*UBS*

Unique Broadband Systems Ltd.

OEM Universal Modulator

*Models: DVU 2001 and DVU 2002 (Board versions)*
DVU 2010 and DVU 2025 (Enclosed versions)

Product Features

- *Direct RF output from 470 MHz to 860 MHz in 1 Hz steps (30 MHz to 1 GHz optional)*

- *Superior Shoulders and MER*

- *SFN and MFN Support*

- *Adaptive Non-linear Pre-corrector*

- *Manual Linear and Non-linear Digital Pre-correction*

- *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*

- *Available in both enclosed and board version*
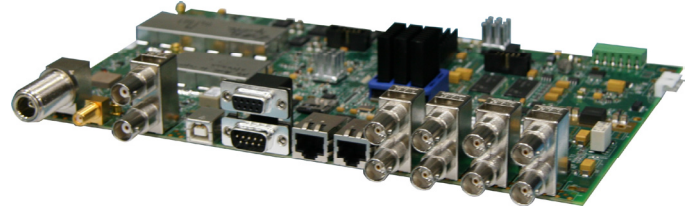


DVU 2001
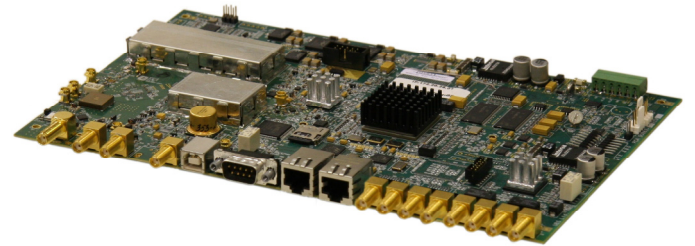
DVU 2002

New Features

DVB-T2, DVB-SHA/SHB and Optional GPS Receiver

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

Supports all DVB-SHA/SHB modulation features for hybrid satellite/terrestrial broadcasting including SHA COFDM modulation and SHB Time-Division Multiplexing (TDM) as well as intra SH-frame time-interleaver compensation to permit code combining at the receiver.

The modulator can be equipped with an on-board GPS receiver which provides 10 MHz and 1PPS reference signals.
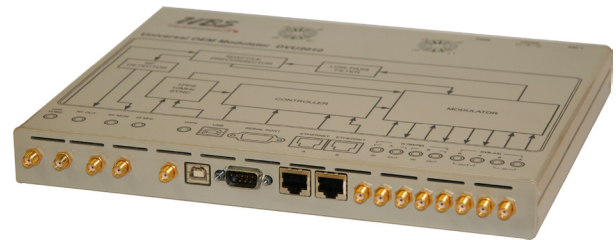
DVU 2010

Standards Supported

- *ATSC and ATSC-M/H compliant with A/53, A/54, A/64, A/110 and A/153*

- *ISDB-T/T$_B$ 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*

DVU 2025

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OEM Universal Modulator

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Unique Broadband Systems Ltd.

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 modulator 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 superior shoulders and MER. A range of optional RF outputs including 30 MHz to 1 GHz are also 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 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/T$_B$ multiplexed TS. The G.703/G.704 inputs are used in DAB mode and accept either NA or NI signals.

The OEM Modulators also support a GbE Transport Stream input based on Pro-MEG CoP #3 / SMPTE 2022 protocol (DAB and DVB-T2 excluded).

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 standard RF output covers a frequency range of 470 MHz to 860 MHz in 1 Hz steps. 30 MHz to 1 GHz RF output is also available.

The output level is adjustable from –10 dBm to 0 dBm 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 ≤ -55 dBc and MER ≥ 45 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.

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.

Manual 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.

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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.

Machine to Machine Interface

Depending on the waveform selected, the modulator RS232, RS485 or Ethernet ports can be used as a machine to machine interface. This is a valuable feature when control of an external power amplifier is required.

Product Specifications | Signal Processing

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

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

ISDB-T/T$_B$ 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/T$_B$ Multiplexed Transport Stream or GbE TS

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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

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

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

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 (NI) 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

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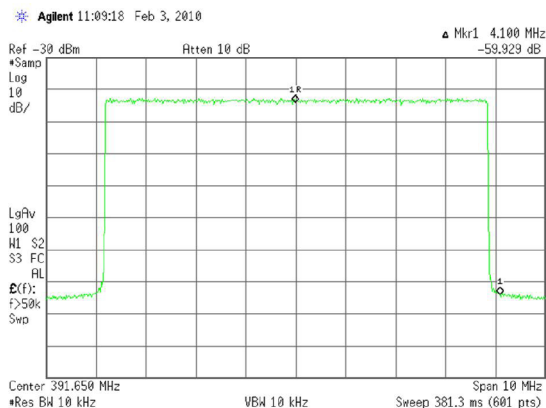
Shoulder Level


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

0	00060000	070A0203	0306010C
12	0E020601	06010409	0B0D0C0E
24	0D0D0301	040F000B	0002010A
36	030F0C00	0E0B010D	0B0C010B
48	000E0000	020E0000	0A0A0D01
60	08060101	0001080D	0E0A0900

