DVB Satellite Modulator-Upconverter

Wide C-, X-, Ku-, K-, Ka-band

Our high-speed DVB Modulator-Upconverter series combines WORK Microwave's fifth-generation upconverters with a DVB modulator in a single housing, providing operators with significant cost and space savings. No extra modulator is required. Ideal use cases include fixed satellite ground stations as well as in satellite newsgathering (SNG) vehicles, fly-aways, and other mobile or portable applications.

New approach – better solution

Traditionally, two separate units are in use for high-power TV uplinks that require low spurious emissions: a modulator plus a conventional upconverter. WORK Microwave's combined modulator and converter concept allows both units to exist in one housing. This approach provides a very low spurious signal over the whole frequency band and reduced group delay characteristics. This is a significant advantage compared with combined L-band modulator/block converters. For each frequency band the entire bandwidth range is covered e.g. for Ku-band, 12.75-14.50GHz is supported.

MPEG transport stream input-RF output

The unit accepts MPEG transport streams on ASI, SPI, or TS over IP inputs from a video encoder or MPEG multiplexer and provides a DVB-S/S2/S2X modulated carrier in the C-, X-, Ku-, K- or Ka-band which can be directly connected to a high-power amplifier.

Additionally a baseband frame input is available for VCM and ACM operation in combination with external multiplexers or encapsulators.

High signal integrity

Low spurious emissions make the modulator-upconverters perfect for use in environments with demanding requirements, like high-power video uplinks. Sophisticated temperature compensation guarantees gain stability over a very wide temperature range.

Predistortion

Broadcast Predistortion and Extended Predistortion – operating in the background during regular transmission – mitigates the negative effects in the filters and amplifiers of satellites by automatically compensating for linear and non linear distortions. Subsequently the satellite link can be operated with less back off/higher power and a higher signal-to-noise ratio increases beam coverage ensuring higher throughput and availability for the satellite operator.

Flexibility, backward compatibility

Mode adaptation, FEC encoding, and modulation is compliant with the DVB-S2/S2X standard ETSI EN 302307. QPSK, 8PSK, 16APSK, 32APSK, 64APSK modulation is available. For backward compatibility, the modulator also supports BPSK, QPSK, 8PSK, 16QAM modulation according to the DVB-S standards ETSI EN 300421 and 301210. Using the modulator, carriers with very low symbol rates (e.g., 8 ksps) up to 80 Msps can be transmitted.

Operating and control – easy integration into your system

The converters can be operated via push buttons on the front panel using intuitive display menus or via remote control (RS232, RS422/485, TCP/IP over Ethernet). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For remote control, addressable, packet-based commands are used. Remote monitoring and control through SNMP and a Web browser interface is available.

Specials and OEM products

WORK Microwave can customize any product to meet an operator's exact specifications.

We offer specials as follows:

- Dual- or Tri-Band versions
- Customized M&C interface and control syntax
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity)
- Outdoor units

Key Features

- DVB-S2X - ETSI EN 302 307-2
  DVB-S2 - ETSI EN 302 307-1
  DVB-DSNG - ETSI EN 301 210
  DVB-S - ETSI EN 300 421
- DVB-S2X modulations:
  QPSK / 8PSK / 16APSK / 32APSK / 64APSK / 128APSK / 256APSK
  normal, short and linear
- DVB-S2 modulations:
  QPSK / 8PSK / 16APSK / 32APSK
  normal, short
- DVB-S and DVB-DSNG:
  QPSK / 8PSK / 16QAM modulation
- DVB Carrier ID - ETSI TS 103 129
- Broadcast Predistortion including automatic group delay and dynamic constellation predistortion for QPSK and 8PSK (option XB)
- Extended Predistortion including automatic group delay and static constellation predistortion up to 32APSK (option XE)
- Optional BISS-E encryption, supports multi program transport stream
- Physical layer framing with scrambling codes 0 to 262141 according to DVB-S2 standard
- Roll-Off: 35 %, 25 %, 20 %, 15 %, 10 %, 5 %
- Adjustable digital slope equalizer
- Low spurious output
- Dual ASI interfaces with automatic cable equalizer and auto-switchover
- DVB-S2 Multistream support with capacity management with two input streams supported. Optional hex ASI interface available, including 3x2 auto redundancy switchover (option MT6)
- Transport Stream over IP inputs (option TI1, TI2)
- VideoACM support
- Baseband Frame Input for VCM operation and connection to external encapsulators, etc
- Null packet insertion and deletion with PCR correction
- Still picture playout; customized picture content can be loaded to the modulator unit
- Symbol rates from 8 ksps to 80 Msps
- Data rate max approx. 213 Mbps per ASI Interface
- Data rate max 356 Mbps with SPI Interface
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface, SNMP with MIBs downloadable from the device
- Summary alarm output with dual change over switch contact
- Transmit mute input
- 10 MHz Reference OCXO included
- Optional test output of modulated signal 990 MHz
- Extended operating temperature range option -30 °C to 60 °C (-22 °F to 140 °F)
- CE compliant
- **3 years warranty**

