

'Comms-On-The-Move' Compact Satellite Modem

OVERVIEW

The Q-Lite™ is a compact, single-board SCPC satellite modem *suitable for integration into custom enclosures* for portable communications and comms-on-the-move.

The Q-Lite™ has been designed for simple mechanical integration into OEM products, being small in physical size and with very low power consumption. It is compatible with our leading-edge Quantum IP modems and inherits all of the core Quantum functions including modulations, FECs and bandwidth saving features.

Monitoring and control of the modem is via Ethernet, with an option to fit a keypad and LCD display for localized control. There are also options to fit one or two fans for cooling.

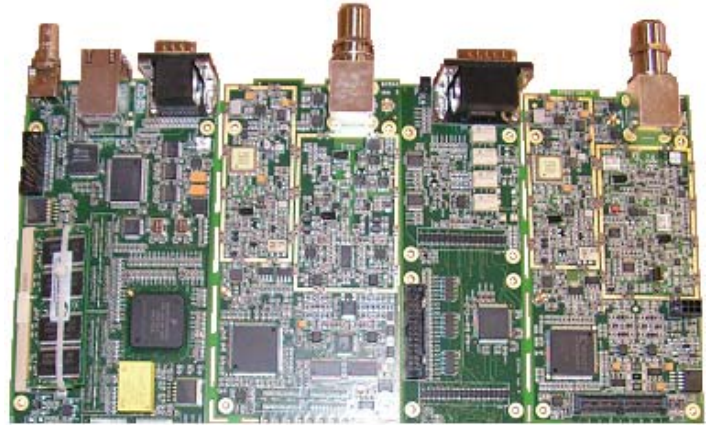
Advanced Bandwidth-Efficient Features

The Q-Lite™ is small in size but big on features!:

Paired Carrier™ overlays transmit and receive carriers reducing satellite bandwidth by 50%. **FastLink™** low-latency LDPC has been designed for latency-sensitive applications while **DVB-S2** is renowned for its bandwidth efficiency.

Applications

- ▶ Comms-on-the-move
- ▶ Portable communication systems
- ▶ Man-packs
- ▶ Disaster relief
- ▶ High-speed train internet connectivity
- ▶ Satellite news gathering
- ▶ Compact, low-power satellite terminals



FEATURES

- ▶ Small form factor (255mm x 184mm)
- ▶ L-band operation (950MHz to 2050MHz)
- ▶ Data rates to 60Mbps
- ▶ IP interface with advanced IP feature set including encryption, TCP acceleration, compression, routing, bridging, traffic shaping, ACM and throughput diagnostic graphs
- ▶ DVB-S2, FastLink low-latency LDPC and other FEC options
- ▶ 24 Volt input power supply
- ▶ 30 Watt power consumption
- ▶ Modulations up to 64QAM
- ▶ Optional keypad/LCD display and fans
- ▶ Optional L-band services (10MHz output, BUC/LNB PSU)
- ▶ Optional 1U half-rack enclosure (half width of standard 19" rack)
- ▶ LinkGuard™ signal-under-carrier interference detection
- ▶ Built-in spectrum and constellation monitors
- ▶ Interoperable with other Paradise modems
- ▶ Software upgradeable

Main Specifications	
Frequency	950 to 2050MHz (resolution 100Hz) (TNC connector)
Data Rate	DVB-S2 50kbps to 60Mbps SCPC: 4.8kbps to 60Mbps 1bps resolution (Note: Operation to 2,048kbps provided as standard; extension options to 5Mbps, 10Mbps, 25Mbps and 60Mbps)
Symbol Rate	DVB-S2: 100ksps to 37.5Msps SCPC: 9.6ksps to 40Msps
Operating Modes	DVB-S2 (EN 302 307) option Closed Network (+ESC) (IESS-315) Closed Network (+ESC) (IESS-315) IBS/IDR (IESS-308/309/310/314) options
Scrambling	DVB-S2: as per EN 302 307 Closed+ESC: Synchronised to ESC overhead
Impedance	50Ω
Return Loss	14dB typical
Frequency Reference	Ageing <4E-8/yr
External Reference	Clocking only: 1 to 10MHz, 1kHz steps Clocking and RF frequency: 10MHz, 0dBm±1dB
Redundancy	Can be operated in standalone, 1:1 or 1:N redundancy configuration (redundancy requires Auxiliary Card option)

Traffic Interfaces
Ethernet (10/100/1000 BaseT) IP traffic on RJ45 with processing capability of 100,000 packets per second. See optional IP features under 'Ethernet Traffic'.