MER

RF Output

Connector	DVU 2001/2002: SMA (F), 50 Ω or N-type (F), 50 Ω DVU 2010: SMA (F), 50 Ω DVU 2025: N-type (F), 50 Ω
Frequency Range	470 MHz - 860 MHz 30 MHz - 1 GHz (optional)
Frequency Step Size	1 Hz
Frequency Stability	Internal reference 0.05ppm / or in accordance with external ref. accuracy
Spectrum Polarity	Inverted or non-inverted, selectable
Level	-10 dBm to 0 dBm in 0.1 dB step
Level Stability	± 0.3 dB
Return Loss	> 26 dB
Shoulder Level	≤ -55 dBc (Note 1)
Spurious Level Outside Channel	< -60 dBm
MER	≥ 45 dB (Note 2) ≥ 42 dB (DVB-T2)
Amplitude Flatness	Center frequency ±3.8 MHz: ±0.3 dB (Note 3)
Group Delay response	Center frequency ±3.8 MHz: ±10 ns (Note 3)
Phase Noise SSB (measured @ 474 MHz)	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
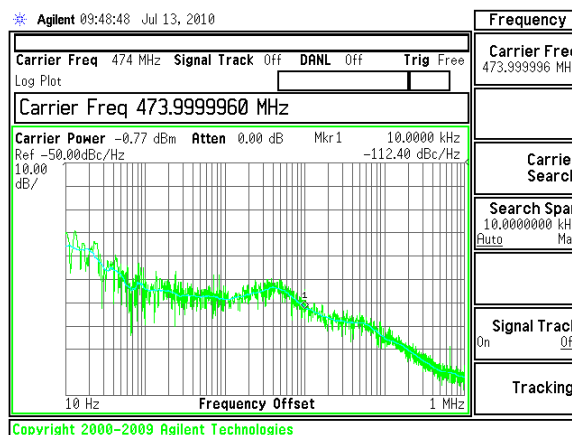
Phase Noise

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.

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Product Specifications

Monitoring Outputs

DVB-ASI	**OUT-A, OUT-B**	DVU 2001/2025: BNC (F), 75 Ω DVU 2002/2010: SMA (F), 50 Ω
G.703/G.704	**OUT-A, OUT-B**	DVU 2001/2025: BNC (F), 50 Ω DVU 2002/2010: SMA (F), 50 Ω
RF Monitor		DVU 2001/2002: MCX, 50 Ω or SMA (F), 50 Ω DVU 2010/2025: SMA (F), 50 Ω Level: 30 dB below RF output
Clock Reference - 10 MHz **(Note 4)**		DVU 2001/2025: BNC (F) DVU 2002/2010: SMA (F) Impedance: High Frequency: 10 MHz Level: 10 dBm, ± 2.5 dB sinewave
Time Reference - 1 PPS **(Note 4)**		DVU 2001/2025: BNC (F) DVU 2002/2010: SMA (F) Impedance: High Frequency: 1 PPS Level: TTL Trigger: Positive transition

Control Interfaces

Ethernet Interface	Connector: 2x RJ45 (DVU 2001/2002/2010) 1x RJ45 (DVU 2025) Speed: 10/100/1000 Base-T
USB Interface	Connector: USB Type B
RS232 Interface	Connector: 9-pin SUB-D Male Serial port for GPS TOD information (CMMB mode only)
RS485 Interface	Connector: 9-pin SUB-D Female (DVU 2001, 2002 & 2025 only)
CLI **(Command Line Interface)**	Connector: USB (HyperTerminal) or Ethernet (HyperTerminal and Telnet)
Web GUI	Internet Explorer, Firefox, etc. Connector: Ethernet
SNMP Control Interface	Connector: Ethernet Note: MIBs are provided
Alarm Relays	Connector: RS232 and RS485 2 Dry Contact Alarm relays, triggered by any major alarm.
Machine to Machine **Interface**	Connector: Ethernet for all waveforms 　or　RS485 for all waveforms 　or　RS232 for all waveforms 　　　except CMMB

Manual Digital Pre-Correction

Non-Linear Pre-Correction

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

Linear Pre-Correction

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

Adaptive Non-linear Pre-correction

HPA FB Connector	To be coupled from the PA output when the Adaptive Pre-corrector is used
Level	-15 dBm to 0 dBm
Frequency	470 MHz to 860 MHz
Spectral Regrowth **Reduction**	7 dB ±2 dB (Note 5)

Note 4: The "10MHz" and "1pps" are inputs, except when the modulator is equipped with an on-board GPS receivers, where they become Monitoring Outputs (high impedance).

Note 5: Greater improvement is possible under particular applications. Performance depends upon power level and waveform.

Unique Broadband Systems Ltd.

Product Specifications

Power Supply

Voltage	12 VDC
Power Consumption	max. 40 Watts (with GPS reciever)
DVU 2001/2002 Connector	6 Pin Header
DVU 2010 Connector	DC Jack, 2.1mm ID, 5.3mm OD
DVU 2025 Connector	6 Pin Header

Mechanical

DVU 2001 Dimensions (BNC) (W x H x D)	258.4mm x 38mm x 175mm (10.173" x 1.5" x 6.891")
DVU 2002 Dimensions (SMA) (W x H x D)	258.4mm x 19.9mm x 175mm (10.173" x 0.783" x 6.891")
DVU 2001/2002 Weight	0.25kg (0.5 lbs.)
DVU 2010 Dimensions (W x H x D)	269.6mm x 29.5mm x 221mm (10.613" x 1.162" x 8.7")
DVU 2010 Weight	1 kg (2.2 lbs.)
DVU 2025 Dimensions (W x H x D)	308.457mm x 40.894mm x 191.262mm (12.144" x 1.61" x 7.53")
DVU 2025 Weight	1 kg (2.2 lbs.)

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	Temperature controlled fan to assist natural convection (DVU 2010 and DVU 2025 only)