WORK MICROWAVE

we are the wave –
excellence in high frequency

Product Catalogue
February 2017

Satellite Frequency Converters
Test Loop Translators
Redundancy Systems 1:1 / N:1

DVB-S / S2 / S2X
Modulators
Modems
Demodulators

WORK MICROWAVE

we are the wave –
excellence in high frequency

Product Catalogue
February 2017

Table of Contents

Analog Products

Satellite IF Converters
Dual Channel Shared Oscillator Downconverters
Test Loop Translators
Synthesized Block Converters
Fixed Frequency Block Converters
Remote Control Units
ALC
Redundancy Systems 1:1/N:1

Satellite Up- and Downconverter

Indoor / Outdoor

Single / Dual / Triple Band
Single / Dual Channel
L-, S-, C-, X-, Ku-, K (DBS)-, Ka-, Q- and V-Band

WORK Microwave's satellite up-and downconverters are designed to support the demanding requirements of analog and digital satellite transmissions, such as TV uplinks and high-speed data networks. Ideal use cases include fixed satellite ground stations as well as in satellite newsgathering (SNG) vehicles, fly-aways and other mobile or portable applications.

The fifth-generation frequency converter series is built with the most advanced technologies available to ensure outstanding performance, high reliability and a longer lifetime.

5th-generation enhancements

Reduced phase noise: Based on a powerful new synthesizer the frequency converters achieve a phase noise significantly beyond the recommended industry specification (Intelsat's IESS-308/309).

Improved flexibility and usability: Through a new USB port, operators can now access the converter via the back panel to make copies of parameter settings, replicate selected configurations on another device or save configuration settings for future reference. In addition, a user-friendly, Web-based interface offers an intuitive user experience. When coupled with the enhanced USB port, the customizable GUI also simplifies the installation of firmware updates.

Higher reliability: An AC power consumption of 45 VA / 30 W maximizes the reliability and lifetime of the units.

Enhanced scalability: A completely modular-based design provides users with a cost-effective solution that can be tailored according to specific needs, including frequency range, output power and conversion gain.

S-, C-, X-, Ku-, K-, Ka-, and Q-band coverage

The following satellite frequency bands are covered: S, C, X, Ku, K, Ka, and Q-band. The converters support the standard IF-frequency bands 70 ±20 MHz and/or 140 ±40 MHz. The conversion is performed without spectral inversion. The upconverters offer an increased power output (P1dB ≥ +10 dBm) in all versions. The units are available as single band, dual band or as triple band converters. For more bands or channels please contact factory.

High signal integrity

The extreme low phase noise of the oscillators guarantees an excellent signal quality. Low spurious emissions allow our customers to use the converters also in the environments with demanding requirements, such as high power video uplinks. Sophisticated temperature compensation guarantees the stability over a wide temperature range.

Housing options

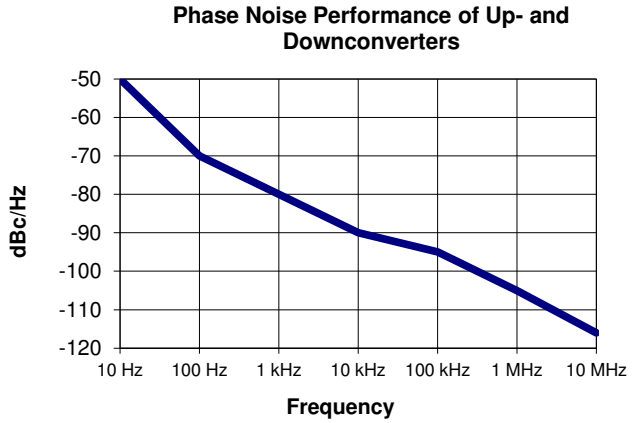
The converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as potential point of failure. For rack installations without any space in between the units, a fan within the converter unit is recommended. This forces an airflow from the right side to left side of the units. Outdoor versions with IP 67 degree of protection are also available.

Operating and control – easy integration into your system

The converters can be operated via the push buttons on the front panel using intuitive display menus or via remote control (RS232, RS422/485 and TCP/IP over Ethernet). Detailed monitoring of the system status

and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string-based commands as well as addressable, packet based commands are provided.

