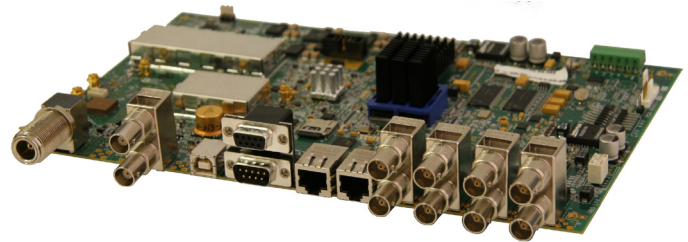


## OEM Universal Modulator

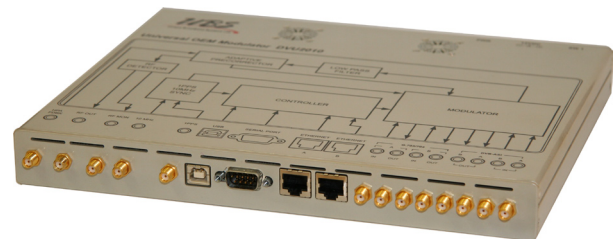
Models: DVU 2000 (Board version)  
DVU 2010 and DVU 2025 (Enclosed versions)

### Product Features

- Direct RF output from 47 MHz to 960 MHz in 1 Hz steps
- Superior Shoulders and MER
- SFN and MFN Support
- Manual Linear and Non-linear Digital Pre-correction
- Adaptive Non-linear Pre-corrector
- GbE Transport Stream Input based on Pro-MPEG Forum CoP #3
- Interfaces for Web GUI, SNMP and Telnet remote control, machine to machine interface and software upgrades
- Available in both enclosed and board version



DVU 2000



DVU 2010



DVU 2025

### Standards Supported

- ATSC and ATSC-M/H compliant with A/53, A/54, A/64 and A/153
- ISDB-T/T<sub>B</sub> compliant with ARIB STD-B31, ARIB STD-B10, ABNT NBR 15601:2007, SBTVD N01 and SBTVD N03
- DVB-T/H compliant with ETSI DVB standards
- DVB-SHA and DVB-SHB 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

### Description and Application

#### Overview

The UBS OEM Universal Modulator Series utilizes the innovative UBS Universal Waveform engine, supporting all world standards for mobile and terrestrial digital broadcasts.

Using the latest technology, UBS has developed a direct conversion process that allows the OEM Universal Modulator to provide an RF output from 47 MHz to 960 MHz with superior shoulders and MER.

The Universal OEM Modulator can be factory configured 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.

This open architecture design enables carriers to take advantage of a proven, robust platform, while designing networks to meet current and future broadcast standards.

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.

#### Application

The core function of the Universal Modulator is to modulate an input stream in accordance with the rules for channel coding and modulation defined in the specific standards for each waveform.

## OEM Universal Modulator

Models: DVU 2000 (Board version)

DVU 2010 and DVU 2025 (Enclosed versions)



## Description and Application

### Signal Inputs

The OEM Modulators are 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.

The OEM Modulators can also be equipped with a GbE Transport Stream input (based on Pro-MEG CoP #3) only when a DVB-T/H or DVB-SH waveform is selected.

The DVB-ASI and G.703/G.704 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 RF output covers a frequency range of 47 MHz to 960 MHz (L-Band optional) in 1 Hz steps. The output level is adjustable from -10 dBm to 0 dBm (0 dBm to 10 dBm optional), in 0.1 dB steps and the user can set the polarity of the spectrum to Inverted or Non-inverted as required.

The direct conversion process offers superior performance with Shoulder Levels  $\leq -57$  dBc and MER  $\geq 50$  dB.

### 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.

Note: The Adaptive Non-linear Pre-corrector is a standard feature. The customer has the option to have this feature removed if desired.

### Machine to Machine Interface

Depending on the waveform selected, the Universal Modulator serial port can be used for as a machine to machine interface. This is a valuable feature when control of an external power amplifier is required.

### Web Interface

This feature allows remote control of the OEM Modulator via an 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 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 OEM Modulator 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.

### Digital Linear and Non-linear Pre-corrector

The digital linear and non-linear 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.



