

Product Features

- Direct RF output from 47 MHz to 960 MHz in 1 Hz steps
- Superior Shoulders and MER
- 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
- Interfaces for Web GUI, SNMP and Telnet remote control, machine to machine interface and software upgrades



Optional Features

- Internal GPS Receiver
- Integrated DVB-S/S2, DVB-T/H or ISDB-T/T_B Receiver
- Adaptive Linear and Non-linear Digital Pre-correctors
- 0 dBm to 10 dBm output
- L-Band RF Output from 1452 MHz to 1492 MHz
- DVB-SH Code Combining mode

Standards Supported

- ATSC and ATSC-M/H compliant with A/53, A/54, A/64 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 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 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 Universal Modulator to provide an RF output from 47 MHz to 960 MHz with superior shoulders and MER.

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.

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.

Universal Modulator

Model: DVU 5000



Description and Application

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 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 5000 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, 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 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 ≤ -57 dBc and MER ≥ 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 on the DVU 5000. The customer has the option to have this feature removed if desired.

Internal GPS Receiver (optional)

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 receiver.

Web Interface

This feature allows remote control of the DVU 5000 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 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.

Optionally, the DVU 5000 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.

Machine to Machine Interface

Depending on the waveform selected, the Universal Modulator RS232 or RS485 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.

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.



Product Specifications | Signal Processing

DVB-T/H Mode

Supported Modes	IFFT: 2k, 4k, 8k
Guard Intervals	1/4, 1/8, 1/16, 1/32
Code Rates	1/2, 2/3, 3/4, 5/6, 7/8
Constellations	QPSK, 16-QAM, 64-QAM
Hierarchical Modes	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 based on Pro-MPEG CoP #3

DVB-SH Mode

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

ATSC Mode

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

DAB Mode

Transmission Modes	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 Modes	DAB mode I, II, III, IV, CW mode, Two tone, 24-tone, 48 tone, 96 tone comb

CMMB Mode

Supported Modes	4K
Guard Intervals	1/8
Code Rates (LDPC)	1/2, 3/4
Constellations	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
Time Information Input	RS232 serial port for GPS TOD Information

DTMB Mode

Supported Modes	IFFT: 3780, Single Carrier
Guard Intervals	945, 595, 420 symbols
Code Rates	0.4, 0.6, 0.8
Constellations	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

ISDB-T/T_B Mode

Supported Modes	IFFT: 2k, 4k, 8k
Guard Intervals	1/4, 1/8, 1/16, 1/32
Code Rates	1/2, 2/3, 3/4, 5/6, 7/8
Constellations	QPSK, 16-QAM, 64-QAM, DQPSK
Hierarchical Modes	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

Universal Modulator

Model: DVU 5000



Front Panel

Product Specifications

Inputs

DVB-ASI	IN-A, IN-B	2 DVB-ASI inputs: BNC (F), 75 Ω
G.703/G.704	IN-A, IN-B	2 G.703/G.704 inputs: BNC (F), 50 Ω
SMPTE-310M	IN-A, IN-B	2 inputs (optional): BNC (F), 75 Ω
GbE Transport Stream (DVB-T/H and DVB-SH only)		Protocol: Pro-MPEG CoP #3 Connector: RJ45
HPA FB		SMA (F), 50 Ω
Clock Reference - 10 MHz (Note 1)		Connector: BNC (F), 50 Ω Frequency: 10 MHz Level: 100 mV - 3 Vpp
Time Reference - 1 PPS (Note 1)		Connector: BNC (F), 50 Ω Frequency: 1 PPS Level: TTL Trigger: Positive transition
Time Information Input		Connector: RS232 Interface for GPS TOD information (CMMB mode only)

Monitoring Outputs

DVB-ASI	OUT-A, OUT-B	2 DVB-ASI outputs: BNC (F) 75 Ω
G.703/G.704	OUT-A, OUT-B	2 G.703/G.704 outputs: BNC (F), 50 Ω
RF Monitor		Connector: SMA (F) Impedance: 50 Ω Level: 30 dB below RF output
Reference Monitor		Connector: BNC (F) Frequency: 10 MHz Level: 2 Vpp Impedance: 50 Ω
Clock Reference - 10 MHz (Note 1)		Connector: BNC (F), High Impedance Frequency: 10 MHz Level: 10 dBm, ± 2.5 dB sinewave
Time Reference - 1 PPS (Note 1)		Connector: BNC (F), High Impedance Frequency: 1 PPS Level: TTL Trigger: Positive transition

