumption (typical)	
Indoor Unit	<50 watts
Outdoor Unit/	<110 watts

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