Remote monitoring and control through SNMP and a Web browser interface is also available.



Customized products

In addition to standard products WORK Microwave offers custom tailored products as follows:

- Modified or smaller housings to fit into your existing design for mobile and portable applications.
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity).
- For down converters: Application specific output filtering and automatic level control. The output level is kept constant independent of the strength of the input signal with adjustable control.
- Additional PLO output.

Key features

- 70 MHz or 140 MHz IF bands available
- Optional switchable IF 70 MHz and 140 MHz (IF 70/140)
- Very low phase noise (< -50 dBc/Hz @ 10 Hz)
- Long-term stability 10^{-7} / year
- Output power +10 dBm (1 dB compression point)
- Automatic reference recognition (5 and 10 MHz)
- Adjustable gain equalizer
- Digital gain compensation
- Operating temperature range either -30 °C to 60 °C (-22 °F to 140 °F), -40 °C to 60 °C (-40 °F to 140 °F) (VECD units) or 0 °C to 50 °C (32 °F to 122 °F)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces. Packet command syntax supports RS485 bus systems and allows addressed operation.
- Remote control through Ethernet supporting a TCP/IP command interface, a Web browser interface and SNMP (MIBs are provided).
- Test output on the front panel: RF-Test at up converter, IF-Test at down converter.
- Optional IF-Test output for up converters (Option: IFT)
- Optional RF-Test output for down converters (Option: RFT)
- AC power switch on the front panel
- Summary alarm output (dual change over switch contacts)
- Transmit mute input
- Optional internal Fan (Option: FAN)
- CE compliant
- **3 years warranty**

Order information

WORK Microwave offers three series of 19” rack satellite converters:
Standard-, High- and Extra High Performance. The specifications are the same for all types except the operating temperature range. The High Performance type operates between -30 °C to 60 °C (-22 °F to 140 °F), the Extra High Performance type between -40 °C to 60 °C (-40 °F to 140 °F) and the Standard type between 0 °C to 50 °C (32 °F to 122 °F). Therefore if you only need units for inside use, the standard unit is perfectly suited for this application.

Open questions, demo units

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

Satellite Upconverter

L-, S-, C-, X-, Ku-, K- (DBS), Ka-band

Q/V-band available on request (contact factory)

Upconverter Type:		VHCU-L-2 / VSCU-L-2	VHCU-S / VSCU-S	VHCU-S4 / VSCU-S4	VHCU-C / VSCU-C
RF-Output Frequency:		L-Band 0.95 … 2.15 GHz	S-Band 2.025 … 2.290 GHz	S-Band 2.0 … 2.6 GHz	C-Band 5.85 … 6.65 GHz
Intermediate Frequency:		5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	3050 MHz for 70 MHz IF Input 3060 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input
Phase Noise:	**10 Hz**	-70 / -67	-70 / -67	-70 / -67	-63 / -60
	100 Hz	-84 / -81	-84 / -81	-84 / -81	-83 / -80
	1 kHz	-98 / -95	-98 / -95	-98 / -95	-93 / -90
	10 kHz	-104 / -101	-104 / -101	-104 / -101	-98 / -95
	100 kHz	-107 /-104[1)]	-107 /-104[1)]	-107 /-104[1)]	-100 / -97[1)]
	1 MHz	-112 / -109[1)]	-112 / -109[1)]	-112 / -109[1)]	-110 / -107[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm SMA female	3120 MHz (70 MHz IF) 3200 MHz (140 MHz IF) -6 ±3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		6.12 … 7.32 GHz (70 MHz IF) 6.05 … 7.25 GHz (140 MHz IF) -7 ±3 dBm SMA female	4.475 … 4.740 GHz (70 MHz IF) 4.465 … 4.730 GHz (140 MHz IF) -7 ±3 dBm SMA female	5.05 … 5.65 GHz (70 MHz IF) 5.06 … 5.66 GHz (140 MHz IF) -7 ±3 dBm SMA female	8.30 … 9.10 GHz (70 MHz IF) 8.29 … 9.09 GHz (140 MHz IF) -7 ±3 dBm SMA female

