Product Features

- Direct RF output from 470 to 860 MHz in 1 Hz steps
- Power Amplifier provides 2 Watt output for broadcast of digital waveforms
- SFN and MFN Support
- Adaptive Non-linear Pre-corrector
- Manual Linear and Non-linear Digital Pre-correctors
- GbE Transport Stream Input based on Pro-MPEG Forum CoP #3 / SMPTE 2022
- Interfaces for Web GUI, SNMP and Telnet remote control, machine to machine interface and software upgrades
- Occupies only 1 RU of standard 19” cabinet space

New Features

DVB-T2
Supports all DVB-T2 modulation features including T2-MI interface support, single and multiple Physical Layer Pipes (PLPs), MFN/SFN operation and SISO/MISO transmission.

Optional Features

- Internal GPS or GPS/GLONASS Receiver
- Integrated DVB-S/S2 Receiver
- Adaptive Linear and Non-linear Digital Pre-correctors
- Optional RF Output: 40 MHz to 1 GHz, DAB Band III

Standards Supported

- ATSC and ATSC-M/H compliant with A/53, A/54, A/64, A/110 and A/153
- ISDB-T/Ts compliant with ARIB STD-B31, ARIB STD-B10, ABNT NBR 15601:2007, SBTVD N01 and SBTVD N03
- DVB-T/H and DVB-T2 compliant with ETSI standards
- DVB-SH(A) and DVB-SH(B) compliant with ETSI standards
- DAB, DAB+ and T-DMB compliant with ETSI DAB standards and EU147
- CMMB compliant with GY/T 220.1-2006 and 220.2-2006
- DTMB compliant with GB20600-2006 and GY/T 229.1-2008
2 Watt Universal Modulator
Model: DVU 5000A

Description and Application

Overview
The UBS Universal Modulator Series utilizes the innovative UBS Universal Waveform engine, supporting all world digital standards for terrestrial broadcasting, including hybrid satellite/terrestrial systems.

The modular, state of the art design allows transmitter manufacturers and network operators to integrate the DVU 5000A into a system/network with relative ease. This open architecture design enables carriers to take advantage of a proven, robust platform while designing networks to meet current and future broadcast standards.

The Universal Modulator can be factory configured with the necessary hardware to support one, two or all the waveforms listed above. The user can easily switch from one waveform to another through software selection. UBS' modulators can also be upgraded in the field as standards evolve.

Using the latest technology, UBS has developed a direct conversion process that allows the Universal Modulator to provide an RF output from 470 MHz to 860 MHz with a power level up to 2 Watt. Note: Other frequencies available.

This series incorporates all of UBS high performance signal processing stages including integrated linear and non-linear pre-correctors. Full remote management and control as well as remote firmware and waveform upgrades are provided.

Signal Inputs
The DVU 5000A is provided with two serial DVB-ASI inputs and two serial G.703/G.704 inputs. The DVB-ASI inputs accept a MPEG-2 TS, a CMMB multiplex stream or an ISDB-T/TB multiplexed TS. The G.703/G.704 inputs are used in DAB mode and accept either NA or NI signals. Optionally, two serial SMPTE-310M inputs can be installed.

The DVU 5000A also support a GbE Transport Stream input based on Pro-MEG CoP #3 / SMPTE 2022 protocol (DAB and DVB-T2 excluded). The DVB-ASI, G.703/G.704 and SMPTE-310M inputs can be automatically selected, or assigned by the user. The automatic switching provides near seamless switching to a secondary transport stream in case the primary transport stream source fails (a truly valuable feature for broadcast applications.)

RF Output
The standard RF output covers a frequency range of 470 to 860 MHz, in 1 Hz steps with an adjustable output power level from 23 to 33 dBm, in 0.1 dB steps. The user can set the spectrum polarity to Inverted or Non-inverted as required.

Optionally, the modulator can be configured with a 40 MHz to 1 GHz output or a DAB Band III output.

Adaptive Non-linear Pre-corrector
The Adaptive Non-linear Pre-corrector is a superior pre-distortion solution that compensates for RF Power Amplifier non-linearities including AM/AM and AM/PM distortion and protects against IMD and spectral regrowth while maximizing EVM performance.

The complex signal processing is done in the RF domain and supports a fully adaptive operation: the feedback signal (HPA output) is compared to the modulator's RF output signal (HPA input) in order to optimize the correction which will improve the shoulders of the RF output.

