DVB-S2 Modem
SK-IP / SK-DV / SK-TS

WORK Microwave's high-speed DVB-S2 IP modem SK-IP provides operators with a platform for transferring IP/Ethernet data over DVB-S2 satellite connections. Ethernet frames and IP packets are encapsulated directly within DVB-S2 baseband frames, resulting in low encapsulation overhead.

In order to achieve speeds up to 356 Mbit/s, only the fastest and most bandwidth efficient encapsulation and modulation parameters are supported. For maximum bandwidth efficiency and ease of operation the device uses Generic Stream Encapsulation according to TS 102 606 and Multiprotocol Encapsulation according to EN 301 192.

The modem SK-TS is used for transmitting and receiving signals as MPEG transport streams. DVB-S as well as DVB-S2 modulation types are supported.

DaVid technology

Utilizing DaVid technology, WORK Microwave's DVB-S2 Modem SK-DV system offers simultaneous transportation of IP data (i.e., network connection) and live broadcasting (i.e., video content) over a single satellite carrier. The DaVid technology works by aggregating multiple transport streams and IP data into a DVB-S2 multiplex while providing end-user control of all transmission types.

OptiACM

An integrated OptiACM controller provides adaptive or variable FEC- and modulation setting for point-to-point or point-to-multipoint IP applications.

VideoACM

An integrated VideoACM controller provides adaptive or variable FEC- and modulation setting for point-to-point or point-to-multipoint Transport Stream transmissions.

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.

Flexible RF connectivity

The modulator provides the modulated signal from 50 to 180 MHz IF or at L-band. With the L-band output, a 10 MHz reference signal for a block upconverter can be enabled on the TX port, as well as DC power 24 V or 48 V (Option DC24 or DC48).

The demodulator accepts an L-band signal in the range from 950 to 2150 MHz on two inputs or alternatively an IF signal in the range from 50 to 180 MHz on a single input. On L-band devices, LNBs can be powered directly over the inputs.

High signal integrity

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

Operating and control - easy integration into your system

The modem can be operated via push buttons on the front panel using intuitive display menus or via remote control (RS232, RS422/485 and TCP/IP over Ethernet). For the remote control addressable packet-based commands, a Web interface (HTTP browser) or SNMP can be used. Detailed monitoring of system parameters is possible.

Key features

- DVB-S2   - ETSI EN 302 307-1
  DVB-DSNG - ETSI EN 301 210
  DVB-S   - ETSI EN 300 421

- DVB-S2 modulations:
  QPSK / 8PSK / 16APSK / 32APSK
  normal, short

- DVB-S and DVB-DSNG:
  QPSK / 8PSK / 16QAM modulation
  (SK-TS)

- 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)

- Normal and short FEC frames, pilots on or off (DVB-S2)

- Physical layer framing with scrambling codes 0 to 262141 according to DVB-S2 standard

- Symbol rates from 500 ksps to 80 Msps

- Roll-Off: 35 %, 25 %, 20 %, 15 %, 10 %, 5 %

- Adjustable digital gain slope equalizer

- Low spurious output

- An output signal multiplexer integrated within the L-band version allows to combine the modulated signal, the 10 MHz reference signal and DC power (option DC24 or DC48) to drive an external power block upconverter

- Automatic integrated uplink power control (option)

- DISEqC 1.1 support on LNB L-band input

- OptiACM system for optimized bandwidth usage and extended weather insensitivity for IP transmission

- Gigabit Ethernet data interface

- IP and baseband traffic shaping

- Generic Stream Encapsulation (GSE) direct to DVB-S2 baseband frames

- Multiprotocol Encapsulation (MPE)

- Operates as Layer 2 Bridge, Layer 3 Bridge or Layer 3 Router

- 2 ASI Input and 2 ASI Output Interfaces (SK-DV, SK-TS)

- Transport Stream Input for DVB-S2 Multiple Input Stream operation, capacity calculator, optional capacity limitation per TS input (SK-DV only)

- Transport Stream over IP Inputs (option TI1,TI2) (SK-DV, SK-TS only)

- Support of 2 Multiple Transport Stream Inputs and Outputs (SK-DV, SK-TS)

- VideoACM system for optimized bandwidth usage and extended weather insensitivity for Transport Stream video transmission

- BISS-E encryption of transport streams on transmit side (option BI), supports multi program transport stream

- Transmit mute input

- Tx Monitor Output on Frontpanel

- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface, SNMP with MIBs downloadable form the device

- 10 MHz Reference OCXO included

- Summary alarm output with dual change over switch contacts

- Operating temperature range 0 °C to 50 °C (32 °F to 122 °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-S2 Modem
SK-IP / SK-DV / SK-TS

