The Commercial Enhanced Bandwidth Efficient Modem (EBEM) 500 and 500R from ViaSat sets the standard for high-speed, high-performance, flexibility and compatibility in a Single Channel Per Carrier (SCPC) modem (STANAG 4486 ed. 3). The EBEM incorporates the latest advanced modulation and coding technology, while providing backwards interoperability with the majority of existing SCPC modems. The modem offers optimal power and bandwidth efficiency with 16-ary modulation and Turbo-coding. It supports a large range of user data rates, from 64 kbps up to 155 Mbps.

The EBEM 500 has a selectable adaptive coding and modulation mode that automatically adjusts modulation and code rates, while maintaining the symbol rate. It matches channel conditions to preserve link margin while combating rain-fades or other channel impairments. This feature is perfect for GSM/LTE back-haul applications where maximizing throughput via channel efficiency is essential.

The optional plug-in Ethernet Service Expansion Module (ESEM) provides a data interface for the modem to support existing and future Ethernet based protocols: IPv4, IPv6, MPLS and non-IP data flows. When the EBEM is in a 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 EBEM is approved to use its internal Advanced Encryption Standard (AES) algorithms in lieu of external TRANSEC devices. The EBEM 500 uses encryption to further protect sensitive user data. Featuring Federal Information Processing Standard (FIPS) 197 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 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 of 64 kbps to 155 Mbps with minimal additional delay. Encryption is disabled for backward compatibility with legacy waveforms: Intelsat Earth Station Standards (IESS) 308, 309 and 310.

The EBEM 500R includes the same features as the EBEM 500 and is housed in a ruggedized chassis for environments such as cruise ships, oil platforms, or other applications where harsh operating environments exist.
SPECIFICATIONS

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

**REFERENCES**
- External Modem Reference Input: 1, 5, 10 MHz or Internal

**MODULATIONS, DATA RATES & SCRAMBLING**
- Binary Phase Shift Keying (BPSK)\(^1\) 64 kbps to >60 Mbps
- Quadrature Phase Shift Keying (QPSK)\(^1\) 64 kbps to >120 Mbps
- Offset Quadrature Phase Shift Keying (OQPSK)\(^1\) 64 kbps to >120 Mbps
- 8-ary Phase Shift Keying (8-PSK)\(^1\) 256 kbps to >155 Mbps
- 16-ary Amplitude Phase Shift Keying (16-APSK) 256 kbps to >155 Mbps
- Symbol Rate: 32 kbps to >60 Mbps
- Scrambling\(^1\): Synchronous, Asynchronous or None
- Differential Encoding/Decoding\(^1\)

**FEC CODING**
- STANAG 4486 (Turbo) FEC Rates\(^1\)
  - 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) Concatenated\(^1\)
  - 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 0.25 dB 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 -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 Modern 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

**NOTE**
- \(^1\) In accordance with STANAG 4486 ed. 3, IESS-308, IESS-309, and IESS-310.
- \(^2\) STANAG 4486 ed. 3, Turbo Modes at data rates >4 Mbps; Worst case performance 0.6 to 1.6 dB higher.
- \(^3\) IESS-308, IESS-309, IESS-310 modes; Worst case performance 0.8 to 2.1 dB higher.
- \(^4\) STANAG 4486 ed. 3, 16-APSK/TCM modes; Worst case performance 0.9 to 5.8 dB higher.

**SEAMLESS ANTENNA HANDOVER FOR MARITIME (500R CONFIGURATION)**
- Up to 50, 80, 90, 100, 110 ms Ship-to-Shore Interruptions
- Up to 1 µs Shore-to-Ship Interruptions
- Supports BPSK, QPSK, and 8-PSK Turbo-like Coded Waveforms
- Ship-to-Shore 64 kbps to 10 Mbps in Antenna Handover mode
- Shore-to-Ship 64 kbps to 30 Mbps in Antenna Handover mode

**HARDWARE**
- Universal Power Input: 100 to 240 VAC, 50/60 Hz, 1.0 to 0.5 A
- Mounting: 1U-high 19-inch rack
- Dimensions (WxHxD): 19 x 1.75 x 17 in.
- Weight: <10 lb (Strategic), <12 lb (500R)
- Operating Temperature: 0° to >50° C Sea Level (500)
- Storage Temperature: -40° to >60° C
- Humidity: <30%
- Non-condensing: <70%
- Shock: MIL-S-901D, Class I, Grade A, Type B (500R)
- 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), REACH, WEEE

