Viasat

The new standard in FDMA throughput and affordability, plus full backward compatibility

The US Government selected the Viasat MD-1366 Enhanced Bandwidth Efficient Modem (EBEM) to set the new standard (MIL-STD-188-165B/STANAG 4486 ed.3) for high-speed, high-performance, flexibility, and compatibility in a Single Channel Per Carrier (SCPC) modem. This modem uses the latest advanced modulation and coding technology, while also providing backwards interoperability with the majority of existing SCPC modems. It supports a large range of user data rates, from 64 Kbps up to 155 Mbps, and provides power and bandwidth efficiency with 16-ary modulation and Turbo coding. In addition to the requirements defined in MIL-STD-188-165B/STANAG 4486 ed. 3, the MD-1366 also supports simplex and point-to-multipoint TRANSEC and low-latency antenna handover.

The Viasat MD-1366 provides a selectable adaptive coding and modulation mode that automatically adjusts modulation and code rates (while maintaining the symbol rate) matched to channel conditions—preserving link margin while combating rain-fades or other channel impairments.

The optional Ethernet Service Expansion Module (ESEM) is a plug-in module providing an Ethernet data interface for the modem, allowing the modem to support existing and future Ethernet based protocols: IPv4, IPv6, MPLS and non-IP data flows. When in Turbo-coded mode, the ESEM enables a new logical data channel, which carries encapsulated Ethernet framed packets over the satellite link. The ESEM packet stream can be used in conjunction with existing fixed serial rate data streams.

The internal AES encryption algorithms can be used in lieu of external TRANSEC devices in government installations. The Viasat MD-1366 provides encryption intended to protect sensitive, but unclassified data. Featuring Federal Information Processing Standard (FIPS) 197 Advanced Encryption Standard (AES) with 256-bit cipher key, the modem is NIST certified at Security Level 2 as described in FIPS PUB 140-2. AES-256 bulk encryption (TRANSEC) of all over-the-air data channels for Turbo-coded modes includes: serial user data, Ethernet user data, overhead data, and embedded data channels. Encryption and decryption operate over the entire data rate range with minimal additional delay. Encryption is disabled for backward compatibility with legacy waveforms: OM-73, MIL-STD-165A, IESS-308, 309, and 310. Encryption can be operated in full-duplex, simplex, and point-to-multipoint configurations.

The Viasat EBEM comes in a standard strategic configuration (MD-1366/U) and a tactical configuration (MD-1366A/U) that is housed in a ruggedized chassis to support antenna handover mode when dual-antennas are required.

MD-1366 EBEM AT-A-GLANCE

Highlights

» Available in Strategic MD-1366/U or Tactical MD-1366A/U configurations
» The only fully-compliant MIL-STD-188-165B/ STANAG 4486 ed.3 modem
» NIST-certified (FIPS 140-2) AES-256 TRANSEC encryption
» Industry-leading advanced modulation and Turbo coding
» Flexibility, interoperability, and bandwidth efficiency in a 1U-high, 19 in. rack mount
» Data rates from 64 Kbps to 155 Mbps (Symbol rates from 32 Ksps to 60 Msps)
» BPSK, QPSK, OQPSK, 8-PSK, 16-APSK
» Versatile IF (selectable 70 MHz, 140 MHz, L-band)
» IESS-310 Trellis Coded Modulation (TCM), Viterbi, and Reed-Solomon decoders
» Information Throughput Adaptation (165B STANAG 4486 ed. 3 waveforms) chooses the optimal modulation and code rate for changing conditions
» Automatic Transmit Power Control algorithm and Transmit Power Inhibit capability (165B STANAG 4486 ed.3 waveforms)
» Built-in test features
» Control and Monitoring: Front panel, SNMP v1, and v3, 32- and 64-bit Windows® XP and 7 GUI, or command line interface (Ethernet or serial)

Unique Features

» Selectable adaptive coding and modulation mode
» AES-256 bulk encryption of all over-the-air data (165B/STANAG 4486 ed.3 waveforms) eliminates the need for a separate inline network encryptor
» Automated session key generation and distribution, seamless session key rollover and self-synchronization
» Seamless and low-delay antenna handover capabilities in tactical configuration
» Performance in Ka-band shipboard Doppler environments
» Monitor Status of Distant/Remote EBEM modem
» Adaptive Equalization (16-APSK modulation)

