Trade Mark of the DVB Digital Video Broadcasting Project

Challenge Series
Satellite High Speed DVB-S2 Modulator-Upconverter

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

CCM, VCM, ACM Functionality

The satellite high speed DVB-S2 modulator / upconverter series combines WORK Microwave's 4th generation upconverters with a high-speed DVB-S2 modulator in one housing. This combination offers a cost and space saving solution. No extra modulator is required. The unit can be used in fixed satellite ground stations as well as in satellite news gathering (SNG) vehicles, Fly-Aways or any other mobile or portable applications.

New approach – better solution

For all high power TV-uplink which require low spurious emissions, two separate units were needed, a modulator plus a conventional upconverter. WORK Microwave's modulator / converter concept allows both units in one housing. This approach provides a very low spurious signal over the whole frequency band. In Ku-Band we cover the complete frequency range from 12.75-14.50 GHz with one unit only: The same is true for other bands. This is a significant advantage compared to the combination L-Band modulator / blockconverter.

MPEG Transport Stream Input-RF Output

The unit accepts an MPEG transport stream on an ASI or SPI input from a video encoder or MPEG multiplexer and provides a DVB-S or DVB-S2 modulated carrier in the C-Band, Ku-Band or K-Band, which can be directly connected to a high power amplifier.

Baseband Frame Data Input

For DVB-S2 VCM and ACM applications the modulator accepts on it's input a baseband frame plus an additional header, which defines the modulation and FEC to be applied to each specific baseband frame. Also here the ASI or SPI input is used as interface. A hardware flow control signal can be used for synchronization purposes between the modulator and the multiplexer or encapsulator.

High signal integrity

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

Flexibility, Backward Compatibility

Mode adaptation, FEC Encoding, and Modulation is compliant with the DVB-S2 Standard EN 302307. QPSK / 8PSK / 16APSK and 32APSK modulation is available. For backward compatibility also framing, scrambling, FEC encoding as well as QPSK / 8PSK / 16QAM modulation according to the DVB-S Standards EN 300421 and EN 301210 is supported. BPSK modulation is also possible. Carriers with symbol rates from very low rates (8 kbps) up to 60 Msps can be transmitted.

Operating and control – easy integration into your system

The converters can be operated via the push buttons on the front panel using self-explanatory 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 is specialized to offer custom tailored products. 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 Satellite modulator-upconverter for digital TV satellite uplinks and digital SNG applications
- DVB-S2 compliant (EN 302 307)
  DVB-DSNG compliant (EN 301 210)
  DVB-S compliant (EN 300 421)
- QPSK / 8PSK / 16 QAM modulation (DVB-S, DVB-DSNG)
- QPSK / 8PSK / 16APSK / 32 APSK modulation (DVB-S2)
- Normal and short FEC frames, Pilots on or off (DVB-S2)
- BISS-E encryption (option), supports multi program transport stream
- Physical layer framing (PL scrambling with codes 0..262141) according to DVB-S2 standard
- Roll-Off: 35%, 25%, 20%
- Adjustable digital slope equalizer
- Low spurious output
- Dual ASI (with auto-switchover) and SPI electrical interfaces
- ASI optical interface (option)
- Null packet insertion and deletion and with PCR correction
- Still picture playout (customized picture content can be loaded to the modulator unit, option)
- Symbol rates from 8 ksps to 60 Msps
- Data rate max appr. 213 Mbps with ASI Interface (depending on modulation type and FEC)
- Data rate max 267 Mbps with SPI Interface (depending on modulation type and FEC)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface, SNMP (MIBs are provided).
- Summary alarm output (dual change over switch contacts)
- Transmit mute input
- Oven controlled 10 MHz reference oscillator.
- Test output of modulated signal 1.4 GHz
- Operating temperature range -30°C to 60°C (-22°F to140°F) (option)
- CE compliant
- **3 years warranty**

Order Information

Customer Field selectable Firmware Option

In order to meet your requirements different maximum symbol rates and different sets of modulation types are supported depending on the selected firmware option. The firmware option is password upgradeable in the field, which allows easy enhancement of the modulators if requirements change.

