HI-BEAM Transceiver
DVB-S2 High-Speed Modem

- Low SWaP
- Near Gigabit Speed
- Environmentally Rugged

The Viasat Highly Integrated Bandwidth Efficient Advanced Modulation (HI-BEAM) two-way modem is designed to provide high-speed, standards-based communication in a low size, weight, and power (SWaP) environmentally sealed package.

The Viasat HI-BEAM modem is based on the Digital Video Broadcasting Satellite–Second Generation (DVB-S2) standard developed by the DVB Project and ratified by ETSI. Advanced Low Density Parity Check/Bose-Chaudhuri-Hocquenghem (LDPC/BCH) error correcting codes provide an advanced method of bit error recovery against non-ideal channel conditions.

Through the DVB-S2 supported modulations and code rates, the Viasat HI-BEAM modem is able to provide up to a 15 dB adjustment in signal level and a change in spectrum efficiency from 0.49 to 3.57 bits/Hz, providing optimal power and bandwidth utilization over a wide range of operating conditions.

A single FPGA is utilized to provide a maximum data throughput of 810 Mbps simultaneously in each direction with a maximum symbol rate of 300 Msym/sec per direction (QPSK/8PSK only). The Viasat HI-BEAM can be purchased in 50, 100, 200, or 300 Msym/sec maximum symbol rate variants. The modem can be upgraded from a lower symbol rate to a higher rate by a software update after your initial purchase. The Viasat HI-BEAM modem uses product key licensing to enable access to advanced features as well as higher symbol rates. You no longer need to send your modem back for reconfiguration or worry about software updates whenever you want new features. All you need to do is input your new product key into the web GUI and your new capabilities are unlocked instantaneously.

VIASAT HI-BEAM TRANSCEIVER AT-A-GLANCE

APPLICATIONS

Ideally suited for IP-centric applications where small size, weight, and power (SWaP) footprints are used in uncontrolled outdoor environments.

- Intelligence/Surveillance/Reconnaissance (ISR) data links
- Backbone connections for ground/airborne/satellite networks
- SCPC SATCOM links
- Wireless and mobile backhaul
- Terrestrial point-to-point trunking
- Point-to-multipoint broadcast services

Viasat's efficient DVB-S2 waveform implementation allows the HI-BEAM modem to achieve the highest data rates on a commercially available, single FPGA platform, making it ideal for low to high-speed data transmission applications. With an FPGA architecture, this modem can be upgraded to support new DVB extensions or enhancements as they mature.

ENVIRONMENTALLY RUGGED

Capable of outdoor operations and little to no environmental control or protection, this modem has been rigorously designed to operate on ground vehicles, littoral buoys, fixed masts and towers, as well as fixed-wing propeller aircraft and helicopters.

Using industrial grade components, the HI-BEAM modem is capable of operating from -20° to +60° C in ambient moving air and up to +70° C using a cold plate, allowing operating scenarios under a wide range of environmental conditions. The HI-BEAM modem has been qualified to MIL-STD-810F/G testing and FCC Class A Part 15 emissions testing by certified test laboratories.

ADVANCED TECHNOLOGY FEATURES (REQUIRES NRE)

The versatility of the FPGA platform allows implementation of new features and technology without having to respin the board. Technology that can be implemented includes:

- **Waveform Roll-Off factors of 5%, 10%, and 15%** By adding the new DVB-S2X roll-offs of 5%, 10%, and 15% to your modem, you can significantly increase your spectrum efficiency.
- **10 MHz External Reference** A high-quality 10 MHz reference output connector can be added to your modem for block upconverter use or global clock synchronization.
- **Higher Level Modulations** This feature adds 32APSK and 64APSK modulations to HI-BEAM for improved spectral efficiency. The FEC code rates included for these two modulations are 3/4, 4/5, 5/6, 8/9, and 9/10.
- **Lower Symbol Rates** The lowest symbol rate for a standard HI-BEAM is 1 Msps. This feature can lower that minimum symbol rate to 100 Ksps.
- **The Unidirectional Lightweight Encapsulation (ULE)** A data link protocol defined by the IETF (RFC 4326) for the transportation of network layer packets over MPEG transport streams. Because of the very low protocol overhead, it is especially suited for IP over Satellite services (where every bit counts).
- **The Multiprotocol Encapsulation (MPE)** A data link layer protocol defined by the ETSI (EN 301 192). It provides means to carry packet oriented protocols (like for instance IP and ULE) on top of MPEG Transport Streams (TS). Its flexibility to adapt to a number of packet oriented protocols makes it difficult to be bandwidth efficient.
- **Modulator Predistortion** The DVB-S2 standard is based on four modulations. The QPSK and 8PSK modulation schemes can be operated close to or at saturation, but 16APSK and 32APSK modulated signals show larger envelope variations and are more sensitive to channel impairments due to non-linearities present in the transmitter chain. The power efficiency of the latter modulations can be improved by introducing predistortion on the transmit data.
- **Transmitter Bandwidth Indication** This capability is useful for adaptive links where upstream traffic generators may benefit from having knowledge of the bandwidth of the datalink. The transmitter modem would feed back the current link bandwidth in MBps to your server application, allowing you to throttle or increase the data flow to match the link conditions.

