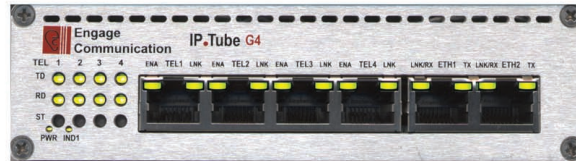




GSM A-bis Optimization



- **Reduce BTS to BSC Bandwidth 50%** • **ROI Measured in Weeks**

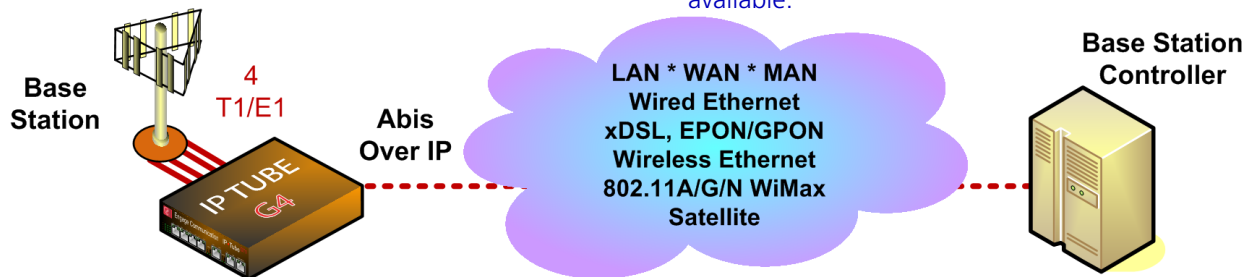
Engage Abis Optimization

The IP•Tube G4 Abis Optimization technology reduces the bandwidth required to interconnect a Mobile Base Station to a Base Station Controller. The interface between the BTS and BSC is a 3GPP reference interface called the Abis interface.

The physical trunk connecting a BTS and BSC is typically a T1/E1 circuit, and carries 24 (T1) or 32 (E1) separate 64 kbps DS0 channels.

The IP•Tube G4 Abis has 1 to 4 Telecom interfaces that can be configured as full or fractional T1 or E1. The Abis traffic is optimized and encapsulated into Ethernet packets for transport over LANs, WANs, MANs, IP Satellite, xDSL, Cable and Wireless Ethernet.

The IP•Tube G4 Abis ships with one to four T1/E1 interfaces and one 10/100 BaseT Ethernet Interface. Optional integrated 5 port QoS/LAN/Rate Limiting Layer-2 Ethernet switch is available.



T1/E1 Optimized Abis Over IP

Engage's Abis Optimization produces bandwidth efficiency increases of 33% to 50%, depending on the nature of the traffic on the Abis interface whenever a voice user is silent which is typically 40-60% of the time, which corresponds to a GSM voice call capacity gain of 50-100% per T1/E1.

HDLC Idle Suppression

The DS0 channels that are used to carry control and signaling traffic utilize HDLC, a synchronous serial link protocol, with idle flags during the intervals between messages. Engage's Abis Optimization technology eliminates these idle flags and only transports the HDLC framed messages.

Idle Channel Suppression

When a sub-rate DS0 is not assigned to a call, a repeating idle pattern is transmitted in accordance with 3GPP TS 08.54 v8.0.1. The Abis Optimization only transmits the idle state of the sub-rate DS0.

TRAU

The voice and data bearer traffic is carried over the sub-rate DS0s in transcoder and rate adaptor (TRAU) frames in accordance with 3GPP TS 08.60 v8.2.1.

TRAU frames are generated when a sub-rate DS0 is assigned to a call. The transcoder and rate adaptation control function that specifies the TRAU frames provides several opportunities to optimize the Abis interface traffic types:

- Idle Speech Frames/Idle Data Frames - Compression of repetitive data patterns as detailed in 3GPP TS (Technical Spec) 08.60 for Full and Enhanced Full Rate Traffic (sects 3.4 & 3.5.5).
- Idle Data Pattern – Compression of Layer 1 Idle Pattern, as detailed in 3GPP TS 8.54 – Layer 1 Structure.
- Silent Speech frames– Monitoring of Discontinuous Transmission (DTX) for Silence Descriptor (SID) indicator. Reference GSM 06.81
- Signaling Optimization – Signaling is based on LAP-D and will be transported as HDLC-over-IP. Provides more robust transport and reduced bandwidth..
- Other TRAU Frames (O&M, Data,etc.) transported in a transparent manner.