IP-Capable with Ethernet Data Interface (Optional)

» ESEM provides over-the-air packet data channel (165B/STANAG 4486 ed.3 waveforms)
» Single Gigabit Ethernet Interface (10/100/1000BASE-T)
» Supports PPPoE with credit extension (RFC 4938)
» Supports Emission Control (EMCON) operation

Interoperability

» Modems: OM-73, MD-1352/BEM-7650, SLM-3650, MD-1340, MD-1030
» Standards: MIL-STD-188-165A/B, STANAG 4486 ed.3, IESS-308, IESS-309, IESS-310
» User Data Interfaces: TIA/EIA-530, NSA 87-20B, TIA/EIA-612/613(HSSI)
» Overhead Data Interfaces: TIA/EIA-422A

SPECIFICATIONS

INTERMEDIATE FREQUENCIES

70 MHz IF Range	52 to 88 MHz in 1-kHz steps
140 MHz IF Range	104 to 176 MHz in 1-kHz steps
L-band IF Range	950 to 2000 MHz in 1-kHz steps

REFERENCES

External Modem Reference Input	1, 5, 10 MHz or Internal

MODULATIONS, DATA RATES & SCRAMBLING

Binary Phase Shift Keying (BPSK)[1,2]	64 Kbps to >60 Mbps
Quadrature Phase Shift Keying (QPSK)[1,2]	64 Kbps to >120 Mbps
Offset Quadrature Phase Shift Keying (OQPSK)[1,2]	64 Kbps to >120 Mbps
8-ary Phase Shift Keying (8-PSK)[1,2]	256 Kbps to >155 Mbps
16-ary Amplitude Phase Shift Keying (16-APSK)[2]	256 Kbps to >155 Mbps
Symbol Rate	32 Ksps to >60 Msps
Scrambling[1,2]	Synchronous, Asynchronous or None
Differential Encoding/Decoding[1]	MIL-STD-188-165A or None

FEC CODING

165B/STANAG 4486 (Turbo) FEC Rates[2]	1/2, 2/3, 3/4, 7/8, 19/20
Convolutional Encoding & Viterbi Decoding (CEVD) Rates[1]	1/2, 3/4, 7/8
Trellis Coded Modulation (TCM) Rates[1]	2/3, 3/4, 7/8
CEVD and Reed-Solomon(RS) Concatenated[1]	CEVD inner with RS outer
TCM and Reed-Solomon (RS) Concatenate[1,2]	TCM inner with RS outer
Reed-Solomon Outer Rates[1]	RS(126, 112), RS(225, 205), RS(219, 201), RS(194, 178), RS(208, 192)
Uncoded[1]	1/1

MODULATION

IF Output Power	+10 to -35 dBm, in 0.01 steps
Output Connectors	TNC for 70/140 MHz, N-Type for L-band, 50 Ohms
Carrier Mode	Modulated or CW
Clock Mode	Internal, TX Terrestrial, or Data Source Sync

DEMODULATION

IF Input Power	+10 dBm to minimum of -141 dBm/Hz or -82 dBm (typical)
Input Connectors	TNC for 70/140 MHz, N-Type for L-band, 50 Ohms
Acquisition Range	-30,000 to +30,000 Hz
Buffer Clock	Derived from Modem Reference (INT, EXT), RX SAT or TX Terrestrial
Buffer Size	0 to 2,000,000 bytes, selectable

BUILT-IN TESTS

» **Built-In Tests** Programmable BIT test modes, alarm, fault, and status reporting, IF Loopback, Baseband Loopback, BERT pattern generation including Mark, Space, 1:1, 1:3, 2047, 2E(15-1), and 2E(23-1), block and bit error counting and BER data

» **Eb/No** Internal AWGN generation, 0 to 20 dB Eb/No over -35 to -5 dBm output power

» **Alarm Interface** Reported via DB-9 (F), FORM C relay contacts for equipment alarm events

ANTENNA HANDOVER (TACTICAL CONFIGURATION)