The Adaptive Non-Linear Pre-Corrector is not recommended for satellite uplink applications as it can only correct for the signal distortion from the ground-based transmitter and not the full signal path distortion. The Manual Pre-Corrector can be configured for the full system path.

Note: The Adaptive Non-linear Pre-corrector only supports a frequency range of 470 MHz to 860 MHz.

Manual Linear and Non-linear Digital Pre-correctors
The manual linear and non-linear digital pre-correctors are used to maximize the performance of the transmitter in which the modulator is installed.

• The Non-linear pre-corrector balances out gain and phase non-linearity in the transmitter RF power amplifier, thereby significantly reducing the in-band and out of band intermodulation products. Optimizing the transmitter’s performance will extend the coverage area. The performance requirement of the transmitter output filter, which is used to suppress radiation in adjacent channels below a maximum allowed level, will also be eased.

• The Linear pre-corrector balances out level and group delay variations that are seen across the channel bandwidth and caused by the transmitter mask filter and/or channel combiner filters. The linear optimization of the transmitter’s radiated signal allows the receiver’s channel equalizer to focus all of its correction capacity on level and group delay errors originating from the actual transmission path.
Description and Application

Web Interface
This feature allows remote control of the DVU 5000A via Ethernet interface and is based on an internal Web server. The Web pages stored on the Web server are designed as a complete graphical user interface (GUI) for testing the status and setting the parameters of the modulator. The Web Interface concept is popular because remote control with this system only requires a standard computer with a network interface card (NIC) and a Web browser (Microsoft Internet Explorer, Firefox, etc.).

SNMP Client
This feature allows remote control of the DVU 5000A in accordance with the SNMP protocol (Get, Set and SNMP traps). This remote control feature is intended for systems solutions where it is desired to integrate the control of a range of SNMP compliant equipment in a common management system.

Optionally, the DVU 5000A RS232 interface can be dedicated for communication with a 3rd party UPS. In this case, the modulator is configured with an extra set of SNMP parameters and will actively monitor the UPS.

Product Specifications | Signal Processing

**CMMB Mode**
- **FFT Mode**: 4K
- **Guard Interval**: 1/8
- **Code Rate (LDPC)**: 1/2, 3/4
- **Constellation**: BPSK, QPSK, 16-QAM
- **Byte Interleave**: Mode 1, Mode 2, Mode 3
- **Reed Solomon Coding**: RS(240,240); RS(240, 224); RS(240,192); RS(240,176)
- **Scrambling Modes**: 0, 1, 2, 3, 4, 5, 6, 7
- **Number of Time Slots**: 40
- **Number of simultaneous multiplexed frames**: 40
- **Network Mode**: SFN and MFN
- **Bandwidth**: 8 MHz
- **Transmission Time delay**: Adjustable, range: ±500 ms, step 100 ns
- **Input**: CMMB Multiplex Stream or GbE TS
- **Time Information Input**: RS232 serial port for GPS TOD Information

**DTMB Mode**
- **FFT Mode**: 3780, Single Carrier
- **Guard Interval**: 945, 595, 420 symbols
- **Code Rate**: 0.4, 0.6, 0.8
- **Constellation**: QPSK, 4QAM-NR, 16-QAM, 32-QAM, 64-QAM
- **Frame Duration**: 500 us, 666.67 us or 571.43 us
- **Sub-carrier Spacing**: 1.5 kHz, 1.75 kHz, 2 kHz
- **Time Interleaver**: 240, 720 symbols
- **Network Mode**: SFN and MFN
- **Bandwidth**: 8 MHz, 7 MHz, 6 MHz
- **Input**: MPEG-2 Transport Stream or GbE TS
2 Watt Universal Modulator
Model: DVU 5000A

Product Specifications | Signal Processing

**DVB-T/H Mode**
- **FFT Mode**: 2k, 4k, 8k
- **Guard Interval**: 1/4, 1/8, 1/16, 1/32
- **Code Rate**: 1/2, 2/3, 3/4, 5/6, 7/8
- **Constellation**: QPSK, 16-QAM, 64-QAM
- **Hierarchical Mode**: Alpha - 1, 2 and 4 for 16-QAM and 64-QAM
- **Network Mode**: SFN and MFN
- **Bandwidth**: 8 MHz, 7 MHz, 6 MHz, 5 MHz
- **Input**: MPEG-2 Transport Stream or GbE TS