T1/E1 Abis CIRCUIT EXTENSION OVER SATELLITE

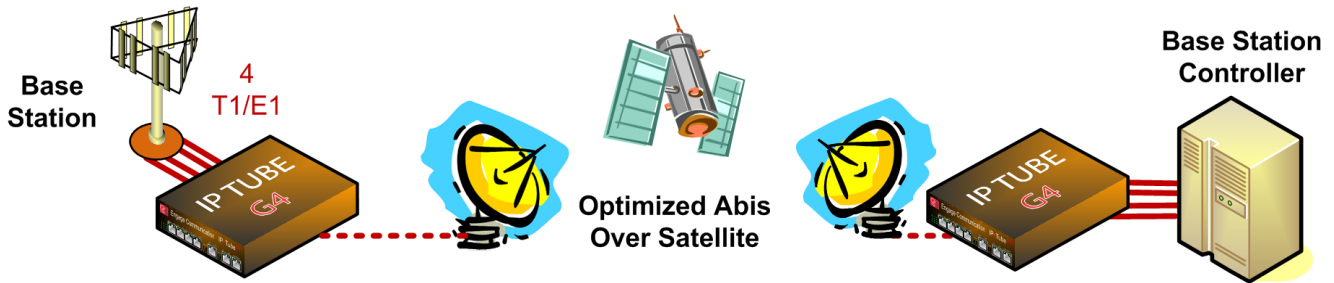
Optimized Abis Over Satellite

IP•Tube G4 Abis enables Satellite Service Providers to efficiently tap into the multi-billion dollar GSM mobile operator backhaul service business. GSM operators are expanding from urban areas to rural and remote areas with lower Average Revenue Per User, especially in economically emerging countries.

Satellite transmission offers the proven solution for quickly reaching smaller, remote and dispersed communities, and delivering reliable connectivity, provided that the cost is right.

The high Operating Expenditure typically associated with satellite transponder usage lowers the profitability of such deployment, limiting its application to specific cases and interim fast service coverage deployment.

Engage's Abis Optimization, which can achieve a 50% reduction in the bandwidth required for GSM BTS satellite backhaul, makes it possible to provide mobile services to locations that are revenue challenged.



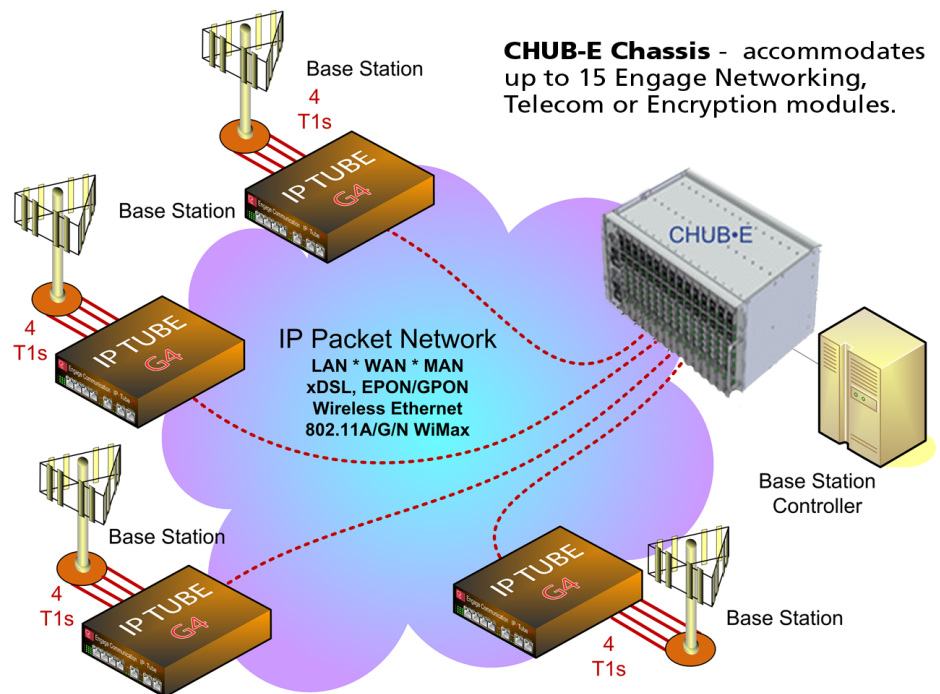
CELLULAR BASE STATION BACKHAUL

IP Cellular Backhaul

IP•Tube G4 Abis provide transparent interconnection of Base Stations, Base Station Controllers and Mobile Switching Centers over IP Ethernet packet-switched networks.

Cellular service providers save substantially by converting to a packet switch network. The Abis compression option, which is specifically designed for Cellular communication links, minimizes the bandwidth required to interconnect.

Note: The Ethernet Switch Option has the sophistication to support Ethernet Native Base Station applications with QoS and rate limiting.



CHUB-E Chassis - accommodates up to 15 Engage Networking, Telecom or Encryption modules.