Upconverter Type:		VHCU-C1 / VSCU-C1	VHCU-X / VSCU-X	VHCU-X4 / VSCU-X4	VHCU-X6 / VSCU-X6
RF-Output Frequency:		C-Band 5.85 … 7.03 GHz	X-Band 7.90 … 8.40 GHz	X-Band 7.80 … 8.60 GHz	X-Band 8.00 … 8.50 GHz
Intermediate Frequency:		2610 MHz for 70 MHz IF Input 2600 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input
Phase Noise:	**10 Hz**	-63 / -60	-63 / -60	-63 / -60	-63 / -60
	100 Hz	-83 / -80	-83 / -80	-83 / -80	-83 / -80
	1 kHz	-93 / -90	-93 / -90	-93 / -90	-93 / -90
	10 kHz	-98 / -95	-98 / -95	-98 / -95	-98 / -95
	100 kHz	-100 / -97[1)]	-100 / -97[1)]	-100 / -97[1)]	-100 / -97[1)]
	1 MHz	-110 / -107[1)]	-110 / -107[1)]	-110 / -107[1)]	-110 / -107[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2680 MHz (70 MHz IF) 2740 MHz (140 MHz IF) -6 ±3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		8.46 … 9.64 GHz (70 MHz IF) 8.45 … 9.63 GHz (140 MHz IF) -7 ±3 dBm SMA female	10.35 … 10.85 GHz (70 MHz IF) 10.34 … 10.84 GHz (140 MHz IF) -7 ±3 dBm SMA female	10.25 … 11.05 GHz (70 MHz IF) 10.24 … 11.04 GHz (140 MHz IF) -7 ±3 dBm SMA female	10.45 … 10.95 GHz (70 MHz IF) 10.44 … 10.94 GHz (140 MHz IF) -7 ±3 dBm SMA female

Upconverter Type:		VHCU-Ku / VSCU-Ku	VHCU-Ku1 / VSCU-Ku1	VHCU-K / VSCU-K	VHCU-Ka / VSCU-Ka
RF-Output Frequency:		Ku-Band 12.75 … 14.50 GHz	Ku-Band 10.70 … 12.75 GHz	K-Band 17.3 … 18.4 GHz	Ka-Band 27.5 … 31.0 GHz
Intermediate Frequency:		2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	3050 MHz for 70 MHz IF Input 3060 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input
Phase Noise:	**10 Hz**	-63 / -60	-63 / -60	-63 / -60	-56 / -53
	100 Hz	-83 / -80	-83 / -80	-83 / -80	-73 / -70
	1 kHz	-93 / -90	-93 / -90	-93 / -90	-84 / -81
	10 kHz	-98 / -95	-98 / -95	-98 / -95	-90 / -87
	100 kHz	-100 / -97[1)]	-100 / -97[1)]	-100 / -97[1)]	-93 / -90[1)]
	1 MHz	-110 / -107[1)]	-110 / -107[1)]	-110 / -107[1)]	-103 / -100[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm SMA female	3120 MHz (70 MHz IF) 3200 MHz (140 MHz IF) -6 ±3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm SMA female	5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		15.20 … 16.95 GHz (70 MHz IF) 15.19 … 16.94 GHz (140 MHz IF) -7 ±3 dBm SMA female	13.75 … 15.80 GHz (70 MHz IF) 13.76 … 15.81 GHz (140 MHz IF) -7 ±3 dBm SMA female	14.85 … 15.95 GHz (70 MHz IF) 14.86 … 15.96 GHz (140 MHz IF) -7 ±3 dBm SMA female	32.67 … 36.17 GHz (70 MHz IF) 32.60 … 36.10 GHz (140 MHz IF) -7 ±3 dBm SMA female

Specifications continued next page

Satellite Upconverter

L-, S-, C-, X-, Ku-, K- (DBS), Ka-band

Q/V-band available on request (contact factory)