**ATSC Mode**
- **Supported Mode**: 8VSB, M/H
- **Network Mode**: SFN and MFN
- **Bandwidth**: 6 MHz
- **Input**: MPEG-2 Transport Stream, SMPTE-310M or GbE TS

**ISDB-T/Tb Mode**
- **FFT Mode**: 2k, 4k, 8k
- **Guard Interval**: 1/4, 1/8, 1/16, 1/32
- **Code Rate**: 1/2, 2/3, 3/4, 5/6, 7/8
- **Constellation**: QPSK, 16-QAM, 64-QAM, DQPSK
- **Hierarchical Mode**: up to 3 layers
- **Carrier Spacing**: 1 kHz, 2 kHz, 4 kHz
- **Time Interleaver**: 0 to 16
- **Network Mode**: Hierarchical, SFN (IIP packets) and MFN
- **Bandwidth**: 6 MHz
- **Input**: ISDB-T/Tb Multiplexed Transport Stream or GbE TS

**DAB Mode**
- **Transmission Mode**: I, II, III, IV
  - Automatically selected from the ETI stream or set via any control interface
- **Processing Delay**
  - Mode I: 156000 usec, Mode II: 84000 usec
  - Mode III: 84000 usec, Mode IV: 108000 usec
- **Transmitter Delay**: Up to 2.4 sec, step 1 usec
- **Transmitter Offset Delay**: 0 to 2047 usec, step 1 usec
- **Network Padding Delay**: 0 to 1.5 second
- **MNSC Control**: Transmitter Identification Information (TII)
- **Input Signal**: ETI (N) 2.048 MHz short haul or ETI (NA) for E1 interface - ETSI 300 799
- **Input Selection**: Dual NA with seamless switchover
  - NI or NA with automatic detection
  - Manual lock to input 1 or 2
- **Input Error Condition**: Input CRC violations (User selectable)
- **Test Mode**: DAB mode I, II, III, IV, CW mode, Two tone, 24-tone, 48 tone, 96 tone comb

**DVB-SHA/SHB Mode**
- **Multiplexing Schemes**: OFDM (A), TDM (B)
- **OFDM FFT Mode (A)**: 1k, 2k, 4k, 8k
- **Guard Interval (A)**: 1/4, 1/8, 1/16, 1/32
- **Code Rate (A)**: 1/2, 1/3, 1/4, 1/5, 2/3, 2/5, 2/7, 2/9
- **Constellation (A)**: QPSK, 16-QAM
- **Network Mode (A)**: SFN and MFN
- **TDM Mapping (B)**: QPSK, 8-PSK, 16-APSK
- **TDM Roll-off Factor (B)**: 0.15, 0.25, 0.35
- **Turbo Code (A & B)**: 3GPP2 encoding
- **Bandwidth (A & B)**: 8 MHz, 7 MHz, 6 MHz, 5 MHz, 1.7 MHz
- **Time Interleaver (A & B)**: From 100 ms to several seconds
- **Input (A & B)**: MPEG-2 Transport Stream or GbE TS

**Network Mode**
- **SFN and MFN**
- **Input**: MPEG-2 Transport Stream, SMPTE-310M or GbE TS

**Bandwidth**
- **6 MHz**
- **1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz, 10 MHz**

**Time Interleaving**
- **Adjustable**

**Pilot Pattern**
- **PP1 to PP8**
- **Input**: T2-MI control
  - Input steam monitoring
  - PCR restamping
  - TS Bit Rate Adaptation

**DVB-T2 Mode**
- **FFT Mode**: 1k, 2k, 4k, 8k, Extended 8k, 16k, Extended 16k, 32k, Extended 32k
- **Guard Interval**: 1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4
- **Code Rate**: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
- **PLP Constellation**: QPSK, 16-QAM, 64-QAM, 256-QAM (normal or rotated)
- **L1 Post Constellation**: BPSK, QPSK, 16-QAM, 64-QAM
- **FEC**: Short (16k), Normal (64k)
- **Network Mode**: MFN, SFN-SISO, SFN-MISO
- **Bandwidth**: 1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz, 10 MHz
- **Time Interleaving**: Adjustable
- **Pilot Pattern**: PP1 to PP8
- **Input**: T2-MI control
  - Input steam monitoring
  - PCR restamping
  - TS Bit Rate Adaptation