Modulator	
Output Power	0 to -30dBm (0.1dB steps)
Output Power Stability	±0.5dB, 0°C to 50°C
Transmit Filter Roll-off	20%, 25%, 35%
Phase Accuracy	±2° maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	As IESS-316, nominally 3dB better
Frequency Stability	<1ppm/yr
Harmonics	Better than -55dBc/ 4kHz in band
Spurious	Better than -55dBc/ 4kHz in band
Transmit On/Off Ratio	55dB minimum

Demodulator	
Input Range	Minimum: -130+10 log (symbol rate) Maximum: -80+10 log(symbol rate)
Maximum Composite Signal	+10dBm
Wanted-to-composite Level	-102+10 log (symbol rate)
Frequency Sweep Width	±1kHz to ±32kHz up to 10 Msps (1kHz steps) ±10kHz to ±250kHz above 10 Msps (10kHz steps)
Acquisition Threshold	<5dB Es/No QPSK
Acquisition Time	Dependent on FEC, data rate and sweep width (e.g. at 9.6kbps, less than 1s at 6dB Es/No QPSK; at 10Mbps, less than 100ms at 6dB Es/No QPSK)
Clock Tracking Range	±100ppm minimum
Receive Filter Roll-off	20%, 25%, 35%
Performance Monitoring	Eb/No (range 0-15dB, ±0.2dB) Frequency offset (100Hz resolution) Receive signal level Buffer fill status
AGC Output	Buffered direct AGC output for antenna tracking, etc. (requires Auxiliary Card option)

Forward Error Correction	
Modulation	DVB-S2 (Option): QPSK, 8PSK, 16APSK SCPC: BPSK, QPSK, OQPSK plus options for: 8PSK, 16QAM, FastLink 8QAM, FastLink 16APSK, FastLink 32APSK, FastLink 64QAM
FEC	DVB-S2 (LDPC/BCH) option: as per EN 302 307 - QPSK, 8PSK, 16APSK; rates 1/4 to 9/10 SCPC: Note BPSK and (O)QPSK provided as standard; other modulations are options FastLink Low-Latency LDPC option: BPSK 0.499 (O)QPSK 0.532, 0.639, 0.710, 0.798 8PSK/8QAM: 0.639, 0.710, 0.778 16APSK/16QAM: 0.726, 0.778, 0.828, 0.851 32APSK: 0.778, 0.828, 0.886, 0.938 64QAM: 0.828, 0.886, 0.938, 0.960 TPC option: BPSK 5/16, 21/44, 0.493 (Paradise), 2/3, 3/4, 0.789 (Paradise), 7/8 (Paradise), Rate 7/8 de facto (O)QPSK: 5/16, 21/44, 0.493 (Paradise), 2/3, 3/4, 0.789 (Paradise), 7/8 (Paradise), 7/8 de facto, 0.93 (Paradise) 8PSK: 3/4 de facto, 7/8 de facto, 0.93 (Paradise) 16QAM: 3/4 de facto, 7/8 de facto, 0.93 (Paradise)