Upconverter Type:		VHCU-Ka1 / VSCU-Ka1	VHCU-Ka2 / VSCU-Ka2	VHCU-Ka3 / VSCU-Ka3	VHCU-Ka5 / VSCU-Ka5
RF-Output Frequency:		Ka-Band 19.2 … 20.2 GHz	Ka-Band 17.7 … 19.5 GHz	Ka-Band 19.4 … 21.2 GHz	Ka-Band 29.0 … 32.0 GHz
Intermediate Frequency:		2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input
Phase Noise:	**10 Hz**	-61 / -58	-61 / -58	-61 / -58	-56 / -53
	100 Hz	-81 / -78	-81 / -78	-81 / -78	-73 / -70
	1 kHz	-91 / -88	-91 / -88	-91 / -88	-84 / -81
	10 kHz	-96 / -93	-96 / -93	-96 / -93	-90 / -87
	100 kHz	-98 / -95[1)]	-98 / -95[1)]	-98 / -95[1)]	-93 / -90[1)]
	1 MHz	-108 / -105[1)]	-108 / -105[1)]	-108 / -105[1)]	-103 / -100[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max 5 dB.		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm SMA female	5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		16.75 … 17.75 GHz (70 MHz IF) 16.76 … 17.76 GHz (140 MHz IF) -7 ±3 dBm SMA female	15.25 … 17.05 GHz (70 MHz IF) 15.26 … 17.06 GHz (140 MHz IF) -7 ±3 dBm SMA female	16.95 … 18.75 GHz (70 MHz IF) 16.96 … 18.76 GHz (140 MHz IF) -7 ±3 dBm SMA female	34.17 … 37.17 GHz (70 MHz IF) 34.10 … 37.10 GHz (140 MHz IF) -7 ±3 dBm SMA female

Common Parameters		
Conversion Scheme:	Dual up conversion, no frequency inversion	
Frequency Resolution:	100 Hz	
IF-Input Characteristics:	Frequency:	70 ±20 MHz or 140 ±40 MHz (optional: both → [IF-Band] = 70/140)
	Impedance:	50 or 75 Ω
	Return loss:	> 20 dB
	Operational input level:	-40 dBm[1)]
	Maximum aggregate input level:	+10 dBm (damage level)
	IF-Connectors:	BNC female N female (standard with option OD)
RF-Output Characteristics:	Impedance:	50 Ω
	Return loss:	> 20 dB
	1 dB compression point:	> 10 dBm
	Output muting:	> 60 dB (by command or sense input or by alarm condition)
	RF-signal monitor:	-20 dB of RF-output (approx.) (indoor only, optional for outdoor)
	RF-connectors:	SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
Transfer Characteristics:	Max. conversion gain:	40 dB ±1.0 dB
	Attenuation range:	0 … 30 dB, Step 0.1 dB
	Level stability:	± 0.25 dB/day at constant temperature ± 0.5 dB max., ±0.2 dB typ. over temperature range
	Gain flatness:	± 0.25 dB over ±20 MHz (IF 70 MHz), ±0.40 dB over ±40 MHz (IF 140 MHz)
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Equalizer (Gain Slope):	Max. ±0.0625 dB / MHz (IF 70 MHz), adjustable Max. ±0.05 dB / MHz (IF 140 MHz), adjustable	
Group Delay (±18 MHz):	Linear:	0.03 ns / MHz max.
	Parabolic:	0.01 ns / MHz² max.
	Ripple:	1 ns peak to peak max.
Group Delay (±36 MHz):	Linear:	0.015 ns / MHz max.
	Parabolic:	0.005 ns / MHz² max.
	Ripple:	2 ns peak to peak max.
Intermodulation (3rd Order):	OIP3:	>18 dBm[1)]
AM / PM conversion:	0.1° / dB[1)]	
Spurious Outputs:	Signal related:	< -60 dBc (Δf < 2 MHz), < -70 dBc (Δf ≥ 2 MHz)[1) 2)]
	Output harmonics:	< -40 dBc[1) 2)]
	Signal independent:	< -70 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain

[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Satellite Downconverter

L-, S-, C-, X-, Ku-, K- (DBS), Ka-band

Q/V-band available on request (contact factory)