**Network Mode**
- **MFN, SFN-SISO, SFN-MISO**
- **Bandwidth**: 1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz, 10 MHz
- **Time Interleaving**: Adjustable
- **Pilot Pattern**: PP1 to PP8
- **Input**: T2-MI control
  - Input steam monitoring
  - PCR restamping
  - TS Bit Rate Adaptation

**Test Mode**
- **DAB mode I, II, III, IV, CW mode, Two tone, 24-tone, 48 tone, 96 tone comb**
Product Specifications

**Inputs**

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Connector Type</th>
<th>Frequency</th>
<th>Level</th>
<th>Impedance</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVB-ASI</td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>75 Ω</td>
<td></td>
</tr>
<tr>
<td>G.703/G.704</td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td>SMPTE-310M</td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>75 Ω</td>
<td></td>
</tr>
<tr>
<td>GbE Transport Stream</td>
<td>SMA (F)</td>
<td></td>
<td></td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td><strong>Clock Reference - 10 MHz</strong></td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>10 MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Time Reference - 1 PPS</strong></td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>1 PPS</td>
<td></td>
</tr>
<tr>
<td><strong>Time Information Input</strong></td>
<td>RS232 Interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Monitoring Outputs**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Connector Type</th>
<th>Frequency</th>
<th>Level</th>
<th>Impedance</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVB-ASI</td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>75 Ω</td>
<td></td>
</tr>
<tr>
<td>G.703/G.704</td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td>RF Monitor</td>
<td>SMA (F)</td>
<td></td>
<td></td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td><strong>Clock Reference - 10 MHz</strong></td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>10 MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Time Reference - 1 PPS</strong></td>
<td>BNC (F)</td>
<td></td>
<td></td>
<td>1 PPS</td>
<td></td>
</tr>
</tbody>
</table>

**Control Interfaces**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Connector Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Panel</td>
<td></td>
<td>LCD display and cursor/execute keys</td>
</tr>
<tr>
<td>Ethernet Interface</td>
<td>2x RJ45</td>
<td>Speed: 10/100/1000 Base-T</td>
</tr>
<tr>
<td>USB Interface</td>
<td>USB Type B</td>
<td></td>
</tr>
<tr>
<td>RS232 Interface</td>
<td>9-pin SUB-D Male</td>
<td>Serial port for GPS TOD information (CMMB mode only)</td>
</tr>
<tr>
<td>RS485 Interface</td>
<td>9-pin SUB-D Female</td>
<td></td>
</tr>
<tr>
<td>CLI (Command Line Interface)</td>
<td>USB (HyperTerminal) or Ethernet (HyperTerminal and Telnet)</td>
<td>Internet Explorer, Firefox, etc.</td>
</tr>
<tr>
<td>Web GUI</td>
<td>Ethernet</td>
<td></td>
</tr>
<tr>
<td>SNMP Control Interface</td>
<td>Ethernet</td>
<td>Note: MIBs are provided</td>
</tr>
<tr>
<td>Alarm Relays</td>
<td>RS232 and RS485</td>
<td>2 Dry Contact Alarm relays, triggered by any major alarm.</td>
</tr>
<tr>
<td>Machine to Machine Interface</td>
<td>Ethernet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or RS485</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or RS232</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The “10MHz” and “1pps” are inputs, except when the modulator is equipped with an internal GPS or GPS/GLONASS receiver, where they become Monitoring Outputs (high impedance).
## Product Specifications