» 0 to 110 ms Ship-to-Shore Interruptions

» 0 to 1 µs Shore-to-Ship Interruptions

» Supports BPSK, QPSK, and 8-PSK Turbo-like Coded Waveforms

» 64 Kbps to 50 Mbps in both Ship-to-Shore and Shore-to-Ship Antenna Handover modes

» Seamless Antenna Handover Mode for error-free handovers

» Low-Delay Antenna Handover Mode for low-latency handovers

HARDWARE

Universal Power Input	100 to 240 VAC, 50/60 Hz, 1.0 to 0.5 A
Mounting	1U-high 19 in. rack
Dimensions (W x H x D)	19 x 1.75 x 17 in.
Weight	<10 lb (Strategic), <12 lb (Tactical)
Operating Temperature	0° to >50° C up to 8,000 ft
Storage Temperature	-40° to >60° C
Humidity	<30% operational, <70%, non-condensing
Shock	MIL-S-901D, Class I, Grade A, Type B (Tactical)
Safety Compliance	CB Scheme, CE Marking Low Voltage Directive (LVD), NRTL Marking (USA, Canada), IEC/EN/UL/CSA 60950-1 2nd Edition
Electromagnetic Compatibility (EMC)	FCC Class B, CE Marking EMC Directive, CISPR 22 (EN 55022), CISPR 24 (EN 55024)
Environmental Compliance	REACH, WEEE
Mean Time Between Failure	40,000 hr

16-APSK TURBO EB/NO VS.BER PERFORMANCE[3]					
BER	1/2	2/3	3/4	7/8	19/20
10⁻⁶	4.00	5.75	6.50	8.00	9.60
10⁻⁸	4.15	5.85	6.60	8.10	9.85

8-PSK TURBO EB/NO VS. BER PERFORMANCE[3]					
BER	1/2	2/3	3/4	7/8	19/20
10⁻⁶	2.90	4.45	5.30	6.65	8.35
10⁻⁸	3.05	4.60	5.45	6.75	8.45

QPSK/OQPSK TURBO EB/NO VS. BER PERFORMANCE[3]					
BER	1/2	2/3	3/4	7/8	19/20
10⁻⁶	1.50	2.50	2.95	3.85	5.50
10⁻⁸	1.55	2.60	3.05	3.90	5.65

BPSK TURBO EB/NO VS. BER PERFORMANCE[3]					
BER	1/2	2/3	3/4	7/8	19/20
10⁻⁶	1.40	2.15	2.75	3.85	5.20
10⁻⁸	1.45	2.25	2.85	3.95	5.35

16-APSK TCM EB/NO VS. BER PERFORMANCE[5]				
BER	TCM 3/4	TCM 7/8	3/4 w/ RS	7/8 WITH RS
10⁻⁶	6.40	10.60	6.85	8.15
10⁻⁸	6.50	12.30	7.05	8.35

BPSK, QPSK & OQPSK EB/NO VS. BER PERFORMANCE[4]					
BER	CEVD 1/2	CEVD 3/4	CEVD 7/8	CEVD w/ RS 1/2	CEVD w/ RS 3/4
10⁻⁶	5.10	6.10	6.95	2.70	3.65
10⁻⁸	6.30	6.25	8.20	2.90	3.85

8-PSK TCM EB/NO VS. BER PERFORMANCE[4]		
BER	TCM R = 2/3	TCM R = 2/3 w/ RS
10⁻⁶	8.05	4.85
10⁻⁸	9.45	5.10

NOTES

1 In accordance with MIL-STD-188-165A, IESS-308, IESS-309 and IESS-310

2 In accordance with MIL-STD-188-165B and STANAG 4486 ed.3

3 MIL-STD-188-165B/STANAG 4486 ed; Turbo Modes at data rates >4 Mbps; Worst case performance 0.6 to 1.6 dB higher.

4 MIL-STD-188-165A and IESS-308, IESS-309, IESS-310 modes; Worst-case performance 0.8 to 2.1 dB higher.

5 MIL-STD-188-165B/STANAG 4486 ed; 16-APSK/TCM modes; Worst case performance 0.9 to 5.8 dB higher.