## OEM Universal Modulator

Models: DVU 2000 (Board version)  
DVU 2010 and DVU 2025 (Enclosed versions)

### Product Specifications | Signal Processing

#### DVB-T/H Mode

<b>Supported Modes</b>	IFFT: 2k, 4k, 8k
<b>Guard Intervals</b>	1/4, 1/8, 1/16, 1/32
<b>Code Rates</b>	1/2, 2/3, 3/4, 5/6, 7/8
<b>Constellations</b>	QPSK, 16-QAM, 64-QAM
<b>Hierarchical Modes</b>	Alpha - 1, 2 and 4 for 16-QAM and 64-QAM
<b>Network Mode</b>	SFN and MFN
<b>Bandwidth</b>	8 MHz, 7 MHz, 6 MHz, 5 MHz
<b>Input</b>	MPEG-2 Transport Stream or GbE TS based on Pro-MPEG CoP #3

#### DVB-SH Mode

<b>Supported Modes</b>	IFFT: 1k, 2k, 4k, 8k
<b>Guard Intervals</b>	1/4, 1/8, 1/16, 1/32
<b>Code Rates</b>	1/2, 1/3, 1/4, 1/5, 2/3, 2/5, 2/7, 2/9
<b>Constellations</b>	QPSK, 16-QAM
<b>Network Mode</b>	SFN and MFN
<b>Bandwidth</b>	8 MHz, 7 MHz, 6 MHz, 5 MHz, 1.7 MHz
<b>Short &amp; Long Time Interleaver</b>	From 100 ms to tens of seconds
<b>Input</b>	MPEG-2 Transport Stream

#### ATSC Mode

<b>Supported Mode</b>	8VSB
<b>Network Mode</b>	SFN and MFN
<b>Bandwidth</b>	6 MHz
<b>Input</b>	MPEG-2 Transport Stream, SMPTE-310M

#### DAB Mode

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

#### CMMB Mode

<b>Supported Modes</b>	4K
<b>Guard Intervals</b>	1/8
<b>Code Rates (LDPC)</b>	1/2, 3/4
<b>Constellations</b>	BPSK, QPSK, 16-QAM
<b>Byte Interleave</b>	Mode 1, Mode 2, Mode 3
<b>Reed Solomon Coding</b>	RS(240,240); RS(240, 224); RS(240,192); RS(240,176)
<b>Scrambling Modes</b>	0, 1, 2, 3, 4, 5, 6, 7
<b>Number of Time Slots</b>	40
<b>Number of simultaneous multiplexed frames</b>	40
<b>Network Mode</b>	SFN and MFN
<b>Bandwidth</b>	8 MHz
<b>Transmission Time delay</b>	Adjustable, range: $\pm 500$ ms, step 100 ns
<b>Input</b>	CMMB Multiplex Stream
<b>Time Information Input</b>	RS232 serial port for GPS TOD Information Connector: 9-pin SUB-D Male

#### DTMB Mode

<b>Supported Modes</b>	IFFT: 3780, Single Carrier
<b>Guard Intervals</b>	945, 595, 420 symbols
<b>Code Rates</b>	0.4, 0.6, 0.8
<b>Constellations</b>	QPSK, 4QAM-NR, 16-QAM, 32-QAM, 64-QAM
<b>Frame Duration</b>	500 us, 666.67 us or 571.43 us
<b>Sub-carrier Spacing</b>	1.5 kHz, 1.75 kHz, 2 kHz
<b>Time Interleaver</b>	240, 720 symbols
<b>Network Mode</b>	SFN and MFN
<b>Bandwidth</b>	8 MHz, 7MHz, 6 MHz
<b>Input</b>	MPEG-2 Transport Stream

#### ISDB-T/T<sub>B</sub> Mode

<b>Supported Modes</b>	IFFT: 2k, 4k, 8k
<b>Guard Intervals</b>	1/4, 1/8, 1/16, 1/32
<b>Code Rates</b>	1/2, 2/3, 3/4, 5/6, 7/8
<b>Constellations</b>	QPSK, 16-QAM, 64-QAM, DQPSK
<b>Hierarchical Modes</b>	up to 3 layers
<b>Carrier Spacing</b>	1 kHz, 2 kHz, 4 kHz
<b>Time Interleaver</b>	0 to 16
<b>Network Mode</b>	Hierarchical, SFN (IIP packets) and MFN
<b>Bandwidth</b>	6 MHz
<b>Input</b>	ISDB-T/T <sub>B</sub> Multiplexed Transport Stream

## OEM Universal Modulator

Models: DVU 2000 (Board version)

DVU 2010 and DVU 2025 (Enclosed versions)



Unique Broadband Systems Ltd.

