

## Product Features

- 50 MHz to 1 GHz RF Output
- RF Output Power Level -10 dBm to 0 dBm
- SFN and MFN Support
- Outstanding Linear and Non-linear Digital Pre-correction
- Superior MER performance
- GbE Transport Stream Input based on Pro-MPEG Forum CoP #3
- Web GUI, SNMP and Telnet remote control and software upgrade

## Optional Features

- Internal GPS Receiver
- Internal Power Amplifier with 0 dBm to +10 dBm output
- Adaptive Pre-correction (coming soon)

## Description and Application

### Overview

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

The Universal 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.



## Waveforms Supported

- ATSC compliant with A/53, A/54, A/64 and SMPTE-310M
- ISDB-T/T<sub>B</sub> compliant with ARB STB-B31 and TR-B14
- DVB-T/H compliant with ETSI DVB standards
- DVB-SH compliant with ETSI DVB 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 (SIP)

### 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.

### Signal Inputs

The DVU 5000 is provided with two serial DVB-ASI inputs and two serial G.703/G.704 inputs. The DVB-ASI inputs accept a MPEG-2 transport stream or a CMMB multiplex stream. 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 5000 can also be equipped with a GbE Transport Stream input (based on Pro-MPEG CoP #3) only when a DVB-T/H waveform is selected.

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.)

## Universal Modulator

Model: DVU 5000



### Description and Application

#### RF Output

The RF output is generated by a high performance RF converter, which covers the entire frequency range from 50 MHz to 1 GHz in steps of just 1 Hz. The output level is adjustable from -10 to 0 dBm (optionally from 0 to +10 dBm) in 0.1 dB steps. The user can set the polarity of the spectrum to Inverted or Non-inverted as required.

In DAB mode, the RF output covers Band-III (channels 5A-13F).

#### IF Output

Based on the selected waveform, the DVU 5000 provides an output channel on a user defined frequency between 35 MHz and 46 MHz (Optional fixed IF frequency from 5 MHz to 80 MHz).

Inverted/non-inverted spectrum is selected through the control interface.

The IF Output can be directly interfaced to a wide range of transmitters and frequency converters.

#### SFN Mode

This mode provides the DVU 5000 with market leading SFN performance, with respect to basic timing accuracy and extent of the local delay offset range. The user can select either the SFN or MFN mode via the control interfaces.

The primary reference clock is the external 10 MHz signal, which is applied to the 10 MHz input from a GPS. If the external 10 MHz signal is missing, the system will operate synchronized to its internal 10 MHz oscillator.

#### Web Interface

This feature allows remote control of the DVU 5000 via Ethernet (TCP/IP). The system is based on a Web server mounted inside the DVU 5000. 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 PC with a network interface card (NIC) and a Web browser (Microsoft Explorer 6.0+).

#### SNMP client

This feature allows remote control of the DVU 5000 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.

The characteristics of the linear and non-linear pre-correction curves are set by means of an easy to use and highly intuitive graphical user interface, the UBS Corrector GUI software package (Windows compatible).

#### GPS Receiver (optional)

Optionally, the DVU 5000 can be equipped with an internal GPS unit. In this case, the frequency references for the modulator and upconverter are derived from the internal GPS. The 10MHz and 1PPS connectors on the rear panel become monitoring outputs (high impedance).

#### Power Amplifier (optional)

Optionally, the DVU 5000 can be equipped with a 10dB amplifier installed at the output of the Upconverter. With the amplifier installed, the RF output level can be set from 0 dBm to +10 dBm.



## Product Specifications | Signal Processing (specifications are subject to change without notice)

### 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

### 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>Time Interleaver</b>	From 100 ms to several 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</b>	1/2, 3/4 LDPC
<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>	1, 2, 3, 4, 5, 6, 7, 8

### Number of Time Slots

40

### Number of simultaneous multiplexed frames

40

### Network Mode

SFN and MFN

### Bandwidth

8 MHz

### Transmission Time delay

Adjustable, range:  $\pm 500$  ms, step 100 ns

### Input

CMMB Multiplex Stream

### Time Information Input

RS232 serial port for GPS TOD  
Information  
Connector: 9-pin SUB-D Female

### 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
<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>	MFN and SFN (IIP packets)
<b>Bandwidth</b>	5.6 MHz
<b>Input</b>	MPEG-2 Transport Stream

## Universal Modulator

Model: DVU 5000



Fig.1 - Front Panel

### Product Specifications (specifications are subject to change without notice)

#### Inputs

<b>DVB-ASI</b>	<b>IN-A, IN-B</b>	2 DVB-ASI inputs: BNC (F), 75 $\Omega$
<b>G.703/G.704</b>	<b>IN-A, IN-B</b>	2 G.703/G.704 inputs: BNC (F), 50 $\Omega$
<b>SMPTE-310M</b>	<b>IN-A, IN-B</b>	2 inputs (optional): BNC (F), 75 $\Omega$
<b>GbE Transport Stream (DVB-T/H mode only)</b>		Protocol: Pro-MPEG CoP #3 Connector: RJ45
<b>Clock Reference - 10 MHz</b>		Connector: BNC (F) Frequency: 10 MHz Level: 100 mV - 3 Vpp Impedance: 50 $\Omega$ or High Impedance (user selectable)
<b>Time Reference - 1 PPS</b>		Connector: BNC (F) Frequency: 1 PPS Level: TTL Trigger: Positive transition Impedance: 50 $\Omega$ or High Impedance (user selectable)

