DT8000

Digital Earth Station

DT8000 Ku-band Outdoor Unit (ODU)

DT8000 Indoor Unit (IDU)

HIGHLIGHTS

- Very low cost earth station for point-to-point or point-to-multipoint SCPC/MCPC satellite communications
- Single-source indoor/outdoor unit combination
  - Outdoor RF unit–2-watt Ku-band SSPA
- Variable-rate modem/indoor unit
  - Antenna/cabling packages available
- Automatic power leveling (optional)
  - 1 x 10^{-9} frequency stability (optional)
- Error-free setup and operation
  - Built-in BERT and automatic self-test/ diagnostics
  - All digital filtering, synthesis, and demodulation
  - VLSI implementation for exceptional reliability
- DVB Compliant, Rate 1/2, 3/4, and 7/8 (Optional).

OVERVIEW

The Radyne ComStream DT8000 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 DT8000 anywhere in the world.

The IDU 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 configurations and run comprehensive self-test operations. An IF interface is integrated into the modem to provide earth station operation.

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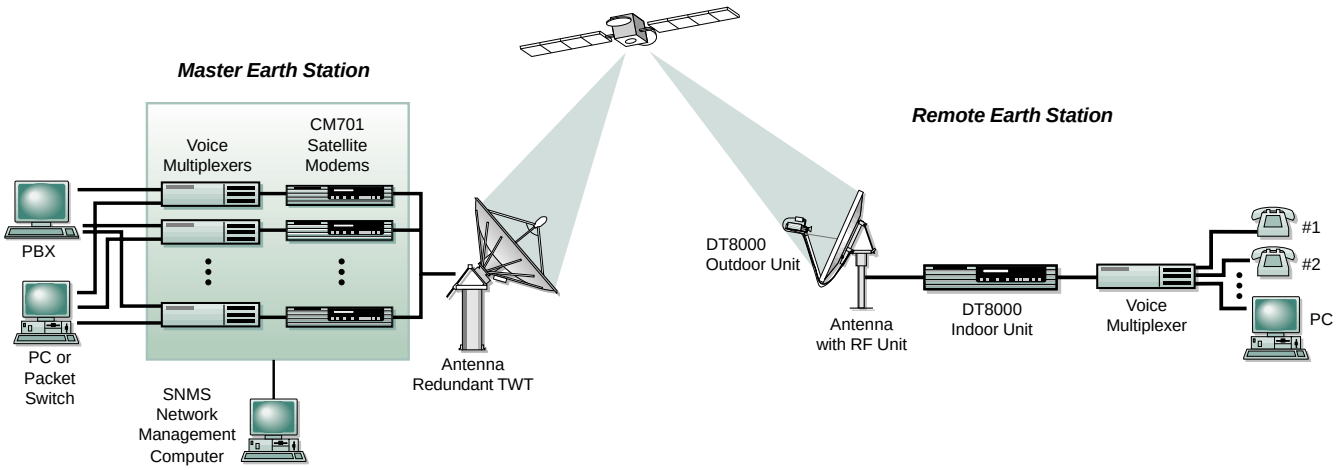

Typical voice/data network using DT8000

The Ku-band outdoor RF unit consists of a temperature-compensated block upconverter and solid state power amplifier with a low-noise block downconverter. The transmit unit mounts on the feed of the antenna.

The earth station can be ordered with a 2-watt Ku-band upconverter.

Power level feedback (optional) is used to maintain output level within ±1.5 dB.

Truly Integrated Earth Station

Radyne ComStream was the first company to manufacture a single-channel-per-carrier (SCPC) earth station that is truly integrated. Most SCPC earth stations are standard modems combined with off-the-shelf RF transceivers. They consist of many separate boxes which must be interfaced together. These systems usually result in duplicated functions among the separate components.

Radyne ComStream designed and built the DT8000 indoor (modem) and outdoor (RF unit) electronics as a combined system. Several advantages result from this design:

- The IDU demodulates the IF signal directly from L-band frequencies (950 to 1700 MHz). This reduces cost by eliminating a second level of downconversion.
- The transmit and receive signals are carried on separate, low-cost cables. The transmit cable multiplexes DC power, reference, and IF signal on the same cable for further cost savings. The optional automatic leveling signal is carried on an additional cable.
- A high-stability frequency reference and combined IDU/ODU power supply are located in the IDU, avoiding the extreme temperature and environmental conditions seen by the ODU. An optional very high stability oscillator is available.
- The IDU and ODU are greatly simplified relative to conventional earth stations, without sacrificing functionality. The result is fewer parts, lower cost, and increased reliability.

Modular Design for Versatility

The DT8000 modulator, demodulator, data interface (RS-422/449), BERT, and Doppler Buffer are all integrated onto a single, independent module, or field-replaceable unit (FRU). This module along with the monitor and control module, power supply, and chassis make up the basic DT8000 IDU. Other FRUs can be added to the basic system to satisfy a multitude of applications.

This modularity also simplifies sparing, since only individual FRUs need to be changed on a failed unit.

A brief description of some available options follows.

HIGH-PERFORMANCE REED-SOLOMON CODING

This option module provides a Reed-Solomon encoder/decoder that concatenates with the Viterbi codec supplied by the standard DT8000. 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.

DATA INTERFACES

The DT8000 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 the earth station can be reconfigured from one application to another. The active interface is selected by front panel or remote control commands.