Modulator Part of Modem Type:			SK-IP / SK-DV / SK-TS	
Signal Outputs:	SK-xx-Lx-xx:	1x L-band output	(950 … 2150 MHz)	
	SK-xx-Vx/Lx-xx:	1x VHF-band output	(50 … 180 MHz),	
		1x L-band output	(950 … 2150 MHz), can be alternatively enabled	

		VHF-band Output	**L-band Output**
IF-Output Frequency:		50 … 180 MHz	950 … 2150 MHz
Frequency Resolution:		1 Hz	1 Hz
Phase Noise:	**10 Hz**	-70	-65
	100 Hz	-80	-75
	1 kHz	-88	-88
	10 kHz	-90	-90
	100 kHz	-100	-100
	1 MHz	-115	-115
		max. values in dBc/Hz	

IF-Output Characteristics:	Impedance:	50 Ω or 75 Ω	Impedance:	50 Ω or 75 Ω
	Return Loss:	> 16 dB	Return Loss:	> 16 dB
	Output Power:	-25 dBm … 5 dBm, 0.1 dB steps, ±0.5 dBm accuracy	Output Power:	-30 dBm … 0 dBm, 0.1 dB steps, ±0.5 dBm accuracy
	Output Power muted:	< -85 dBm	Output Power muted:	< -85 dBm
	Connector:	BNC female	Connector:	N female (50 Ω) F female (75 Ω)
			10 MHz reference output on L-band output:	1.5 ±1.5 dBm (can be switched on/off)
			DC output on L-band output:	24 V or 48 V, 4 A max (can be switched on/off) (option DC24 or DC48)

Monitoring Output (on front panel):	Output Power:	-20 dB of IF Output	Output Power:	-20 dB of L-band Output
	Impedance:	50 Ω	Impedance:	50 Ω
	Return Loss:	> 20 dB	Return Loss:	> 20 dB
	Connector:	SMA female	Connector:	SMA female

Spurious Outputs:	Signal related:	< -67 dBc, unmodulated carrier, 50 … 90 MHz or 100 … 180 MHz < -45 dBc, unmodulated carrier, out of band	Signal related:	<-67 dBc (unmodulated carrier, in band) <-45 dBc (unmodulated carrier harmonics, out of band)

Frequency and 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	

Frequency and Clock Stability	$\pm2 \times 10^{-8}$ (-30 °C ... 60 °C, after warm up), aging: $\pm1 \times 10^{-9}$ per day, $\pm1 \times 10^{-7}$ per year	
Symbol Rate:	Max. Range:	500 ksps … 80 Msps (depending on firmware option)
	Step size:	1 sps
Modulation / Coding DVB-S2:	Outer BCH Code:	FEC-Frames n_{ldpc} = 64800 (normal FEC Frame) n_{ldpc} = 16200 (short FEC Frame)
	Inner LDPC Code:	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
	Physical Layer Framing:	yes
	Physical Layer Signaling:	yes
	Pilots Insertion:	on / off
	Physical Layer Scrambling:	N = 0 … 262141 all according ETSI EN 302307
Modulation / Coding DVB-S / DVB-DSNG:	Outer Reed Solomon Coding:	188/204, T=8
	Convolutional Interleaving:	Depth I =12
	Inner Coding depending on Firmware Option (according ETSI EN 300421, 301210)	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) (SK-TS only)
Carrier ID:	DVB-CID according to ETSI TS 103 129	
Signal Spectrum Mask:	α = 0.35, 0.25, 0.20 according ETSI EN 302307 α = 0.15, 0.10, 0.05 (with Firmware Option …S)	
Transport Stream Adaption DVB-S2:	CRC-8 Encoder:	yes
	Merger/Slicer:	yes
	Baseband Header Insertion:	yes
	Stream Adaption:	yes
	Baseband Scrambling:	yes (according ETSI EN 302307) (SK-DV, SK-TS only)
Transport Stream Adaption DVB-S / DVB-DSNG:	Transport Stream Adaption	yes
	Randomization	yes (according ETSI EN 300421) (SK-TS only)

<div align="right">Specifications continued next page</div>

DVB-S2 Modem
SK-IP / SK-DV / SK-TS

Transport Stream Inputs:	2x ASI (BNC female 75 Ω) (SK-DV only)
	Supporting 1 Multiple Transport Stream Input (auto switching dual input)
	With option MT2:
	2x ASI (BNC female 75 Ω) (SK-DV only)
	Supporting 2 Multiple Transport Stream Inputs or 1 Multiple Transport Stream (auto switching dual input)
	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 TS. (SK-DV, SK-TS only)