Downconverter Type:		VHCD-L-2 / VSCD-L-2	VHCD-S / VSCD-S	VHCD-S4 / VSCD-S4	VHCD-C / VSCD-C
RF-Input Frequency:		L-Band 0.95 … 2.15 GHz	S-Band 2.025 … 2.290 GHz	S-Band 2.0 … 2.6 GHz	C-Band 3.4 … 4.2 GHz
Intermediate Frequency:		5170 MHz for 70 MHz IF Output 5100 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	3050 MHz for 70 MHz IF Output 3040 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output
Phase Noise:	**10 Hz**	-70 / -67	-70 / -67	-70 / -67	-70 / -67
	100 Hz	-84 / -81	-84 / -81	-84 / -81	-84 / -81
	1 kHz	-98 / -95	-98 / -95	-98 / -95	-98 / -95
	10 kHz	-104 / -101	-104 / -101	-104 / -101	-104 / -101
	100 kHz	-107 /-104[1)]	-107 /-104[1)]	-107 /-104[1)]	-107 /-104[1)]
	1 MHz	-112 / -109[1)]	-112 / -109[1)]	-112 / -109[1)]	-112 / -109[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	3120 MHz (70 MHz IF) 3180 MHz (140 MHz IF) -6 ±3 dBm SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		6.12 … 7.32 GHz (70 MHz IF) 6.05 … 7.25 GHz (140 MHz IF) -7 ±3 dBm SMA female	4.475 … 4.740 GHz (70 MHz IF) 4.465 … 4.730 GHz (140 MHz IF) -7 ±3 dBm SMA female	5.05 … 5.65 GHz (70 MHz IF) 5.04 … 5.64 GHz (140 MHz IF) -7 ±3 dBm SMA female	5.55 … 6.35 GHz (70 MHz IF) 5.54 … 6.34 GHz (140 MHz IF) -7 ±3 dBm SMA female

Downconverter Type:		VHCD-C1 / VSCD-C1	VHCD-X / VSCD-X	VHCD-Ku / VSCD-Ku	VHCD-Ka / VSCD-Ka
RF-Input Frequency:		C-Band 3.4 … 4.8 GHz	X-Band 7.25 … 7.75 GHz	Ku-Band 10.70 … 12.75 GHz	Ka-Band 18.1 … 21.2 GHz
Intermediate Frequency:		5170 MHz for 70 MHz IF Output 5100 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output
Phase Noise:	**10 Hz**	-63 / -60	-63 / -60	-63 / -60	-61 / -58
	100 Hz	-83 / -80	-83 / -80	-83 / -80	-81 / -78
	1 kHz	-93 / -90	-93 / -90	-93 / -90	-91 / -88
	10 kHz	-98 / -95	-98 / -95	-98 / -95	-96 / -93
	100 kHz	-100 / -97[1)]	-100 / -97[1)]	-100 / -97[1)]	-98 / -95[1)]
	1 MHz	-110 / -107[1)]	-110 / -107[1)]	-110 / -107[1)]	-108 / -105[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		8.57 … 9.97 GHz (70 MHz IF) 8.50 … 9.90 GHz (140 MHz IF) -7 ±3 dBm SMA female	9.40 … 9.90 GHz (70 MHz IF) 9.39 … 9.89 GHz (140 MHz IF) -7 ±3 dBm SMA female	12.85 … 14.90 GHz (70 MHz IF) 12.84 … 14.89 GHz (140 MHz IF) -7 ±3 dBm SMA female	15.65 … 18.75 GHz (70 MHz IF) 15.66 … 18.76 GHz (140 MHz IF) -7 ±3 dBm SMA female