#### IF Output

<b>Connector</b>	BNC (F), 50 $\Omega$
<b>Center Frequency (adjustable)</b>	35 MHz to 46 MHz in steps of 0.1 Hz (optional fixed center IF frequency 5 MHz to 80 MHz)
<b>Frequency Stability</b>	Internal ref. 0.3ppm / or in accordance with external ref. accuracy
<b>Spectrum Polarity</b>	Inverted or Non-inverted, user selectable
<b>Level</b>	-10 dBm to 0 dBm in 0.1 dB steps
<b>Level Stability</b>	$\pm$ 0.2 dB
<b>Return Loss</b>	> 26 dB
<b>Shoulder Level</b>	$\leq$ -53 dBc
<b>Harmonics and Spurious</b>	< 60 dB relative to the total output power
<b>MER</b>	$\geq$ 43 dB

#### RF Output

<b>Connector</b>	N-type (F), 50 $\Omega$
<b>Frequency</b>	Adjustable: 50 MHz to 1 GHz, in 1 Hz step DAB: Band III (channel 5A to 13F)
<b>DAB Output Spectrum Mask</b>	Compliant with ETS 300 401
<b>Frequency Stability</b>	Internal reference 1ppm / or in accordance with external reference 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 to 10 dBm)
<b>Level Stability</b>	$\pm$ 0.3 dB
<b>Return Loss</b>	> 20 dB
<b>Shoulder Level</b>	< -52 dBc
<b>Spurious Level Outside Channel</b>	< -60 dBm
<b>MER</b>	$\geq$ 43 dB
<b>Amplitude Flatness</b>	Center frequency $\pm$ 3.8 MHz: $\pm$ 0.5 dB (Note 1)
<b>Group delay response:</b>	Center frequency $\pm$ 3.8 MHz: $\pm$ 10 ns (Note 1)
<b>Phase Noise SSB (measured @ 474 MHz)</b>	10 Hz: < -60dBc/Hz 100 Hz: < -86 dBc/Hz 1 kHz: < -100 dBc/Hz 10 kHz: < -105 dBc/Hz 100 kHz: < -110 dBc/Hz 1 MHz: < -120 dBc/Hz

#### Monitoring Outputs

<b>DVB-ASI</b>	<b>OUT-A, OUT-B</b>	2 DVB-ASI outputs: BNC (F) 75 $\Omega$
<b>G.703/G.704</b>	<b>OUT-A, OUT-B</b>	2 G.703/G.704 outputs: BNC (F), 50 $\Omega$
<b>RF Monitor</b>		Connector: BNC (F) Impedance: 50 $\Omega$ Level: 30 dB below RF output
<b>Reference Monitor</b>		Connector: BNC (F) Frequency: 10 MHz Level: 2 Vpp Impedance: 50 $\Omega$

**Note 1:** 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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Fig.2 - Rear Panel

## Product Specifications (specifications are subject to change without notice)

### Control Interfaces

<b>Front Panel</b>	LCD display and cursor/ execute keys
<b>USB</b>	Interactive CLI commands
<b>Alarm Relays</b>	2 Dry Contact Alarm relays Triggered by any major alarm Contacts available on the RS232 and RS485 connectors
<b>RS232 Interface</b>	Connector: 9-pin SUB-D Male Command protocol: Interactive CLI commands (All except CMMB)
<b>RS485 Interface</b>	Connector: 9-pin SUB-D Female Command protocol: Interactive CLI commands (CMMB only)
<b>Web Interface</b>	Internet Explorer 6.0+ Ethernet 10/100/1000 Base-T 2 Connectors: RJ45
<b>SNMP Control Interface</b>	Ethernet 10/100/1000 Base-T 2 Connectors: RJ45 MIBs are provided

### Pre-Correction

#### Non-Linear Pre-Correction

<b>Curve Formats</b>	S 21 and VO/M
<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>	±10 dB
<b>Amplitude Resolution</b>	0.01 dB
<b>Group Delay Correction</b>	±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>	100 - 240 VAC
<b>Frequency</b>	50 - 60 Hz
<b>Power Consumption</b>	max. 45 VA (70 VA with +10 dBm RF amplifier and GPS receiver installed)
<b>Harmonic Correction</b>	EN61000-3-2

### 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

### Mechanical

<b>Size</b>	1 U of 19" wide cabinet
<b>Dimension (W x H x D)</b>	483mm x 44mm x 495mm (19" x 1.75" x 19.5")
<b>Weight</b>	6 kg (13 lbs)
<b>Transport and Storage</b>	Vibration acc. to IEC Publ.68

### ETSI Compliance

<b>Essential Requirement R&amp;TTE Directive 1995/5/EC</b>	<b>Standard / Specification</b>
<b>Safety</b>	EN 60950-1: 2001, A11: 2004 First Edition
<b>Health</b>	Not Applicable. No Antenna
<b>EMC</b>	EN 301 489-1 V1.8.1
<b>Radio</b>	EN 302 296 V1.1.1 (The technical requirement of Clause 4.3 was substituted for Clause 8.2 of EN 301 489-1 using the Class A limits specified in Table 4.)

### CE Compliance

This equipment is CE Compliant.