**16-APSK TURBO EB/NO VS. BER PERFORMANCE\(^2\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>1/2</th>
<th>2/3</th>
<th>3/4</th>
<th>7/8</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>4.00</td>
<td>5.75</td>
<td>6.50</td>
<td>8.00</td>
<td>9.60</td>
</tr>
<tr>
<td>10^9</td>
<td>4.15</td>
<td>5.85</td>
<td>6.60</td>
<td>8.10</td>
<td>9.85</td>
</tr>
</tbody>
</table>

**8-PSK TURBO EB/NO VS. BER PERFORMANCE\(^2\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>1/2</th>
<th>2/3</th>
<th>3/4</th>
<th>7/8</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>2.90</td>
<td>4.45</td>
<td>5.30</td>
<td>6.65</td>
<td>8.35</td>
</tr>
<tr>
<td>10^9</td>
<td>3.05</td>
<td>4.60</td>
<td>5.45</td>
<td>6.75</td>
<td>8.45</td>
</tr>
</tbody>
</table>

**QPSK/QOQPSK TURBO EB/NO VS. BER PERFORMANCE\(^2\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>1/2</th>
<th>2/3</th>
<th>3/4</th>
<th>7/8</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>1.50</td>
<td>2.50</td>
<td>2.95</td>
<td>3.85</td>
<td>5.50</td>
</tr>
<tr>
<td>10^9</td>
<td>1.55</td>
<td>2.60</td>
<td>3.05</td>
<td>3.90</td>
<td>5.65</td>
</tr>
</tbody>
</table>

**BPSK TURBO EB/NO VS. BER PERFORMANCE\(^2\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>1/2</th>
<th>2/3</th>
<th>3/4</th>
<th>7/8</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>1.40</td>
<td>2.15</td>
<td>2.75</td>
<td>3.85</td>
<td>5.20</td>
</tr>
<tr>
<td>10^9</td>
<td>1.45</td>
<td>2.25</td>
<td>2.85</td>
<td>3.95</td>
<td>5.35</td>
</tr>
</tbody>
</table>

**16-APSK TCM EB/NO VS. BER PERFORMANCE\(^4\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>TCM 3/4</th>
<th>TCM 7/8</th>
<th>3/4 w/ RS</th>
<th>19/20 w/ RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>6.40</td>
<td>10.60</td>
<td>6.85</td>
<td>8.15</td>
</tr>
<tr>
<td>10^9</td>
<td>6.50</td>
<td>12.30</td>
<td>7.05</td>
<td>8.35</td>
</tr>
</tbody>
</table>

**BPSK, QPSK & OQPSK EB/NO VS. BER PERFORMANCE\(^3\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>CEVD 1/2</th>
<th>CEVD 3/4</th>
<th>CEVD 7/8</th>
<th>CEVD w/ RS 1/2</th>
<th>CEVD w/ RS 3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>5.10</td>
<td>6.10</td>
<td>6.95</td>
<td>2.70</td>
<td>3.65</td>
</tr>
<tr>
<td>10^9</td>
<td>6.30</td>
<td>6.25</td>
<td>8.20</td>
<td>2.90</td>
<td>3.85</td>
</tr>
</tbody>
</table>

**B-PSK TCM EB/NO VS. BER PERFORMANCE\(^3\)**

<table>
<thead>
<tr>
<th>BER</th>
<th>TCM R = 2/3</th>
<th>TCM R = 2/3 w/ RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^6</td>
<td>8.05</td>
<td>4.85</td>
</tr>
<tr>
<td>10^9</td>
<td>9.45</td>
<td>5.10</td>
</tr>
</tbody>
</table>

**CONTACT**

SALES
TEL 888 842 7281 (US Toll Free)  FAX +1 760 683 6815  EMAIL insidesales@viasat.com  WEB www.viasat.com

Copyright © 2013 ViaSat, Inc. All Rights Reserved. AcceleNet, and the AcceleNet logo are trademarks or registered trademarks of ViaSat, Inc. All other trademarks mentioned are the sole property of their respective companies.
Specifications and availability are subject to change without notice. 028-131204-009