Downconverter Type:		VHCD-Ka2 / VSCD-Ka2	VHCD-Ka3 / VSCD-Ka3	VHCD-Ka4 / VSCD-Ka4	VHCD-Ka7 / VSCD-Ka7
RF-Input Frequency:		Ka-Band 17.7 … 19.5 GHz	Ka-Band 19.4 … 21.2 GHz	Ka-Band 27.5 … 31 GHz	Ka-Band 25.5 … 27.5 GHz
Intermediate Frequency:		2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	5170 MHz for 70 MHz IF Output 5100 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output
Phase Noise:	**10 Hz**	-61 / -58	-61 / -58	-56 / -53	-57 / -54
	100 Hz	-81 / -78	-81 / -78	-73 / -70	-77 / -74
	1 kHz	-91 / -88	-91 / -88	-84 / -81	-87 / -84
	10 kHz	-96 / -93	-96 / -93	-90 / -87	-92 / -89
	100 kHz	-98 / -95[1)]	-98 / -95[1)]	-93 / -90[1)]	-94 / -91[1)]
	1 MHz	-108 / -105[1)]	-108 / -105[1)]	-103 / -100[1)]	-104 / -101[1)]
		typ. / max. values in dBc/Hz	[1)] 0°C ... 50°C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm SMA female	5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		15.25 … 17.05 GHz (70 MHz IF) 15.26 … 17.06 GHz (140 MHz IF) -7 ±3 dBm SMA female	16.95 … 18.75 GHz (70 MHz IF) 16.96 …18.76 GHz (140 MHz IF) -7 ±3 dBm SMA female	32.67 … 36.17 GHz (70 MHz IF) 32.60 … 36.10 GHz (140 MHz IF) -7 ±3 dBm SMA female	23.05 … 25.05 GHz (70 MHz IF) 23.06 … 25.06 GHz (140 MHz IF) -7 ±3 dBm SMA female

Specifications continued next page

Satellite Downconverter

L-, S-, C-, X-, Ku-, K- (DBS), Ka-band

Q/V-band available on request (contact factory)

Common Parameters		
Conversion Scheme:	Dual down conversion, no frequency inversion	
Frequency Resolution:	100 Hz	
RF-Input Characteristics:	Impedance:	50 Ω
	Return loss:	> 20 dB
	Operational input level:	-45 dBm[1)]
	Maximum aggregate input level:	+5 dBm (damage level)
	LO leakage:	< -80 dBm
	RF-connector:	SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
IF-Output Characteristics:	Frequency:	70 ±20 MHz or 140 ±40 MHz (optional: both → [IF-Band] = 70/140)
	Impedance:	50 or 75 Ω
	Return loss:	> 20 dB
	1 dB compression point:	> 10 dBm, 13 dBm typical
	Output muting:	> 60 dB (by command or sense input or by alarm condition)
	IF-signal monitor:	-20 dB of IF-output (approx.)
	IF-connectors:	BNC female N female (standard with option OD)
Transfer Characteristics:	Max. conversion gain:	45 dB ±1.0 dB
	Attenuation range:	0 … 30 dB, Step 0.1 dB
	Level stability:	±0.25 dB/day at constant temperature ±0.5 dB max., ±0.2 dB typ. over temperature range
	Gain flatness:	±0.25 dB over ±20 MHz (IF 70 MHz), ±0.40 dB over ±40 MHz (IF 140 MHz)
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Equalizer (Gain slope):	Max. ±0.0625 dB / MHz (IF 70 MHz), Max. ±0.05 dB / MHz (IF 140 MHz) (programmable)	
Group Delay (±18 MHz):	Linear:	0.03 ns / MHz max.
	Parabolic:	0.01 ns / MHz² max.
	Ripple:	1 ns peak to peak max.
Group Delay (±36 MHz):	Linear:	0.015 ns / MHz max.
	Parabolic:	0.005 ns / MHz² max.
	Ripple:	2 ns peak to peak max.
Intermodulation (3rd Order):	OIP3:	> 20 dBm[1)]
AM / PM conversion:	0.1° / dB [1)]	
Spurious Outputs:	Signal related:	< -60 dBc (Δf < 2 MHz), < -70 dBc (Δf ≥ 2 MHz)[1) 2)]
	Output harmonics:	< -40 dBc[1) 2)]
	Signal independent:	< -75 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain

[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Satellite Up- and Downconverter

Indoor / Outdoor

L-, S-, C-, X-, Ku-, K- (DBS), Ka-band
Q/V-band available on request (contact factory)

Indoor Housing:

Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, 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:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 95 % non condensing	
User Interface: (Indoor only)	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (with option VFD)	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 35 W (single converters)	
Mains Power Input Connector:	Indoor: IEC C14	
Mains Fuse:	2 x 2.0 A, time-lag fuse	
Dimension and Weight:	Indoor: 483 x 44 x 505 mm³ (WxHxD), 1 RU (19") approx. 8.4 kg	

Outdoor Housing:

Reference Input (Option):	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern SMA female
Reference Output (Option):	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Combined Monitoring and Control Interface and Alarm Interface:	Protocol: Connection: Alarm output: Connection type: Mute Input:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector MIL-C-26482: MS 3120 E 14-19-S Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A MIL-C-26482: MS 3120 E 14-19-S TTL logic input with internal pull up
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Temperature Range:	-30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 100 %	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 35 W (single converters)	
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimensions:	322 x 108 x 391 mm^3 (WxHxD) (small housing) (standard) 402 x 111 x 391 mm^3 (WxHxD) (large housing) 412 x 74 x 515 mm^3 (WxHxD) (XL housing)	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

Compact Satellite Up- and Downconverter

Indoor

Single / Dual Channel
L-Band

WORK Microwave's integrated, compact frequency converter is a new cost-effective option for satellite operators, integrators, and teleports made possible by the latest advancements in RF chipsets.

Enhancements

Compact Design: Designed specifically for operators using classic IF frequency bands, the compact version enables operators to support multiple simultaneous channels in one unit, saving significant rack space and costs.

Input and Output Adjustable Attenuator: With two software adjustable attenuators the operator can now optimize the system performance regarding noise figure and intermodulation.

RF-RMS Detector: Through a new RMS Detector the user can perform a real time monitoring of RF-power, giving the opportunity to initialize a switch over to spare units in case of RF power loss or simply to monitor the system.

Scalability

Together with WORK Microwave's new compact N:1 Redundancy Switch (RSCC-N) very compact and flexibly redundancy solutions up to 8:1 can be designed, giving the user the possibility to start with a small group of converters and expand it later to 8 operational units and one spare unit.

Operating and control – easy integration into your system

The converters can be operated via the push buttons on the front panel using intuitive display menus or via remote control (RS232, RS422/485 and TCP/IP over Ethernet). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string-based commands as well as addressable, packet based commands are provided.

Remote monitoring and control through SNMP and a Web browser interface is also available.

Key features

- 70 MHz or 140 MHz IF bands available
- Optional switchable IF 70 MHz and 140 MHz (IF 70/140)
- Variable attenuator on input and output
- Digital gain compensation
- RF RMS detector (UPC)
- Very low phase noise (< -67 dBc/Hz @ 10 Hz)
- Long-term stability 10^{-7} / year
- Automatic reference recognition (5 and 10 MHz)
- Adjustable gain equalizer
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces. Packet command syntax supports RS485 bus systems and allows addressed operation.
- Remote control through Ethernet supporting a TCP/IP command interface, a Web browser interface and SNMP (MIBs are provided).
- Test output on the front panel: RF-Test at upconverter, IF-Test at downconverter.
- AC power switch on the front panel
- Summary alarm output (dual change over switch contacts)
- Transmit mute input
- Optional internal Fan (Option: FAN)
- CE compliant
- **3 years warranty**

Compact Satellite Up- and Downconverter
L-Band

Upconverter Type:		VSCU-L
RF-Output Frequency:		L-Band 0.95 … 2.15 GHz
Intermediate Frequency:		5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input
Phase Noise:	10 Hz	-70 / -67
	100 Hz	-84 / -81
	1 kHz	-93 / -90
	10 kHz	-100 / -95
	100 kHz	-103 /-100
	1 MHz	-130 / -125
		typ. / max. values in dBc/Hz
Fixed Oscillator with Test Output:		5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm SMA female
Microwave Oscillator with Test Output		6.12 … 7.32 GHz (70 MHz IF) 6.05 … 7.25 GHz (140 MHz IF) -7 ±3 dBm SMA female