Multiple Transport Stream Input Operation:	Individual modulation and FEC (MODCOD) configuration per TS input, capacity calculator, capacity limitation per TS input can be activated. Input stream synchronization and Null-Packet deletion according to ETSI EN 302307, Annex D.2, D.3. (SK-DV, SK-TS only)
Transport Stream Frames Size:	188 or 204 bytes (SK-DV, SK-TS only)
Packet Stuffing:	TS Null packet or TS All Zero packet insertion (SK-TS only) or Dummy PLFRAME insertion (SK-IP, SK-DV 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 (SK-TS only). PCR (program clock reference) correction (with Null packet insertion/deletion) for max 250 PID streams with PCRs included (SK-TS only, not supported in case of DVB-S2 multiple input stream operatio). (SK-DV, SK-TS only)
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). (SK-DV, SK-TS only)

Demodulator Part of Modem Type:	SK-IP / SK-DV / SK-TS	
Signal Inputs:	SK-xx-xx-L75: 2x L-band input (950 … 2150 MHz), can be alternatively enabled SK-xx-xx-Vx/L75: 1x VHF-band input (50 … 180 MHz) 1x L-band input (950 … 2150 MHz), can be alternatively enabled	
	VHF-band Input	**L-band Input**
IF-Input Frequency:	50 … 180 MHz	950 … 2150 MHz

IF-Input Characteristics:	Impedance: 50 Ω or 75 Ω
	Return Loss: > 16 dB
	Input Power: -60 dBm … -15 dBm
	                          (total aggregate power)
	IF-Connector: BNC female
		Impedance: 75 Ω
		Return Loss: > 13 dB
		Input Power: -70 dBm … -20 dBm
		                          (total aggregate power)
		IF-Connector: 2x F female,
		                          input selectable
		LNB DC-Feed: 13.5V or 18 VA (450mA) switchable,
		                          22 kHz tone on/off, DISEqC 1.1
		                          short circuit protected

Symbol Rate:	Max. Range: 500 ksps … 80 Msps Step size: 1 sps	

Demodulation / Decoding DVB-S2:	Outer BCH Code: FEC-Frames n_{ldpc} = 64800 (normal FEC Frame)
	                                                            n_{ldpc} = 16200 (short FEC Frame)
	Inner LDPC Code: 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
	Demodulator auto detection: Modulation- and FEC-type, pilots on/off are automatically detected
	Physical Layer Scrambling: N = 0 … 262141
	                                               all according ETSI EN 302307	

Demodulation / Decoding DVB-S:	Outer Reed Solomon Code: 188/204, T=8
	Convolutional Interleaving: Depth I=12
	Inner Code: QPSK 1/2, 2/3, 3/4, 5/6, 6/7, 7/8 (Convolutional K=7)
	                                               automatically selected
	                                               all according ETSI EN 300421 (SK-DV, SK-TS only)	

Signal Spectrum Mask:	α = 0.35, 0.25, 0.20 according ETSI EN 302307 α = 0.15, 0.10, 0.05 (compatible)	
Transport Stream Output:	2x ASI (BNC female 75 Ω) Supporting Single Transport Stream Operation or 1 Multiple Transport Stream Operation (Dual Output) Processing of 2 Multiple Transport Streams (can be assigned arbitrarily to Output) (Option MT2) Up to 6 x RTP/UDP IP over Ethernet according to IETF RFC 2250 Support of Null Packet Reinsertion according to ETSI EN 302 307 Annex G.3 (SK-DV, SK-TS only)	
Transport Stream Frame Size:	188 bytes (SK-DV, SK-TS only)	

DVB-S2 Modem
SK-IP / SK-DV / SK-TS

Common Parameters:	SK-IP / SK-DV / SK-TS
Baseband Channels:	16 baseband channel with separate DVB-S2 baseband settings (MODCOD, FEC frame length, pilots, encapsulation type, multistream ID, timeout) (SK-IP, SK-DV only)
OptiACM:	CCM / VCM / ACM functionality for point-to-point and point-to-multipoint links 16 ACM channels with separate MODCOD range and Es/N0 sensitivity ACM channels arbitrary assignable to baseband channels (SK-IP, SK-DV only)
BB Traffic Shaper:	Baseband channel limits based on symbol rate for virtual share of the carrier Guaranteed and limited bandwidth individually configurable (SK-IP, SK-DV only)
Data Interface:	Ethernet (1xRJ-45, 10/100/1000 Mbps auto sensing)
IP Data Rate:	up to 356 Mbps or 80000 pps (SK-IP, SK-DV only)

Network Operation:	Layer 2: Bridge (Ethernet frame transmission)
	          STP/RSTP
	Layer 3: Bridge/Router (IP packet transmission), IPv4, IPv6
	          256 IP/subnet routes per port
	          16 DVB-S2 baseband channels (SK-IP, SK-DV only)