Open questions, demo units

If you need more information about WORK Microwave's satellite modulators or if you would like to have demo a unit, please contact us via e-mail: sales@work-microwave.com or call us. We are glad to assist you.

DVB Satellite Modulator-Upconverter

Indoor Unit

Wide C-, X-, Ku-, K-, Ka-band
Ka-Band available on request (contact factory)

Modulator-Upconverter Type:		**VHM2CU-C / SM2CU-C**	**VHM2CU-X**	**VHM2CU-Ku / SM2CU-Ku**	**VHM2CU-K / SM2CU-K**
		Frequency bands shown here are examples, other frequencies from C through Ka band are available as well. Dualband (e.g. CKu, KuK) or Triband versions (e.g. CXKu, CKuK) are also available			
RF-Output Frequency:		C-Band 5.85 … 6.65 GHz	X-Band 7.90 … 8.40 GHz	Ku-Band 12.75 … 14.5 GHz	K-Band 17.3 … 18.4 GHz
Frequency Resolution:		10 Hz			
Phase Noise:	**10 Hz**	-55	-53	-50	-50
	100 Hz	-75	-73	-70	-70
	1 kHz	-85	-83	-80	-80
	10 kHz	-87	-87	-85	-84
	100 kHz	-100 **1)**	-98 1)	-95 1)	-95 1)
	1 MHz	-110 **1)**	-108 1)	-105 1)	-105 1)
		max. values in dBc/ Hz	1) 0°C ... 50°C, outside this temperature range degraded by max 5 dB.		
Conversion Scheme:		IQ-Modulator at 2450 MHz, single up-conversion			
RF-Output Characteristics:		Impedance: 50 Ω Return Loss: > 16 dB Output Power: -25 dBm ... 5 dBm, 0.1 dB steps or -30 dBm ... 0 dBm , 0.1 dB steps *) Output Muting: > 70 dB (by command or sense input or by alarm condition) RF-Connectors: SMA female			
Test Output **(Microwave Oscillator):**		8.3 … 9.1 GHz -7 ± 3 dBm -13 ± 3 dBm *) SMA female	10.35 … 10.85 GHz -7 ± 3 dBm -13 ± 3 dBm *) SMA female	15.2 … 16.95 GHz -7 ± 3 dBm -13 ± 3 dBm *) SMA female	14.85 … 15.95 GHz -7 ± 3 dBm -13 ± 3 dBm *) SMA female
		*) valid for some dualband and all triband versions			
Monitoring Output **(on front panel):**		Output Power: -20 dB of RF Output Impedance: 50 Ω Return Loss: >20 dB Connector: SMA female			
L-band Test Output **(Option LT)**		Frequency: 990 MHz Level: -45 ± 3 dBm Connector: F female			
Spurious Outputs:		Signal related: < -60 dBc (Δf < 2 MHz) < -70 dBc ($\Delta f \geq$ 2 MHz)			
Frequency Stability:		±2 x 10^{-8} (-30 °C ... 60 °C, after warm up), aging: ±1 x 10^{-9} per day, ±1 x 10^{-7} per year			
Reference Input:		Frequency: 10 MHz or 5 MHz Level: -3 … 10 dBm Modes: internal, external, auto (senses reference input) Connector: BNC female			
Symbol Rate:		Max Range, 8 ksps … 80 Msps Step size: 1 sps			
Clock Stability:		±2 x 10^{-8} (-30 °C ... 60 °C, after warm up), aging: ±1 x 10^{-9} per day, ±1 x 10^{-7} per year			
Data Rate:		3 kbps … 213 Mbps (ASI interface) *) 10 kbps … 213 Mbps (TS over IP interface) *) *) max 170 Mbps, when BISS-1/E active			
Modulation / Encoding **DVB-S2X:**		ModCods: (normal FEC frame)	QSPK	13/45, 9/20, 11/20	
			8PSK	23/36, 25/36, 13/18	
			16APSK	26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90	
			32APSK	32/45, 11/15, 7/9	
			64APSK	11/15, 7/9, 4/5, 5/6	
			128APSK	3/4, 7/9	
			256APSK	32/45, 3/4	
		ModCods: (short FEC frame)	QPSK	11/45, 4/15, 14/45, 7/15, 8/15, 32/45	
			8PSK	7/15, 8/15, 26/45, 32/45	
			16APSK	7/15, 8/15, 26/45, 3/5, 32/45	
			32APSK	2/3, 32/45	
		ModCods linear: (normal FEC frame)	8PSK	5/9-L, 26/45-L	
			16APSK	1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L	
			32APSK	25/36-L	
			64APSK	32/45-L	
			256APSK	29/45-L, 2/3-L, 31/45-L, 11/15-L	
		all according to ETSI EN 302307-2			
Modulation / Encoding **DVB-S2:**		ModCods: (normal and short FEC frame; except 9/10 short FEC frame only)	QPSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10	
			8PSK	3/5, 2/3, 3/4, 5/6, 8/9, 9/10	
			16APSK	2/3, 3/4, 4/5, 5/6, 8/9, 9/10	
			32APSK	3/4, 4/5, 5/6, 8/9, 9/10	
		Pilots Insertion:	on / off		
		Physical Layer Scrambling:	N = 0 … 262141		
		all according to ETSI EN 302307-1			
Modulation / Encoding **DVB-S / DVB-DSNG:**		Outer Reed Solomon Coding:	188/204, T=8		
		Convolutional Interleaving:	Depth I =12		
		Inner Coding	BPSK or QPSK 1/2, 2/3, 3/4, 5/6, 6/7, 7/8 (Convolutional K=7)		
			8PSK 2/3, 5/6, 8/9 (Pragmatic Trellis)		
			16QAM 3/4, 7/8 (Pragmatic Trellis)		