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

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 the Radyne ComStream 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.

OTHER OPTIONS/CONFIGURATIONS

Special options or configurations can be provided by adding other DT8000 modules that are available now or are in development.

ERROR-FREE SETUP AND OPERATION

BUILT-IN BERT AND SELF-DIAGNOSTICS

The DT8000 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 is used to time stamp faults to help track system problems.

CAPABILITY SUMMARY

- Programmable data rates from 9.6 kbps to 2.336 Mbps
- Programmable RF frequency
  - Access to full satellite band
  - Independent Tx and Rx synthesis
- Programmable Ku power levels
  - Ku to +33 dBm (2 watt)
- 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, DS-1, and RS-232
  - Multiple interface capability
- Built-in BERT
  - Useful for network setup and fault diagnosis
- Real time clock
  - Time stamping of fault
- Optional Reed-Solomon codec and satellite control channel modules

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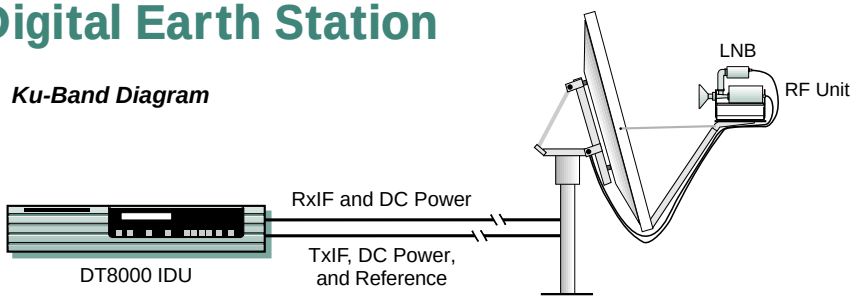
Ku-Band Diagram



SPECIFICATIONS

SYSTEM

Data rates	9.6 kbps to 2.3 Mbps (programmable in 1-bps steps)	
Modulation types	BPSK and QPSK	
Code types and rates	Viterbi	Rate 1/2, 3/4, 7/8, and 1 (uncoded)
	Sequential	Rate 1/2, 3/4, and 1 (uncoded)

Frequencies

Synthesis	Programmable in 100 Hz increments	
Stability	±0.1 ppm over operating temperature ±0.01 ppm (optional)	
Aging	±0.1 ppm per year	
Ku-band	Tx:	14.0 to 14.5 GHz
	Rx:	10.95 to 11.7 GHz 11.7 to 12.2 GHz 12.25 to 12.75 GHz
Transmit power	+13 to +33 dBm (1dB GCP) minimum	
Power level stability	±2.5 dB (over any 40°C range) typical ±1.0 dB maximum over operating temperature with power leveling option	
Spurious	-50 dBc/4 kHz (in band) -45 dBc/4 kHz (out of band) -20 dBc/4 kHz (harmonics)	
Phase Noise	< -27 dBc/Hz at 10 Hz offset < -57 dBc/Hz at 100 Hz offset < -67 dBc/Hz at 1 kHz offset < -77 dBc/Hz at 10 kHz offset < -87 dBc/Hz at 100 kHz offset < -87 dBc/Hz at 1MHz	

RF MODULE/ODU

Ku-Band Unit

Noise temperature	129°K typical (cross-pol) 144°K typical (co-pol)	
IF interface	Tx:	950 to 1450 MHz
	Rx:	950 to 1700 MHz
IFL Cable Length	80 meters maximum Antenna/cabling packages are available	

MODEM/IDU

Acquisition range	
Carrier	Programmable up to ±500 kHz
Clock	±100 ppm max
Data interface	RS-422/449 Other interfaces (optional)

System Performance (typical)

Typical E_b/N_o (Viterbi)	Rate 1/2	Rate 3/4	Rate 7/8
at BER=10^{-7}	6.7	8.0	9.0
Typical E_b/N_o, @ 64 kbps Sequential (Optional)	Rate 1/2	Rate 3/4	
at BER=10^{-7}	5.6	6.4	
Typical E_b/N_o, @ 2.048 Mbps Sequential (Optional)	Rate 1/2	Rate 3/4	
at BER=10^{-7}	6.4	7.0	

MONITOR AND CONTROL

Outdoor unit	Tx Freq, Rx Freq, RF power level, Tx disable
Indoor unit	Tx/Rx data rates, Tx/Rx mod type, Tx/Rx code type and rate, Acq range, Int/Ext/Loop timing, E_b/N_o, 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 +50°C operating -20 to +70°C nonoperating
Outdoor unit	-40 to +50°C operating -40 to +70°C nonoperating

Humidity

Indoor unit	Up to 95%, noncondensing
Outdoor unit	Up to 100% condensing

Altitude

Up to 10,000 ft operating
Up to 40,000 ft nonoperating

Dimensions

Indoor unit	Modem	8.9 cm H x 48.2 cm W x 45.7 cm D (3.5 in. H x 19 in. W x 18 in. D)
Outdoor unit	Ku-band	11.4 cm H x 11.4 cm W x 24.1 cm D (4.5 in. H x 4.5 in. W x 9.5 in. D)

Power

AC input	85 to 264 VAC, 47 to 63 Hz (autoranging)
Consumption	135 watts typical

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