Summary of firmware options:

Firmware Option	Max Symbol Rate, Supported Modulation Types 1) DVB-S / DVB-DSNG 2) DVB-S2
- QL	20 Msps, BPSK / QPSK 1)
- QH	60 Msps, BPSK / QPSK 1)
- PL	20 Msps, BPSK / QPSK / 8PSK / 16QAM 1)
- PH	60 Msps, BPSK / QPSK / 8PSK / 16QAM 1)
- P2L	15 Msps, BPSK / QPSK 1) 15 Msps, QPSK / 8PSK 2)
- P2N	30 Msps, BPSK / QPSK 1) 30 Msps, QPSK / 8PSK 2)
- P2M	45 Msps, BPSK / QPSK 1) 45 Msps, QPSK / 8PSK 2)
- P2H	60 Msps, BPSK / QPSK 1) 60 Msps, QPSK / 8PSK 2)
- A2L	15 Msps, BPSK / QPSK / 8PSK / 16QAM 1) 15 Msps, QPSK / 8PSK / 16APSK / 32APSK 2)
- A2N	30 Msps, BPSK / QPSK / 8PSK / 16QAM 1) 30 Msps, QPSK / 8PSK / 16APSK / 32APSK 2)
- A2M	45 Msps, BPSK / QPSK / 8PSK / 16QAM 1) 45 Msps, QPSK / 8PSK / 16APSK / 32APSK 2)
- A2H	60 Msps, BPSK / QPSK / 8PSK / 16QAM 1) 60 Msps, QPSK / 8PSK / 16APSK / 32APSK 2)

Open questions, demo units

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

Challenge Series
Satellite High Speed DVB-S2 Modulator-Upconverter
Indoor Unit

Wide C-, X-, Ku-, K-Band
S-Type (standard version), H-Type (extended temperature range)

Modulator-Upconverter Type:		**HM2CU-C / SM2CU-C**	**HM2CU-X**	**HM2CU-Ku / SM2CU-Ku**	**HM2CU-K / SM2CU-K**
		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
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 to 50°C, outside this temperature range degraded by max 5 dB.		
Frequency Resolution:		10 Hz			
Conversion Scheme:		IQ-Modulator at 2450 MHz, single up-conversion			
RF-Output Characteristics:		Impedance: 50 Ω Return Loss: >20 dB >17 dB *) Output Power: -25 dBm to +5 dBm , 0.1 dB steps -30 dBm to +0 dBm , 0.1 dB steps *) Output Muting: >70 dB (by command or sense input or by alarm condition) RF-Signal Monitor: -20 dB of RF-output RF-Connectors: SMA female *) valid for some dual band and all triband versions			
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			
L-Band Test Output (Option LT)		Frequency: 990 MHz Level: -45 ± 3 dBm Connector: F female			
Spurious Outputs:		Signal related: < - 70 dBc (Pout > 0 dBm) < - 65 dBc (-20 dBm < Pout ≤ 0 dBm) < - 60 dBc (Pout ≤ -20 dBm) -			
Frequency Stability:		± 1 x 10^{-7}, 0°C to 50°C ± 2 x 10^{-8}, 0°C to 50°C (after 30 min warm up) ± 1.5 x 10^{-9} per day (fixed temperature after 24 h warm up)			
Reference Input:		Frequency: 10 MHz or 5 MHz Level: -3...10 dBm Modes: intern al, external, auto (senses reference input) Connector: BNC female			
Symbol Rate:		Max Range, depending on Firmware Option: 8 ksps - 60 Msps Step size: 1 sps			
Clock Stability:		± 5 x 10^{-8} (-30°C to 60°C), aging: ± 1.5 x 10^{-9} per day, ± 1 x 10^{-7} per year			
Data Rate:		3 kbps - 267 Mbps (depending on firmware option, modulation, coding) (SPI interface) 3 kbps - 213 Mbps (depending on firmware option, modulation, coding) (ASI interface) *) *) 3 kbps…170 Mbps (option BI, when BISS-1/E active)			
Transport Stream Adaption DVB-S2:		CRC-8 Encoder: yes Merger/Slicer: yes Base-Band Header Insertion: yes Stream Adaption: yes Base-Band Scrambling: yes according EN 302307			
Transport Stream Adaption DVB-S / DVB-DSNG:		Transport Stream Adaption: yes Randomization: yes according EN 300421			
Modulation / Encoding DVB-S2:		Outer BCH Coding: FEC-Frames n_{ldpc} = 64800 (normal FEC Frame) or n_{ldpc} = 16200 (short FEC frame) Inner LDPC Coding, depending on Firmware Option: QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (only n_{ldpc}=64800) 8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 (only n_{ldpc}=64800) 16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (only n_{ldpc}=64800) 32APSK 3/4, 4/5, 5/6, 8/9, 9/10 (only n_{ldpc}=64800) Physical Layer Framing: yes Physical Layer Signalling: yes Pilots Insertion: on / off Physical Layer Scrambling: N=0…262141 according EN 302307			