OPTIONAL FEATURES

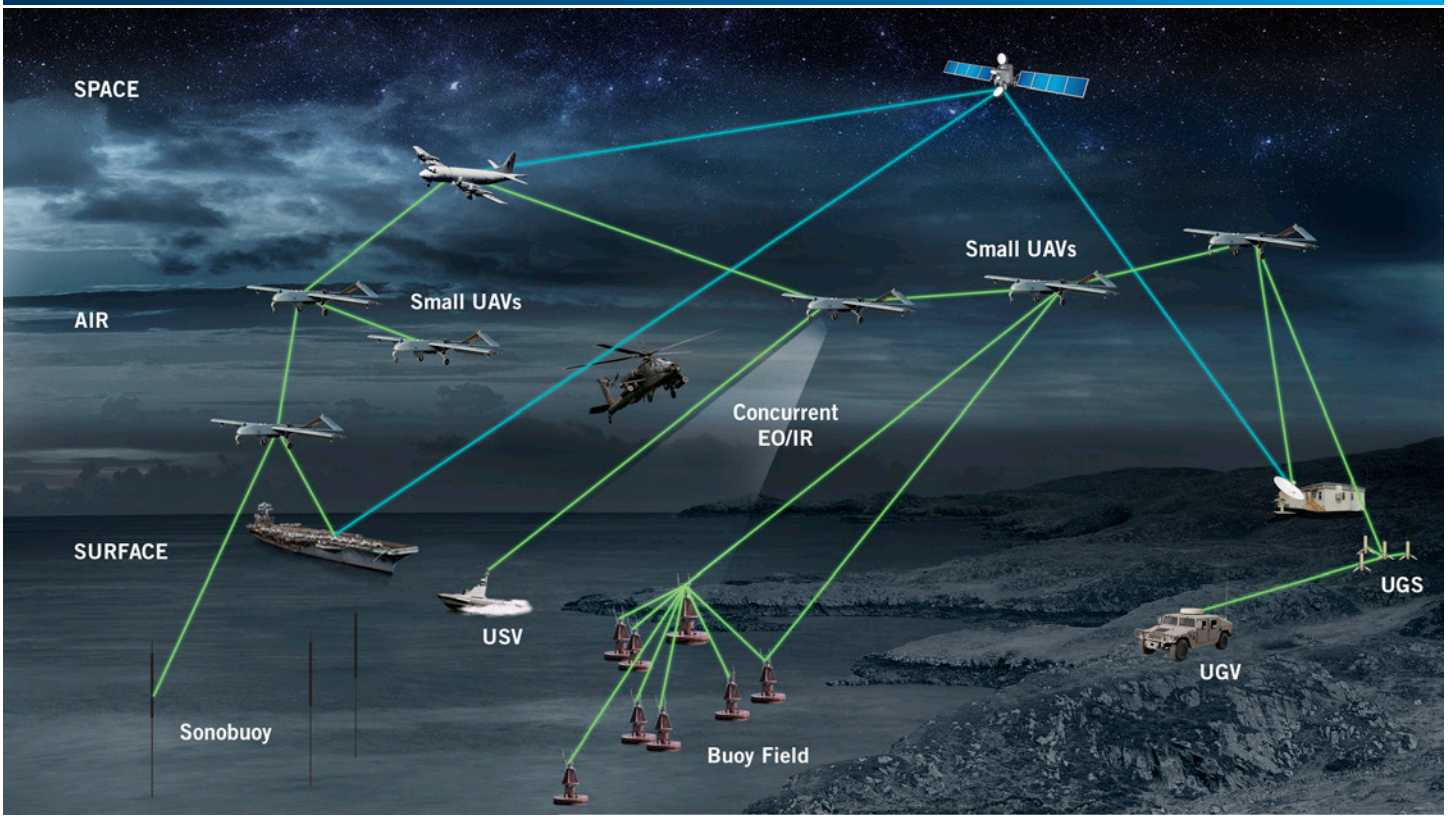
Optional features can be added to any Viasat HI-BEAM modem at any time by the use of our product key technology. By loading a new product key into the modem, you will be able to immediately unlock access to the following features.