Ethernet Traffic	
Throughput Performance	The maximum modem throughput depends on IP traffic format and the features enabled. Bridged IP/UDP data can be processed up to the modem maximum data rate. Please seek assistance from Paradise Datacom in evaluating your particular requirements.
Routing and Bridging	Bridging (standard). Static routing (standard). Dynamic routing option: RIP V1, V2; OSPF V2, V3; BGP V4
TCP Acceleration Option	Typical throughput level of 90% of link capacity. IP Traffic card option: Supports 5,000 concurrent accelerated TCP connection limit (plus at least 35,000 unaccelerated TCP connections) up to the modem maximum data rate. IP Traffic card includes HTTP Acceleration (reduces web page download times)
Header Compression Option	IP Traffic card option. Robust Header Compression to RFC 3095. Reduces Ethernet/IP/UDP/RTP header sizes typically by 90%. 1-way packet processing limit: 60,000 pps; 2-way limit: 45,000 pps. Includes Ethernet header compression (compresses 14-byte Ethernet frame to typically one byte)
Payload Compression Option	Uses Deflate algorithm (RFC 1951) to compress all TCP/IP packets (TCP and UDP), typically resulting in compression of payloads by 50%
Traffic Shaping Option	Provides guaranteed throughput levels for IP streams, using Committed Information Rate and Burst Information Rate settings. Stream differentiation is by IP address, IEEE 802.1p priority class, Diffserv DSCP class or MPLS EXP field
Encryption Option	Encrypts all IP traffic using AES with 256-bit keys
IPv6	Provided as standard. Dual IPV4/IPV6 TCP/IP stack allowing use of both IPV4 and IPV6 addresses for bridging and routing of traffic
VLAN Support	IEEE 802.1q VLAN support (standard) IEEE 802.1p Quality of Service (packet prioritisation) using strict priority or fair weighting queuing
DHCP, SNMP	DHCP (standard) for automatic allocation of M&C IP address. SNMP (standard) v1, v2c and v3
Web Server	Embedded web server M&C interface (standard)
IP Diagnostic Graphs	Shows Tx, Rx throughput (bps, pps); dropped, errored packet counts (standard)
Operating mode	Can be operated in standalone, 1:1 or 1:N redundancy configuration.
IP over DVB Encapsulation Option	Supports encapsulation/decapsulation of MPE, ULE and Paradise PXE
DVB-S2 ACM Option	Dynamically varies modcod with varying link conditions, maximising throughput at all times by converting unused link margin into additional throughput

Paired Carrier	
Paired Carrier	Transmit and receive carriers are overlaid on top of each other in the same space segment. Echo cancellation techniques are used in the demodulator to cancel the transmit carrier and extract the wanted receive carrier signal
Paired Carrier data rate options	512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps and 60Mbps traffic rate
Supported power asymmetry	-10dB to +10dB
Supported symbol rate asymmetry	Up to 12:1
Eb/No degradation	Typically < 0.5dB (0.7dB for 16QAM/16APSK with 10dB power asymmetry)
Mobile Operation	Uses GPS data to continually recalculate position relative to satellite, allowing uninterrupted operation in mobile environments (ships, etc.) anywhere in satellite footprint

Advanced ESC	
ESC/Aux Port (requires optional Auxiliary Card)	Provides high rate async ESC or Intelsat low rate async IBS ESC
Electrical Interface	IP, RS232, RS422 or RS485 (requires Auxiliary Card option)
Async ESC	Closed Net Plus ESC Overhead scales to any ESC baud rate from 0.5% to 70% of the main channel rate

DVB-S2 Performance at PER 1e-6											
Guaranteed Es/No (dB) for Normal (64k) frames											
	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	-1.6	-0.7	0.3	1.5	2.8	3.4	4.3	5.0	5.5	6.5	6.7
8PSK					6.4	7.2	8.5		9.8	11.0	11.3
16APSK						9.7	10.8	11.6	12.2	13.4	13.7

DVB-S2 Performance at PER 1e-6											
Guaranteed Es/No (dB) for Short (16k) frames											
	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	-1.3	-0.4	0.5	1.9	3.0	3.5	4.4	5.2	5.6	6.7	
8PSK					6.5	7.3	8.6		9.9	11.2	11.3
16APSK						9.8	11.1	11.7	12.3	13.5	