T1/E1 CIRCUIT EXTENSION OVER WIRELESS ETHERNET

Wireless Ethernet

The IPTube has proven itself around the world as an effective method for using Commercial Off the Shelf Wireless Ethernet Bridges to interconnect T1/E1 circuits.

Interconnection of T1/E1 based data communication systems over wireless as a primary or back up connection is a major application.

The IPTube's Assured Delivery Protocol has the sophistication required for solid performance across a wide range of wireless connections.

The use of parallel Wireless Ethernet links minimizes the latency and Radio's packet processing requirement. Note: Parallel Application requires Ethernet Switch Option.

IP•Tube G4 Abis Standard Features

Assured Delivery Protocol

In order to assure high quality communications over links with intermittent or noisy performance, such as Wireless or Broadband over Power Line, the **IP•Tube G4 Abis** employs Engage's robust Assured Delivery Protocol with the following benefits:

- Packet out of sequence detection and re-sequencing
- Duplicate skipping
- Lost packet retransmission with configured delay.

Dynamic Host Configuration Protocol - DHCP

The **IP•Tube G4 Abis** can be configured to obtain its Internet Protocol network parameters: IP Address, Subnet Mask, Default Gateway, DNS; from a local DHCP server.

Domain Name Addressing

IP•Tube G4 Abis can be configured to use a Domain Name for the remote IP•Tube in place of a fixed IP address. Supports mobile multi service provider installations with ease.

Dynamic DNS

IP•Tubes can be configured to register their IP address with Dynamic Domain Name Servers for discovery by the IPTube at the other end of the T1/E1 circuit. DDNS support combined with DHCP make installations Name-based which is very easy to setup and maintain when compared to Static IP addressing.

Secure Socket Shell - SSH

Engage's Secure Socket Shell, which is based upon industry proven Open SSH and FIPS 140 approved Open SSL version 2.0, provides secure encrypted communications between SSH clients such as OpenSSH, SecureCRT, and PuTTY and the IPTube's Command Line Interface.

SNMP

The **IP•Tube G4 Abis** is able to be fully managed with SNMP via standard and private MIBs. Large scale deployments of IPTubes with centralized management have made SNMP support a priority. SNMP Traps for error events enable proactive service fault isolation.

IP•Tube G4 Abis Optional Features

Ethernet Switch OPTION - SWITCH

The **IP•Tube G4 Abis** is available with a four port 10/100 Ethernet QoS switch integrating a high-performance switching fabric with four priority queues. Advanced features include 802.1p/IPv4/IPv6 traffic classification, full IEEE 802.1Q VLAN, RMON, SNMP, Port Monitoring and Layer 2 firewall.

QoS determined by destination MAC address, port ID, IEEE 802.1p and multimedia traffic tags, IPv4 Type of Service (TOS), and Differentiated Services (DiffServ).

Protector OPTION -PRO

The protector option utilizes the Ethernet Switch port ETH1 as a redundant path for the interconnection of the IP encapsulated T1/E1 data.

The PRO Option is configured to Always-On, or with Switch-Over criteria.

Rate Limiter

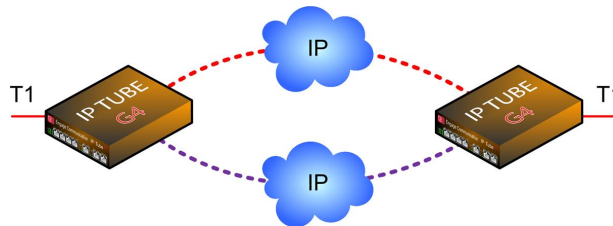
The Ethernet switch Ingress and/or Egress Rate Limiter option enables the reservation of the bandwidth for time-sensitive T1/E1 Over IP real time connections.

Required for applications where the LAN traffic can exceed the WAN bandwidth required by the T1/E1 over IP/Ethernet application. The data rate limit range is 128 kilobits to 64 Megabits in binary increments.

Alternator OPTION -ALT

The Alternator option alternatively sends the IP packetized T1/E1 frames on two Ethernet interfaces, balancing the load.

The Alternator option enables fractional and full T1/E1 circuits to be split over two IP WAN connections such as ADSL.



Pay As You Grow Expansion

The **IP•Tube G4 Abis** is designed for Pay-As-You-Grow expansion. Customers can elect to economize initial installation and add additional capabilities via a software-based license key.

Field Upgrade benefits are extended to additional T1/E1 interfaces & DS0s, and Protector and Alternator options.