- **Symbol Rate Upgrades** Do you eventually want a higher symbol rate but don't need it right away? Help keep your CAPEX costs lower initially and only buy a symbol rate upgrade when you need it.
- **Adaptive Coding and Modulation** When used between two HI-BEAM modems, the transmitter will adjust the modulation and code rate based on the received signal to noise ratio. This will optimize the link to ensure that the maximum amount of data can be transmitted per frame.
- **AES-256 TRANSEC Cover** Between two HI-BEAM modems, you can implement basic transport security over the air using our built-in hardware AES-256 encryption. The encryption key can be configured for both transmit and receive directions using either the web GUI or the SNMP interface.
- **Transport Bypass** This feature provides the entire baseband frame payload over the DATA port, useful for capturing the full content of the downstream carrier for later processing or analysis.
- **RSSI Antenna Pointing** If you need to know the current receiver link conditions, this feature will send periodic messages using TCP/IP to your server application with the relevant information. It is very helpful for assisted antenna pointing algorithms or as stimulus for a simplified ACM transmitter.

ENVIRONMENTAL—HI-BEAM CERTIFICATION TESTING

TEST	PARAMETER	METHOD/PROCEDURE	STANDARD
Low Pressure Altitude—Operating	60° C Chamber	500.5/Procedure II	MIL-STD-810G
Low Pressure Altitude—Operating	-20° C Chamber	500.5/Procedure II	
Storage High Temperature	85° C Chamber	501.5/Procedure I	
Storage Low Temperature	-40° C Chamber	502.5/Procedure I	
High Temperature—Operating	60° C Chamber	501.5/Procedure II	
Low Temperature—Operating	-20° C Chamber	502.5/Procedure II	
Vibration—Truck, Prop Aircraft, Helicopter	Category 4, 8, 9	514.6/Procedure I	
Humidity—Operating	Aggravated	507.5/Procedure II	
Blowing—Rain	No Ingress	506.5/Procedure I	
Blowing—Dust	No Ingress	510.4/Procedure I	MIL-STD-810F
Conducted Emissions	Emissions	Part 15 Subpart B	FCC Class A
Radiated Emissions	Emissions	Part 15 Subpart B	FCC Class A

Viasat HI-BEAM Transceiver



DVB-S2 PERFORMANCE

Viasat is a leader in high-performance LDPC/BCH decoders for DVB-S2 applications, enabling very high data rates in a single FPGA-based decoder. The following table describes the operating point in Es/No and Eb/No for all supported MODCOD combinations.

SOFTWARE MAINTENANCE

With the purchase of the annual software maintenance plan, you will have access to Viasat's biannual software releases that contain all bug fixes to the software and FPGA. For time critical or high reliability use of the modem, an additional level of maintenance will grant you access to monthly bug fixes. Time and Material critical fixes are also available.

FLEXIBLE FPGA ARCHITECTURE

The Viasat HI-BEAM DVB-S2 waveform implementation is entirely FPGA-based. The use of FPGA technology allows for the ultimate flexibility in supporting advanced capabilities, including the new DVB-S2 extensions now in development by various members of the DVB working group.

The architecture of the Viasat HI-BEAM modem platform lends itself to prototyping of new waveform and software features due to evolving communication standards or meeting critical customer requirements.