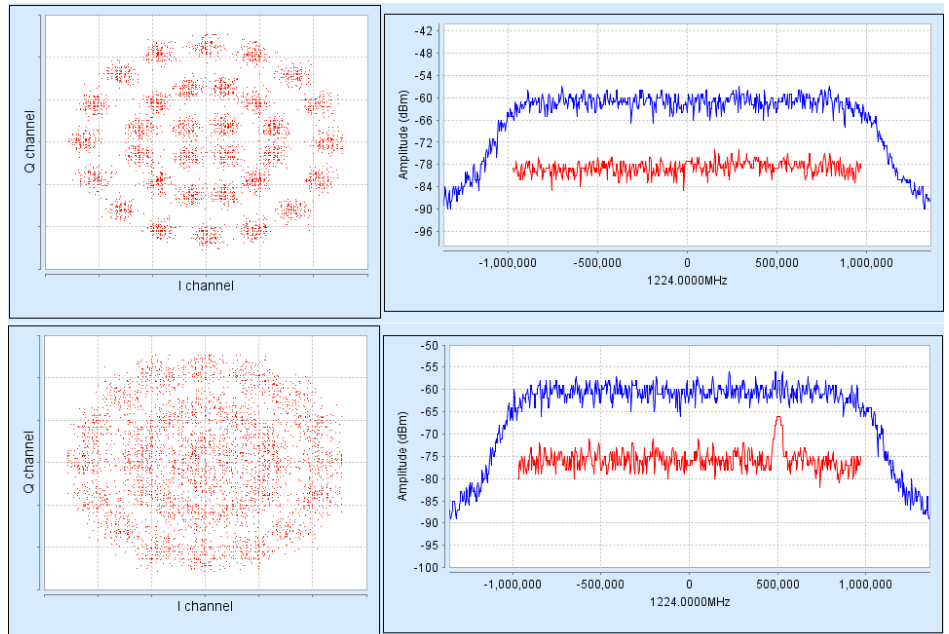
Guaranteed Eb/No BER Performance (dB)							
(Typical in brackets)							
		Rate 1/2	Rate 3/4	Rate 7/8	Rate 2/3	Rate 0.93	
Turbo (TPC) QPSK	1E-4	2.7 (2.4)	3.5 (3.2)	4.1 (3.8)			
	1E-6						6.3 (6.0)
	1E-8	3.3 (3.0)	4.5 (4.2)	4.5 (4.2)			6.8 (6.5)
Turbo (TPC) 8PSK	1E-4		5.6 (5.3)	6.8 (6.5)			
	1E-6						9.2 (8.9)
	1E-8		6.8 (6.3)	7.2 (6.8)			9.9 (9.6)
Turbo (TPC) 16QAM	1E-3		6.5 (6.2)	7.7 (7.4)			
	1E-6						10.0 (9.7)
	1E-7		7.8 (7.5)	8.2 (7.8)			
	1E-8						10.7 (10.4)

FASTLINK LOW-LATENCY LDPC: SEE SEPARATE DATASHEET

EZ BERT Option	
BER Channel	BERT operates over main traffic, ESC or Aux channels, allowing BER monitoring while on traffic. Not available in DVB-S2 mode
Test Patterns	PRBS 2 ^N -1: N=6, 7, 9, 11, 15, 19, 20, 23. All 1s, All 0s, alternate patterns, sparse patterns, QRSS, user-defined Compatible with common BER testers
Other test modes	Transmit CW (pure carrier) Transmit alternate 1-0 pattern

Mechanical/Environmental	
Size	Card: 255mm x 184mm Optional 1U half-rack chassis, 280mm deep, excluding front panel handles and rear panel connectors and fan
Weight	0.7kg
Power Supply	24 Volt DC input (not provided) Consumes 30 Watts
Safety Standards	EN60950-1
Emission and Immunity	EN55022 Class B (Emissions) EN55024 (Immunity)
Operating Temperature	0 to 50°C
Humidity	95% relative humidity, non-condensing
Compliance	FCC, CE and RoHS compliant
Alarm Relays	4 Independent Form C relays for unit, Tx, Rx and backward alarms (requires Auxiliary card)

Built-in Spectrum Analyser showing LinkGuard™ Signal-Under-Carrier interference detection without/with interferer present.