Data Encapsulation:	Generic Stream Encapsulation (GSE) according ETSI TS 102606 Multiprotocol Encapsulation (MPE) according to ETSI EN 301192 (SK-IP, SK-DV only)
IP Traffic Shaper:	64 independent rules Guaranteed and limited bandwidths Fixed or dynamically integrated into ACM (bind to MODCOD) Match criteria: source/destination IP subnet, source MAC, UDP/TCP port ranges, TOS/DS field, packet size (Active IP Traffic shaper reduces max. packet rate to typ. 50000 pps) (SK-IP, SK-DV only)

Transport Stream Security (Option BI):	BISS-E Scrambler on transmit side, compliant to EBU Tech 3292 rev. 2 (SK-DV, SK-TS only)
	For use with unit supporting 1 Multiple Transport Stream input.
	Supports Single or Multi Program 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.

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 and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10/100 Mbps auto sensing) IPv4, IPv6, connector RJ-45 Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10/100 Mbps, auto sensing) IPv4, IPv6, 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, IPv6, connector RJ-45
Alarm Interface: Mute Input:	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09
Internal Fan	FAN included
Temperature Range:	0 °C ... 50 °C operating -30 °C ... 80 °C storage
Relative Humidity:	< 95 % non condensing
User Interface:	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max, 50 … 60 Hz
Mains Power Consumption:	Typ.: 65 VA / 45 W, Max 190 W (with option DC24, DC power on) Max 300 W (with option DC48, DC power on)
Mains Power Input Connector:	IEC C14
Mains Fuse:	2 x 3.15 A time-lag fuse (standard) 2 x 5 A time lag fuse (with option DC24 or DC48)
Dimension and Weight:	483 x 44 x 470 mm³ (WxHxD), 1 RU (19") approx. 8 kg (standard) approx. 10 kg (with option DC24 or DC48)

Specifications are subject to change

DVB-S2 Modem
SK-IP / SK-DV / SK-TS

Order Information:

 SK-[Device Type]-[Output Band Output Imp]-[Input Band Input Imp]-[Hardware Options]

Device Types:

IP	DVB-S2 IP Modem
DV	DaVid Technology Modem (combination of TS and IP into one carrier)
TS	DVB-S/S2 Transport Stream Modem

Hardware Options are:

		Cannot be combined with:	Available for:
DC24	24 V DC power on L-band output	DC48	SK-IP, SK-DV, SK-TS
DC48	48 V DC power on L-band output	DC24	SK-IP, SK-DV, SK-TS
TI1	one TS over IP input interface	TI2	SK-DV, SK-TS
TI2	two TS over IP input interfaces	TI1	SK-DV, SK-TS
BI	BISS scrambling and descrambling for Transport Stream	MT2	SK-DV, SK-TS
MT2	Support of 2 Multiple Transport Stream inputs and outputs	BI	SK-DV, SK-TS

Soiftware Options are:

		Cannot be combined with:	Available for:
BBO	Baseband frame input and output	-	SK-IP, SK-DV, SK-TS
XB	Broadcast Predistortion	-	SK-IP, SK-DV, SK-TS
XE	Extended Predistortion	-	SK-IP, SK-DV, SK-TS

Modulation options as per following table:

Modulation Option	Max Symbol Rate, Supported Modulation Types and other Features DVB-S2
- P2L	15 Msps, QPSK / 8PSK
- P2N	30 Msps, QPSK / 8PSK
- P2M	45 Msps, QPSK / 8PSK
- P2H	60 Msps, QPSK / 8PSK
- P2E	80 Msps, QPSK / 8PSK
- A2L	15 Msps, QPSK / 8PSK / 16APSK / 32APSK
- A2N	30 Msps, QPSK / 8PSK / 16APSK / 32APSK
- A2M	45 Msps, QPSK / 8PSK / 16APSK / 32APSK
- A2H	60 Msps, QPSK / 8PSK / 16APSK / 32APSK
- A2E	80 Msps, QPSK / 8PSK / 16APSK / 32APSK
- …S	Support of Roll-Off-Filters down to 5%

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

Examples:

SK-IP-L50-L75-DC24	IP Modem with L-band Output 50 Ω and L-band Input 75 Ω, DC24 Volt
SK-IP-V50/L50-V75/L75	IP Modem with VHF-band and L-band Output, VHF-band and L-band Input
SK-DV-V75/L50-V75/L75	DaVid Technology Modem with VHF-band and L-band Output and Input

DVB
Digital **V**ideo **B**roadcasting

Trade Mark of the DVB Digital Video Broadcasting Project