### Product Specifications

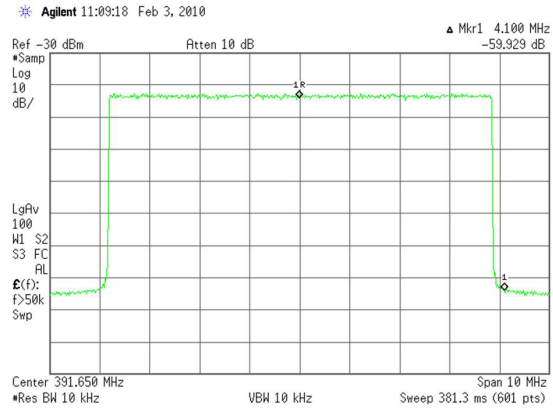
#### Inputs

<b>DVB-ASI</b>	<b>IN-A, IN-B</b>	2 Inputs: BNC (F), 75 Ω (DVU 2000) or SMA (F), 50 Ω (DVU 2010) or BNC (F), 75 Ω (DVU 2025)
<b>G.703/G.704</b>	<b>IN-A, IN-B</b>	2 Inputs: BNC (F), 50 Ω (DVU 2000) or SMA (F), 50 Ω (DVU 2010) or BNC (F), 50 Ω (DVU 2025)
<b>GbE Transport Stream (DVB-T/H and DVB-SH only)</b>		Protocol: Pro-MPEG CoP #3 Connector: RJ45
<b>HPA FB</b>		Connector: MCX, 50 Ω (DVU 2000) or SMA (F), 50 Ω (DVU 2010) or SMA (F), 50 Ω (DVU 2025)
<b>Clock Reference - 10 MHz</b>		Connector: BNC (F), 50 Ω (DVU 2000) or SMA (F), 50 Ω (DVU 2010) or BNC (F), 50 Ω (DVU 2025) Frequency: 10 MHz Level: 100 mV to 3 Vpp
<b>Time Reference - 1 PPS</b>		Connector: BNC (F), 50 Ω (DVU 2000) or SMA (F), 50 Ω (DVU 2010) or BNC (F), 50 Ω (DVU 2025) Frequency: 1 PPS Level: TTL Trigger: Positive transition

#### RF Output

<b>Connector</b>	SMA (F), 50 Ω (DVU 2000) N-type (F), 50 Ω (DVU 2010 & DVU 2025)
<b>Frequency Range</b>	47 MHz to 960 MHz 1452 MHz to 1492 MHz (optional)
<b>Frequency Step Size</b>	1 Hz
<b>Frequency Stability</b>	Internal reference 0.02ppm / or in accordance with external ref. accuracy
<b>Spectrum Polarity</b>	Inverted or non-inverted, selectable
<b>Level</b>	-10 dBm to 0 dBm in 0.1 dB step (optional 0 dBm to 10 dBm)
<b>Level Stability</b>	± 0.3 dB
<b>Return Loss</b>	> 26 dB
<b>Shoulder Level</b>	≤ -57 dBc (Note 1)
<b>Spurious Level Outside Channel</b>	< -60 dBm
<b>MER</b>	≥ 50 dB (Note 2)
<b>Amplitude Flatness</b>	Center frequency ±3.8 MHz: ±0.3 dB (Note 3)
<b>Group Delay response</b>	Center frequency ±3.8 MHz: ±10 ns (Note 3)

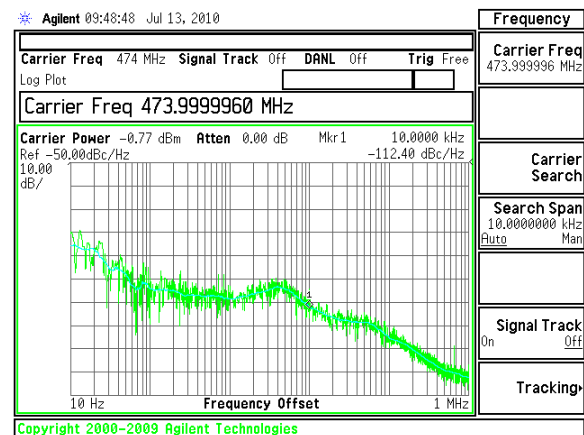
<b>Phase Noise SSB (measured @ 474 MHz)</b>	10 Hz: < -60 dBc/Hz 100 Hz: < -85 dBc/Hz 1 kHz: < -100 dBc/Hz 10 kHz: < -105 dBc/Hz 100 kHz: < -120 dBc/Hz 1 MHz: < -135 dBc/Hz
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Shoulder Level

D: Symbols/Metrics			
MER:	-53.294 dB	EVM:	0.21642 %rms
Frequency Error:	-13.342 Hz	RMS Mag Error:	0.158 %rms
Peak Mag Error:	0.761 %	RMS Phase Error:	0.109 degrms
Peak Phase Error:	0.576 deg	IQ Gain Imb:	0.00125 dB
IQ Quad Skew:	0.039 deg		

MER



Phase Noise

**Note 1:** Shoulder measurements were performed with Agilent E4443A PSA Series Spectrum Analyzer.

**Note 2:** MER measurements were performed on a DVB-T waveform with an Agilent E4443A PSA Series Spectrum Analyzer in conjunction with Agilent E9285B Digital Video Analysis Modulation software.