### RF Output

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>N-type (F), 50 Ω</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>470 MHz - 860 MHz</td>
</tr>
<tr>
<td></td>
<td>40 MHz to 1 GHz (optional)</td>
</tr>
<tr>
<td></td>
<td>DAB Band III (optional)</td>
</tr>
<tr>
<td>Frequency Step Size</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Frequency Stability</td>
<td>Internal reference 0.05 ppm / or in accordance with external ref. accuracy</td>
</tr>
<tr>
<td>Spectrum Polarity</td>
<td>Inverted or non-inverted, selectable</td>
</tr>
<tr>
<td>Digital Average</td>
<td>2 Watt (adjustable from 23 dBm to 33 dBm in 0.1 dB steps)</td>
</tr>
<tr>
<td>Power Level</td>
<td>± 0.5 dB</td>
</tr>
<tr>
<td>Shoulder Level</td>
<td>≤ -38 dBc (uncorrected)</td>
</tr>
<tr>
<td>Spurious Level Outside Channel</td>
<td>&lt; -40 dBc</td>
</tr>
<tr>
<td>Amplitude Flatness</td>
<td>Center frequency ±3.8 MHz: ±0.5 dB (Note 2)</td>
</tr>
<tr>
<td>Phase Noise SSB</td>
<td>10 Hz: &lt; -60 dBc/Hz</td>
</tr>
<tr>
<td></td>
<td>100 Hz: &lt; -85 dBc/Hz</td>
</tr>
<tr>
<td></td>
<td>1 kHz: &lt; -95 dBc/Hz</td>
</tr>
<tr>
<td></td>
<td>10 kHz: &lt; -105 dBc/Hz</td>
</tr>
<tr>
<td></td>
<td>100 kHz: &lt; -120 dBc/Hz</td>
</tr>
<tr>
<td></td>
<td>1 MHz: &lt; -125 dBc/Hz</td>
</tr>
<tr>
<td>Return Loss</td>
<td>&gt; 20 dB</td>
</tr>
</tbody>
</table>

### Adaptive Non-linear Pre-correction

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPA FB Connector</td>
<td>To be coupled from the PA output when the Adaptive Pre-correction is used</td>
</tr>
<tr>
<td>Level</td>
<td>-15 dBm to 0 dBm</td>
</tr>
<tr>
<td>Frequency</td>
<td>470 MHz to 860 MHz</td>
</tr>
<tr>
<td>Spectral Regrowth Reduction</td>
<td>7 dB ±2 dB (Note 3)</td>
</tr>
</tbody>
</table>

### Manual Digital Pre-Correction

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve Formats</td>
<td>S 21 and VO/VI</td>
</tr>
<tr>
<td>Amplitude Scale</td>
<td>Linear and Logarithmic</td>
</tr>
<tr>
<td>Correction Points</td>
<td>Max. 256, user-defined position</td>
</tr>
<tr>
<td>Spectral Regrowth Reduction</td>
<td>Max. 12 dB, subject to available headroom</td>
</tr>
<tr>
<td>Phase Correction</td>
<td>-6 to +30 degrees, subject to available headroom</td>
</tr>
<tr>
<td>Linear Pre-Correction</td>
<td>61</td>
</tr>
<tr>
<td>Correction Points</td>
<td>1/60 of nominal spectrum BW</td>
</tr>
<tr>
<td>Amplitude Correction</td>
<td>±10 dB</td>
</tr>
<tr>
<td>Amplitude Resolution</td>
<td>0.01 dB</td>
</tr>
<tr>
<td>Group Delay Correction</td>
<td>±2000 ns</td>
</tr>
<tr>
<td>Group Delay Resolution</td>
<td>1 ns</td>
</tr>
<tr>
<td>Peak Power Clip Level</td>
<td>+17 dB to +7 dB (peak power relative to average RMS level)</td>
</tr>
</tbody>
</table>

---

**Note 2**: Levels are measured in 10 kHz bandwidth, where 0 dB is the level of the carriers at the edge of the spectrum. Harmonics and spurious are not included.

**Note 3**: Greater improvement is possible under particular applications. Performance depends upon power level and waveform.
2 Watt Universal Modulator
Model: DVU 5000A

Product Specifications

Power Supply
- Voltage: 100 - 240 VAC
- Frequency: 50 - 60 Hz
- Power Consumption: max. 70 VA
- Harmonic Correction: EN61000-3-2

Environmental
- Operating Temperature: 0°C to +50°C (+32°F to +122°F)
- Storage Temperature: -30°C to +70°C (-22°F to +158°F)
- Relative Humidity: max. 95%
- Cooling: Internal fans to assist natural convection

Mechanical
- Size: 1 U of 19" wide cabinet
- Dimension (W x H x D): 483mm x 44mm x 521mm (19" x 1.75" x 20.5")
- Weight: 7 kg (15.4 lbs)
- Transport and Storage: Vibration acc. to IEC Publ.68
PART ORDERING MATRIX FOR 1 RU ADVANCED MODULATOR

DVU-5000-Z7-

WAVEFORM
A. DVB-T2
B. DVB-T2 Light
C. DTMB
D. ISDBT
E. ATSC
F. DVB-S2

FREQUENCY
A. IF
B. UHF
C. L-Band
D. Other

POWER
A. 0 dBm
B. +10 dBm
C. 2 Watt