Technical Specifications

LAN Network Interface:

- One 10/100BaseT Full/Half Ethernet (2nd LAN requires Switch)
- Auto negotiation or Configured Speed and Duplex

LAN Network Protocols Supported:

- IP, TCP, UDP, ICMP
- Assured Delivery Protocol
- DHCP • DNS Address Discovery • Dynamic DNS

T1/E1 Specifications:

- One to Four Port Model • Connects directly to T1/E1 or DS1
- T1: Framing - ESF or D4 • Coding - B8ZS or AMI
- E1: Framing - CRC4 or FAS • Coding - HDB3
- Supports DS0 assignments from 1 to 24/31
- Not Contiguous Configuration x,y,z Supported
- Comprehensive Clocking:
 - Internal** – the master clock source for the TDM circuit is provided by an internal clock oscillator
 - Network/Loopback** – the transmit clock is derived from the T1/E1 port receive clock
 - Adaptive** – the clock is recovered from the Ethernet network interface
- External** - Stratum1 GPS Clock Synchronization

Abis Over IP Protocol 3GPP Compliant:

- Abis Over IP: GSM 2G (GPRS), 2.5G (EDGE), 3G (UMTS & CDMA)
- GSM CODECS: FR, EFR, AMR
- Circuit Extension Services Over IP - CESOIP
- HDLC Over IP - HDLCOIP
- Frames Per Packet Configured 8 to 56
- Extremely low processing delay under 2 milliseconds
- Low Latency Mode: 500 microseconds 4 T1/E1 frames
- Max Payload Mode: 7/5 millisecond 56/40 T1/E1 frames
- Configured jitter buffer to compensate for packet delay jitter/variance from 1.5 to 595 milliseconds

TFTP Online Upgrade Capable (FLASH ROMs)

- IPTube is fully operational during upgrade

Quality of Service Support:

- IANA Registered UDP Port 3175 • IP Type of Service (TOS) CLI configured
- Diffserv configuration of TDMOverIP header
- VLAN tagging and priority labeling according to 802.1p&Q
- T1/E1 Over IP frames are tagged with a dedicated VLAN ID.

Regulatory:

- CE • Safety -IEC60950 • EMC - CFR 47 Part 15 Sub Part B:2002, EN55022:1994+A1&A2, EN55024, ICES-003 1997, CISPR 22 Level A
- Telecom Part 68

Management:

- Remote config., monitoring, & reset • Secure Socket Shell - SSH Diffie-Hellman Group1/14 key exchange and strong integrity checking via MAC SHA1/SHA1-96 with Cipher AES-128 and 3DES and DSS and OpenSSH public key format
- Telnet support with Edit and Paste Template Files
- Console Port for Out of Band Management
- SNMP support (MIB I, MIB II, Engage proprietary) with configured traps

Environmental:

- Temperature: 0–50°C (32–122°F).
- Optional Extended Temp ranges avail.
- Humidity: Up to 90% non-condensing

Rear Panel/Power:

- 10-30 VDC, 1.0A.
- Screw Locking Connector
- Power 7 Watts
- Universal Adapter 100/240 VAC 50/60 Hz
- Optional -48V 0.25 Amp
- Hot Standby

Physical:

- Dimensions: Length 9"; Width 7"; Height 1.50" • Weight 2 Pounds (1 kilogram)

Ethernet Switch OPTION:

- Out of band management interface with independent IP configuration
- 802.1Q VLAN support with Filtering for up to 64 VLANs
- Support both port-based membership or 802.1Q VLAN-based VLANs
- 2,048 MAC address entries with automatic learning and aging

Diagnostics:

- Telco Diagnostics: Local Loop, Remote Loop, Loop Up/Down NIU and CSU Codes. Enables isolation of connectivity faults to local, network or remote equipment
- Physical layer alarms for LOS, AIS, LOF
- Comprehensive statistics: LAN and IP layer network statistics: such as packet loss and packets arriving late, out of sequence, underruns, overruns CRC, and delay variation (jitter).

How to Order – IP•Tube G4 Abis

Part No.	Description	Notes
432-1520-0x	IP•Tube G4 Abis, (x=1 - 4 Ports)	Base Model Specify # of T1/E1 Ports Enabled
Base Options		Specify as suffix
-ROHS	ROHS compliant materials and processes	Restriction of Hazardous Substances no PB
-SWITCH	4 Port QOS/VLAN/Rate Limiter 10/100 Ethernet Switch	QOS and VLAN tagging Reserve TDMOver IP Rate Limiter
-PRO	Protector Option	Fault Tolerant Network Interconnect Requires Ethernet Switch Option
-ALT	Alternator Load Balancing Option	Load Balancing Inverse Mux Requires Ethernet Switch Option
Power Options		Specify as suffix
-DCMOD	Power Module 10/30 VDC ADAPTER	Ships with Universal Adapter 100/240 50/60
-N48VDC	Power Supply Module Negative 48 Volt DC	Isolated Negative 48 Volt Power