Specifications continued next page

DVB Satellite Modulator-Upconverter

Indoor Unit

Wide C-, X-, Ku-, K-, Ka-band
Ka-Band available on request (contact factory)

Carrier ID:	DVB-CID according to ETSI TS 103219
Signal Spectrum Mask:	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05
Transport Stream Inputs:	DVB-SPI (DSUB25 female) and Dual DVB-ASI-electrical (2 x Connector BNC female, Impedance 75 Ω, cable EQ) auto switching selectable between input 1 and 2 in case of ASI signal interruption, ASI data missing support of 2 TS multiple input streams (except with option BI) Alternatively with option MT6, 6 DVB ASI electrical interfaces (6 x Connector BNC female, Impedance 75 Ω, cable EQ) 3 pairs of auto switching inputs or 6 individual inputs for multiple transport stream support Additionally with option TI1 or TI2 up to two individual Transport Stream over IP Inputs (Connector RJ-45, 100/1000 Mbps, auto sensing), IPv4, UDP and RTP support, FEC according SMPTE 2022 1/2, Jitter tolerance 1… 500 ms, Conversion TS over IP to ASI, internally bridged with option MT6, external bridging for all other versions.
Multiple Transport Streams:	Individual modulation and FEC (MODCOD) configuration per TS input Capacity calculator/limitation per TS input can be activated Input stream synchronization and Null-Packet deletion according to ETSI EN 302307-1, Annex D.2, D.3.
Transport Stream Security (Option BI):	BISS-E Scrambler, compliant to EBU Tech 3292 rev. 2 Supports single or multi program transport streams in BISS Mode 0, 1 and E BISS Mode 0: no scrambling, MPEG transport stream is transferred untouched BISS Mode 1: MPEG transport stream is scrambled using 12-hexadecimal-character Clear Session Word BISS Mode E: MPEG transport stream is scrambled using a session word which is derived from a 16-hexadecimal-character Encrypted Session Word and 14-hexadecimal-character Injected Identifier Max. input rate for Clear Session Word and Encrypted Session Word: - 10 times per 5 minutes - 1 time per 10 seconds **Important note**: Option BI operates exclusively with single stream operation. Devices with option BI do not contain the otherwise included support for 2 input streams!
Transport Stream Frames Size:	188 or 204 bytes
Packet Stuffing:	TS Null packet or TS All Zero packet insertion (DVB-S, DVB-DSNG, DVB-S2) or Dummy PLFRAME insertion (DVB-S2 only), when the data rate to transmit is higher than the data rate at the data input. Null packet deletion can be enabled to remove incoming null packets. PCR (program clock reference) correction (with Null packet insertion/deletion) for max 250 PID streams with PCRs included. Not supported in case of DVB-S2 multiple input stream operation
Still Picture Playout:	As standard a color bar pattern is transmitted with main profile at main level (MPML) MPEG-2 encoding, 4:3 aspect ratio, 25 Hz frame rate, interlaced (suitable for PAL or SECAM). As option an alternative, customized still picture can be loaded (different content, different aspect ratio, different frame rate).