Fully configurable - only pay for what you need!

	Options	Description
Base Modem	✓	<p>4.8kbps to 2.048Mbps closed network modem with Ethernet 10/100/1000 BaseT RJ45s for M&C and traffic respectively (combined 100,000 packets per second processing capability); Ethernet bridge, static routing (IPv4 & IPv6) L-band operation for 950-2050MHz: high-stability 10MHz reference BPSK/QPSK/OQPSK (note: no FEC is provided as part of the base modem) Advanced ESC: Variable rate Async channel for Closed Net plus ESC operation AUPC: Automatic Uplink Power Control Web browser monitoring tools: Spectrum Display including LinkGuard™, Constellation Monitor and link performance versus time IEEE 802.1p QoS supporting choice of strict priority or fair weighting queuing; IEEE 802.1q VLAN support</p>
Data Rate Options		<p>5Mbps data rate: extends base operation to 5Mbps 10Mbps data rate: extends 5Mbps operation to 10Mbps 25Mbps data rate: extends 10Mbps operation to 25Mbps 60Mbps data rate: extends 25Mbps operation to 60Mbps</p>
IP Options		<p>Traffic Shaping: supports CIR/BIR/priority settings for IP streams classified by IP address, Diffserv class, IEEE 802.1p priority tag or MPLS EXP field Header Compression: IP/UDP/TCP/RTP packet header compression (RFC 3095) plus Ethernet header compression Payload Compression: TCP/UDP packet payload compression using the Deflate algorithm (RFC 1951) Encryption: TCP/IP packet payload encryption using AES with 256-bit keys Dynamic Routing: RIP, OSPF, BGP plus static routes Web Acceleration: acceleration of HTTP requests through pre-fetching of web page contents TCP Acceleration: to 10Mbps, subject to prevailing modem data rate limits TCP Acceleration: extends 10Mbps operation to 25Mbps, subject to prevailing modem data rate limits TCP Acceleration: extends 25Mbps operation to 60Mbps, subject to prevailing modem data rate limits DVB-S2 encapsulation: encapsulation of IP packets and Ethernet frames over DVB-S2 using Paradise eXtreme Protocol (PXE), MPE or ULE (requires DVB-S2 hardware option) DVB-S2 ACM: Transmit to 2Mbps - requires DVB-S2 hardware option (DVB-S2 ACM Rx to all data rates free subject to having DVB-S2-capable Rx modem) Extends DVB-S2 ACM Transmit to 5Mbps, subject to prevailing modem data rate limits Extends DVB-S2 ACM Transmit to 10Mbps, subject to prevailing modem data rate limits Extends DVB-S2 ACM Transmit to 25Mbps, subject to prevailing modem data rate limits Extends DVB-S2 ACM Transmit to 60Mbps, subject to prevailing modem data rate limits</p>
DVB-S2 Hardware Option (mounts above main card)		<p>DVB-S2 CCM Tx: DVB-S2 QPSK, 8PSK & 16APSK Tx operation per EN 302 307, subject to prevailing data rate limits DVB-S2 CCM Rx: DVB-S2 QPSK, 8PSK & 16APSK Rx operation per EN 302 307, subject to prevailing data rate limits</p>
FastLink Low-latency LDPC FEC <i>subject to prevailing modem data rate limits</i>		<p>FastLink LDPC hardware option (requires one or more additional FastLink options below); BPSK & QPSK provided as standard; also supports 8PSK, 8QAM, 16QAM, 32APSK & 64QAM subject to selection of these options; FastLink card mounts above main card FastLink LDPC up to 1Mbps (requires FastLink LDPC hardware option) Extends FastLink LDPC to 2.5Mbps Extends FastLink LDPC to 5Mbps Extends FastLink LDPC to 10Mbps Extends FastLink LDPC to 25Mbps Extends FastLink LDPC to 60Mbps 8QAM 16APSK 32APSK 64QAM</p>
8PSK		8PSK (requires either FastLink LDPC or 2nd Generation Turbo FEC option)
16QAM		16QAM (requires either FastLink LDPC or 2nd Generation Turbo FEC option)

Configuration options continue on next page.