DVB-S2 PERFORMANCE (IF LOOPBACK, AWGN, PILOTS OFF)

		16K BLOCK SIZE			64K BLOCK SIZE		
Mod	LDPC Code Identifier	Special Efficiency	HI-BEAM Target (PER = 1e-6 or BER = 1e-9)		Spectral Efficiency	HI-BEAM Target (PER = 1e-6 or BER = 1e-9)	
		bits/sym	Es/No [dB]	Eb/No [dB]	[bits/sym]	Es/No [dB]	Eb/No [dB]
QPSK	1/4	0.37	-1	2.7	0.49	-0.9	2.2
QPSK	1/3	0.63	0.5	1.4	0.66	0.3	2.1
QPSK	2/5	0.76	1.5	1.5	0.79	1.2	2.2
QPSK	1/2	0.85	2.1	1.8	0.99	2.5	2.5
QPSK	3/5	1.16	3.9	2.3	1.19	3.7	2.9
QPSK	2/3	1.29	4.8	2.4	1.32	4.6	3.4
QPSK	3/4	1.42	5.8	2.9	1.49	5.5	3.8
QPSK	4/5	1.51	6.4	3.2	1.59	6.2	4.2
QPSK	5/6	1.6	6.9	3.6	1.65	6.7	4.5
QPSK	8/9	1.73	8	4.3	1.77	7.7	5.2
QPSK	9/10	N/A	N/A	N/A	1.79	7.9	5.4
8PSK	3/5	1.73	7.3	3.8	1.78	7	4.5
8PSK	2/3	1.92	8.2	4.4	1.98	8.1	5.1
8PSK	3/4	2.12	9.5	5.1	2.23	9.4	5.9
8PSK	5/6	2.38	11	6.0	2.48	10.9	7.0
8PSK	8/9	2.58	12.4	7.1	2.65	12.2	8.0
8 PSK	9/10	N/A	N/A	N/A	2.68	12.5	8.2
16APSK	2/3	2.55	10.7	5.5	2.64	10.5	6.3
16APSK	3/4	2.81	12	6.4	2.97	11.7	7.0
16APSK	4/5	2.98	12.7	6.8	3.17	12.5	7.5
16APSK	5/6	3.16	13.3	7.1	3.3	13.1	7.9
16APSK	8/9	3.42	14.6	8.1	3.52	14.4	8.9
16APSK	9/10	N/A	N/A	N/A	3.57	14.6	9.1

SPECIFICATIONS

INPUT/OUTPUT INTERFACES

IF Frequency	950 to 2150 MHz (Transmit and Receive)
Frequency Step Size	100 KHz
RF Connector	50 Ohm SMA
Receive Power Input Level	-65 to -132 dBm/Hz, integrated signal over spectrum bandwidth not to exceed -27 dBm
Transmit Power Output Level	-20 to -70 dBm
DC Input Power1	9 to 36 VDC
DC Power Consumption	37 W (Transmit and Receive at 135 Msym/sec)
Data Interface	Auto Switching 10/100/1000 Base-T Ethernet
Data Routing Mechanism	Ethernet Layer 2 Repeater
Control and Status Interface	Auto Switching 10/100 Base-T Ethernet Using Web-Based GUI
SNMP v2c Support	Yes
Data Encapsulation Method	Ethernet Frame Over Subset of Generic Stream Encapsulation (GSE)
IPv4 and IPv6 Support	Yes
GUI Control of Far-End Modem Settings	Yes
BER Measurement	Built-in PRBS Generator/Checker Computes Link BER
Maximum User Data Rate	810 Mbps (8PSK 9/10 to 300 Msym/sec

DVB-S2 WAVEFORM

Modulation	QPSK, 8PSK, 16APSK
Roll-off Factor	0.2, 0.25, 0.35
Symbol Rate	1 to 300 Msym/sec (QPSK and 8PSK) 1 to 200 Msym/sec (16APSK)
Symbol Rate Step Size	100 Ksym/sec
TX/RX Symbol Rate Configuration	TX/RX Independently Configurable
Code Rates	See Performance Table
FEC Block Size	64 or 16K
Receiver ACM/VCM Capable	Yes
Doppler Tolerance2	Varies
Minimum Bit Rate	500 Kbps (QPSK ¼)

PHYSICAL

Size (W x H x D)	10 x 6.6 x 1.5 in.
Weight	3.2 lb

NOTES

[1] Nominal operating voltage is 24 VDC

[2] Provide the modulations, code rate, minimum symbol rate, maximum Doppler frequency off-set (Hz), maximum Doppler rate of change (Hz/sec), FER requirement and phase noise mask at input to the receiver. Using this information, Viasat will determine if your Doppler requirements can be met by the basic HI-BEAM modem without change.

CONTACT

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