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

Control Interfaces

Front Panel	LCD display and cursor/ execute keys
Ethernet Interface	Connector: 2x RJ45 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
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 RS232 for all waveforms except CMMB or RS485 for CMMB only



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Universal Modulator

Model: DVU 5000



Rear Panel

Product Specifications

RF Output

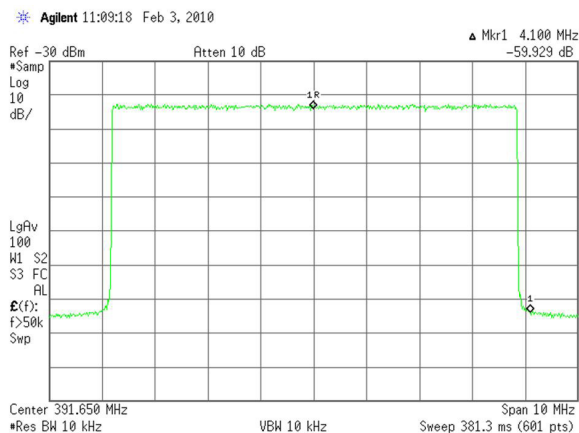
Connector	N-type (F), 50 Ω
Frequency Range	47 MHz to 960 MHz 1452 MHz to 1492 MHz (optional)
Frequency Step Size	1 Hz
Frequency Stability	Internal reference 0.02ppm / or in accordance with external ref. accuracy
Spectrum Polarity	Inverted or non-inverted, selectable
Level	-10 dBm to 0 dBm in 0.1 dB step (optional 0 dBm to 10 dBm)
Level Stability	± 0.3 dB
Return Loss	> 20 dB
Shoulder Level	≤ -57 dBc (Note 2)
Spurious Level Outside Channel	< -60 dBm
MER	≥ 50 dB (Note 3)
Amplitude Flatness	Center frequency ±3.8 MHz: ±0.3 dB (Note 4)
Group delay response:	Center frequency ±3.8 MHz: ±10 ns (Note 4)
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

DAB Output Spectrum Mask Compliant with ETS 300 401

Note 2: Shoulder measurements were performed with Agilent E4443A PSA Series Spectrum Analyzer.

Note 3: 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 4: 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.



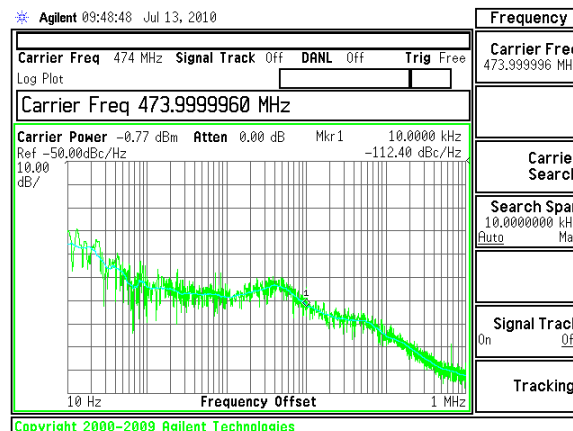
Shoulder Level

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



Phase Noise

Universal Modulator

Model: DVU 5000



Product Specifications

Manual Digital Pre-Correction

Non-Linear Pre-Correction

Curve Formats	S 21 and VO/M
Amplitude Scale	Linear and Logarithmic
Correction Points	Max. 256, user-defined position
Spectral Regrowth Reduction	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 connected to the PA output when the Adaptive Pre-corrector is used
Level	-15 dBm to 0 dBm
Frequency	470 MHz to 860 MHz
Gain Correction	7 dB ±2 dB (Note 5)

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

Power Supply

Voltage	100 - 240 VAC
Frequency	50 - 60 Hz
Power Consumption	max. 45 VA (70 VA with +10 dBm RF amplifier and GPS receiver installed)
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 (operating/storage)	max. 95%
Cooling	Temperature controlled fan 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	6 kg (13 lbs)
Transport and Storage	Vibration acc. to IEC Publ.68

ETSI Compliance

Essential Requirement R&TTE Directive 1995/5/EC	Standard / Specification
Safety	EN 60950-1: 2001, A11: 2004 First Edition
Health	Not Applicable. No Antenna
EMC	EN 301 489-1 V1.8.1
Radio	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.

CE 06780