Compliant with Standards:	ETSI EN 300421, 301210, 302307-1 and 2,ETSI TS 103129 EN 50083-9 (ASI electrical, SPI Interface)
Broadcast Predistortion (Option XB) **Extended Predistortion (Option XE):**	Hardware and signal processing can be enabled through customer field selectable firmware options. An external windows PC is required to run the application program, which optimizes the predistortion parameters in the background of live transmissions (if activated), by reading information from a reference demodulator. For all communication between the reference demodulator, the application program and the modulator IP connectivity is used.
Monitoring:	Faults, stored faults with time stamps
Monitoring and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10/100 Mbps, auto sensing), IPv4,connector RJ-45 Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10/100 Mbps, auto sensing), IPv4,connector RJ-45 Protocol: Multipoint Connection: RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10/100 Mbps, auto sensing), IPv4, connector RJ-45
Alarm Interface: **Mute Input:**	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09 female
Temperature Range:	VHM2CU: -30 °C ... 60°C operating (10 minutes warm up at -30 °C) VSM2CU: 0 °C ... 50°C operating -30 °C ... 80°C storage
Relative Humidity:	<95 % non condensing
User Interface:	VSM2CU: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VHM2CU: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (Option VFD for SM2CU)
Mains Power Input:	100 … 240 V AC nominal, 90…264 V AC max, 50…60 Hz
Mains Power Consumption:	Typ: 45 VA / 30 W
Mains Power Input Connector:	IEC C14
Mains Fuse:	2 x 2 A time-lag fuse
Dimension and Weight:	483 x 44 x 505 mm³ (WxHxD), 1 RU (19"), approx. 10 kg

Specifications are subject to change

DVB Satellite Modulator-Upconverter
Indoor Unit

Order Information:	**VSM2CU-[RF Band]-[Hardware Options]**	Single Band modulator-upconverter
	VHM2CU-[RF Band]-[Hardware Options]	Single Band modulator-upconverter
	VHM2CUx-[RF Band(s)]-[Hardware Options]	Multiband modulator-upconverter

x=2: Dualband modulator-upconverter, x=3: Triband modulator-upconverter

Hardware Options are:		**Cannot be combined with:**	**Requires:**
VFD	VFD display, standard with VHM2CU-type devices	-	-
LT	L-band test output	-	-
TI1	one TS over IP input interface	TI2	-
TI2	two TS over IP input interfaces	TI1	-
MT6	Support of 6 Multiple ASI Input streams	BI	-

Software Options are:		**Cannot be combined with:**	**Requires:**
BI	BISS scrambling	MT6	-
XB	Broadcast Predistortion	-	-
XE	Extended Predistortion	-	-

Software Options are not part of the device order code and will be listed separately

Examples:

VHM2CU-Ku	Ku-band Modulator-Upconverter
VSM2CU2-KuK	Dualband Modulator-Upconverter KuK
VSM2CU3-CKuK	Triband Modulator-Upconverter CKuK