Fully configurable - only pay for what you need!

Options	Description
Paired Carrier <i>Subject to prevailing modem data rate limits. Occupied bandwidth: minimum 30kHz; maximum 36MHz</i>	Paired Carrier hardware option (requires one or more additional Paired Carrier options below); allows carriers to be overlapped thereby reducing the required satellite bandwidth; Paired Carrier card mounts above main card
	Paired Carrier up to 512kbps (requires Paired Carrier hardware option)
	Extends Paired Carrier up to 1.024Mbps
	Extends Paired Carrier up to 2.5Mbps
	Extends Paired Carrier up to 5Mbps
	Extends Paired Carrier up to 10Mbps
	Extends Paired Carrier up to 15Mbps
	Extends Paired Carrier up to 20Mbps
	Extends Paired Carrier up to 25Mbps
	Extends Paired Carrier up to 30Mbps
	Extends Paired Carrier up to 40Mbps
	Extends Paired Carrier up to 50Mbps
Extends Paired Carrier up to 60Mbps	
Tx Only Option	Transmit functions only
Rx Only Option	Receive functions only
Auxiliary Card Option	Size: 168mm x 104mm; mounts above main card 9-way D type for 1:1 and 1:N, compatible with PDQS Standalone Redundancy Switch 15-way D type for alarms and AGC USB connector for software upgrades, etc. BNC connector for Station Clock Also alarm relays, transmit inhibit function, additional fan, Async ESC channel, AGC output for antenna pointing, FSK signalling
PRBS Tester	Internal Bit Error Rate Tester (for non-DVB-S2 operation only)
24V 100W BUC PSU	P3542 AC Input, 24V 100W DC to Tx BUC
48V 100W BUC PSU	P3541 AC Input, 48V 100W DC to Tx BUC
24V 200W BUC PSU	P3544 AC Input, 24V 200W DC to Tx BUC
48V 200W BUC PSU	P3543 AC Input, 48V 200W DC to Tx BUC
Low Rate TPC <i>10Mbps maximum. Subject to prevailing modem data rate limits</i>	Rates 5/16, 21/44, 3/4 in BPSK, QPSK, OQPSK Rate 7/8 in QPSK, OQPSK Rate 0.93 Paradise in QPSK, OQPSK Rates 3/4, 7/8, 0.93 Paradise in 8PSK (requires 8PSK option) Rates 3/4, 7/8, 0.93 Paradise in 16QAM (requires 16QAM option)
High Rate TPC <i>Extension to 60Mbps. Requires Low Rate TPC. Subject to prevailing modem data rate limits</i>	Rates 5/16, 21/44, 3/4 in BPSK, QPSK, OQPSK Rate 7/8 in QPSK, OQPSK Rate 0.93 Paradise in QPSK, OQPSK Rates 3/4, 7/8, 0.93 Paradise in 8PSK (requires 8PSK option) Rates 3/4, 7/8, 0.93 Paradise in 16QAM (requires 16QAM option)

Options	Description
Keypad/LCD display Option	Paradise standard front-panel membrane (local user interface) consisting of : LEDs that provide basic modem status; 3-line LCD display; alphanumeric keypad. The Q-Lite software will automatically detect and support the membrane when it is fitted.
Fan Option	Paradise standard modem fan: 20mm; 12V; 2.5W; 12.0 CFM; 65000 hour lifetime; second fan can be fitted using Auxiliary card
Half-rack Enclosure Option	Paradise 1U half-rack (half width of 19" rack) enclosure (depth 280mm). Supports RJ45 for IP, RF I/O via TNC connectors, 24V input connector. Due to size limitations, this enclosure does not support the fitting of any option cards, front-panel membrane or BUC PSU.

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