**Note 3:** 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.



## OEM Universal Modulator

Models: DVU 2000 (Board version)  
DVU 2010 and DVU 2025 (Enclosed versions)

### Product Specifications

#### Monitoring Outputs

<b>DVB-ASI</b>	<b>OUT-A, OUT-B</b>	2 Outputs: BNC (F), 75 $\Omega$ (DVU 2000) or SMA (F), 50 $\Omega$ (DVU 2010) or BNC (F), 75 $\Omega$ (DVU 2025)
<b>G.703/G.704</b>	<b>OUT-A, OUT-B</b>	2 Outputs: BNC (F), 50 $\Omega$ (DVU 2000) or SMA (F), 50 $\Omega$ (DVU 2010) or BNC (F), 50 $\Omega$ (DVU 2025)
<b>RF Monitor</b>		Connector: MCX, 50 $\Omega$ (DVU 2000) or SMA (F), 50 $\Omega$ (DVU 2010) or SMA (F), 50 $\Omega$ (DVU 2025) Level: 30 dB below RF output

#### Control Interfaces

<b>Ethernet Interface</b>	Connector: 2x RJ45 (DVU 2000 & 2010) 1x RJ45 (DVU 2025) Speed: 10/100/1000 Base-T
<b>USB Interface</b>	Connector: USB Type B
<b>RS232 Interface</b>	Connector: 9-pin SUB-D Male Serial port for GPS TOD information (CMMB mode only)
<b>RS485 Interface</b>	Connector: 9-pin SUB-D Female (DVU 2000 & 2025 only)
<b>CLI (Command Line Interface)</b>	Connector: USB (HyperTerminal) or Ethernet (HyperTerminal and Telnet)
<b>Web GUI</b>	Internet Explorer, Firefox, etc. Connector: Ethernet
<b>SNMP Control Interface</b>	Connector: Ethernet Note: MIBs are provided
<b>Alarm Relays</b>	Connector: RS232 and RS485 2 Dry Contact Alarm relays, triggered by any major alarm.
<b>Machine to Machine Interface</b>	Connector: Ethernet for all waveforms or RS232 for all waveforms except CMMB or RS485 for CMMB only

#### Adaptive Non-linear Pre-correction

<b>HPA FB Connector</b>	To be connected to the PA output when the Adaptive Pre-corrector is used
<b>Level</b>	-15 dBm to 0 dBm
<b>Frequency</b>	470 MHz to 860 MHz
<b>Gain Correction</b>	7 dB $\pm$ 2 dB (Note 4)

**Note 4:** The amount of gain correction is subject to external amplifier characteristics.

#### Manual Digital Pre-Correction

##### Non-Linear Pre-Correction

<b>Curve Formats</b>	S 21 and VO/VI
<b>Amplitude Scale</b>	Linear and Logarithmic
<b>Correction Points</b>	Max. 256, user-defined position
<b>Gain Correction</b>	Max. 12 dB, subject to available headroom
<b>Phase Correction</b>	-6 to +30 degrees, subject to available headroom

##### Linear Pre-Correction

<b>Correction Points</b>	61
<b>Point Spacing</b>	1/60 of nominal spectrum BW
<b>Amplitude Correction</b>	$\pm$ 10 dB
<b>Amplitude Resolution</b>	0.01 dB
<b>Group Delay Correction</b>	$\pm$ 2000 ns
<b>Group Delay Resolution</b>	1 ns
<b>Peak Power Clip Level</b>	+17 dB to +7 dB (peak power relative to average RMS level)

#### Power Supply

<b>Voltage</b>	12 VDC
<b>Power Consumption</b>	max. 37 Watts
<b>DVU 2000 Connector</b>	6 Pin Header
<b>DVU 2010 Connector</b>	DC Jack, 2.1mm ID, 5.3mm OD
<b>DVU 2025 Connector</b>	6 Pin Header

#### Mechanical

<b>DVU 2000 Dimensions (W x H x D)</b>	258.4mm x 38mm x 175mm (10.173" x 1.5" x 6.891")
<b>DVU 2000 Weight</b>	0.25kg (0.5 lbs.)
<b>DVU 2010 Dimensions (W x H x D)</b>	269.6mm x 29.5mm x 221mm (10.613" x 1.162" x 8.7")
<b>DVU 2010 Weight</b>	1 kg (2.2 lbs.)
<b>DVU 2025 Dimensions (W x H x D)</b>	308.457mm x 40.894mm x 191.262mm (12.144" x 1.61" x 7.53")
<b>DVU 2025 Weight</b>	1 kg (2.2 lbs.)

#### Environmental

<b>Operating Temperature</b>	0°C to +50°C (+32°F to +122°F)
<b>Storage Temperature</b>	-30°C to +70°C (-22°F to +158°F)
<b>Relative Humidity (operating/storage)</b>	max. 95%
<b>Cooling</b>	Temperature controlled fan to assist natural convection (DVU 2010 and DVU 2025 only)