Specifications continued next page

Challenge Series
Satellite High Speed DVB-S2 Modulator-Upconverter
Indoor Unit

Wide C-, X-, Ku-, K-Band

Specifications continued:

Modulation / Encoding DVB-S / DVB-DSNG:	Outer Reed Solomon Coding: Convolutional Interleaving: Inner Coding depending on Firmware Option:	188/204, T=8 Depth I =12 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) according EN300421, EN 301210
Transport Stream Input Interface:	DVB-SPI (DSUB25 female) and Dual DVB-ASI-electrical (Connector BNC female, Impedance 75 Ohm) auto switching (can be enabled) between input 1 and 2 in case of ASI signal interruption, ASI data missing DVB-ASI-optical (Connector ST female, Multimode, 1300 nm) (Option)	
Baseband Frame Input:	Through DVB-ASI inputs or DVB-SPI input (can be used alternatively to Transport stream input, configurable) , Flow control signal available as LVDS Output signal on DVB-SPI connector or RS232 Signal on DVB-SPI connector (Option BBR)	
Transport Stream Security (Option BI):	BISS-E Scrambler, compliant to EBU Tech 3292 rev. 2 Supports 1 single or 1 multi program transport stream in BISS Mode 0, 1 and E BISS Mode 0: no scrambling, MPEG transport stream is transfered untouched BISS Mode 1: MPEG transport stream is scambled using 12-hexadecimal-character Clear Session Word BISS Mode E: MPEG transport stream is scambled 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	
Signal Spectrum Mask:	α = 0,35 according EN 300421 α = 0,25 according EN 301210, EN 302307 α = 0,20 according EN 302307	
Transport Stream Frames Size:	188 or 204 bytes	
Packet Stuffing:	Null 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 when the encoder sends to many null packets PCR (program clock reference) correction (with Null packet insertion) for max 250 PID streams with PCRs included	
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:	EN 300421, EN 301210, EN 302307 EN 50083-9 (ASI electrical, SPI Interface)	
Monitoring:	Faults, stored faults with time stamps	
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), 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:	HM2CU:-30°C to 60°C operating (10 minutes warm up at -30°C) SM2CU: 0°C to 50°C operating -30°C to 80°C storage	
User Interface:	SM2CU: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HM2CU: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys	
Power Input:	85…264 V AC, 40…70 Hz, appr. 30 W / 45 VA	
Mains Fuse:	2 x 3.15 A time-lag fuse	
Dimension and Weight:	483 x 44 x 500 mm³, 1 RU (19") appr. 9.6 kg	

Specifications are subject to change

Order Information:

SM2CU-[RF Band]-[Firmware Option]-[Options] Single Band modulator-upconverter
HM2CU-[RF Band]-[Firmware Option]-[Options] Single Band modulator-upconverter
HM2CUx-[RF Band(s)]-[Firmware Option]-[Options] Multiband modulator-upconverter
x=2: Dualband modulator-upconverter, x=3: Triband modulator-upconverter

Possible Options are:
FAN (internal fan)
LT (L-Band test output)
VFD (VFD display, standard with HCU-type converters)
BI (BISS scrambling)
BBR (Baseband Frame flow control as RS232 signal)

Examples:
HM2CU-Ku-QH-FAN (Ku-band Modulator-Upconverter with fan)
SM2CU2-KuK-P2H (Dualband Modulator-Upconverter KuK)
SM2CU3-CKuK-A2H-FAN (Triband Modulator-Upconverter CKuK with fan)