Downconverter Type:		VSCD-L
RF-Input Frequency:		L-Band 0.95 … 2.15 GHz
Intermediate Frequency:		5170 MHz for 70 MHz IF Output 5100 MHz for 140 MHz IF Output
Phase Noise:	10 Hz	-70 / -67
	100 Hz	-84 / -81
	1 kHz	-93 / -90
	10 kHz	-100 / -95
	100 kHz	-103 /-100
	1 MHz	-130 / -125
		typ. / max. values in dBc/Hz
Fixed Oscillator with Test Output:		5240 MHz (70 MHz IF) 5240 MHz (140 MHz IF) -6 ±3 dBm, Connector SMA female
Microwave Oscillator with Test Output		6.12 … 7.32 GHz (70 MHz IF) 6.05 … 7.25 GHz (140 MHz IF) -7 ±3 dBm SMA female

Common Parameters		
Conversion Scheme:	Dual conversion, no frequency inversion	
Frequency Resolution:	100 Hz	
IF Characteristics:	Frequency:	70 ±20 MHz or 140 ±40 MHz (optional: both → [IF-Band] = 70/140)
	Impedance:	50 or 75 Ω
	Return loss:	> 20 dB
	IF-Connectors:	BNC female
RF Characteristics:	Impedance:	50 Ω
	Return loss:	> 20 dB
	1 dB compression point:	> 10 dBm
	Output muting:	> 60 dB (by command or sense input or by alarm condition)
	RF-signal monitor:	-20 dB of RF-output (approx.)
	RF-connectors:	SMA female (standard)
Transfer Characteristics:	Max. conversion gain:	40 dB ±1.0 dB for upconverter 45 dB ±1.0 dB for downconverter
	Attenuation range IF:	0 … 30 dB, Step 0.1 dB
	Attenuation range RF:	0 … 20 dB, Step 0.1 dB
	Level stability:	± 0.25 dB/day at constant temperature ± 0.5 dB max., ±0.2 dB typ. over temperature range
	Gain flatness:	± 0.25 dB over ±20 MHz (IF 70 MHz), ±0.40 dB over ±40 MHz (IF 140 MHz)
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Equalizer (Gain Slope):	Max. ±0.0625 dB / MHz (IF 70 MHz), adjustable Max. ±0.05 dB / MHz (IF 140 MHz), adjustable	
Group Delay (±18 MHz):	Linear:	0.03 ns / MHz max.
	Parabolic:	0.01 ns / MHz² max.
	Ripple:	1 ns peak to peak max.
Group Delay (±36 MHz):	Linear:	0.015 ns / MHz max.
	Parabolic:	0.005 ns / MHz² max.
	Ripple:	2 ns peak to peak max.
Intermodulation (3rd Order):	OIP3:	>20 dBm[1)]
AM / PM conversion:	0.1° / dB[1)]	
Spurious Outputs:	Signal related:	< -60 dBc[1) 2)]
	Output harmonics (DNC only):	< -40 dBc[1) 2)]
	Signal independent:	< -70 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	
Reference Input:	Frequency:	5 or 10 MHz sine wave
	Level:	5 dBm ±5 dB
	Modes:	auto/extern/intern
	Connector:	BNC female
Reference Output:	Frequency:	10 MHz
	Level:	0 dBm ±3 dB
	Connector:	BNC female

Specifications continued next page

Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, 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:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage	
Relative Humidity:	< 95 % non condensing	
User Interface: (Indoor only)	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (with option VFD)	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 40 VA / 25 W (single converters)	
Mains Power Input Connector:	Indoor: IEC C14	
Mains Fuse:	2 x 2.0 A, time-lag fuse	
Dimension and Weight:	Indoor: 483 x 44 x 505 mm³ (WxHxD), 1 RU (19") approx. 8.4 kg	

[1] at max. conversion gain

[2] Pout = 0 dBm

All specifications are preliminary and subject to change

Open questions, demo units

For detailed order options or if you need more information about WORK Microwave's new compact IF/L-Band frequency converters, please contact us via e-mail: sales@work-microwave.com or call us. We are glad to assist you.

Dual Channel, Shared Oscillator Downconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K (DBS)-, Ka-, and Q-band
Triple-channel converters also available

All of WORK Microwave's satellite down converters meet the demanding requirements of modern satellite transmission applications. Customers worldwide appreciate their reliability and high level of quality. The dual-channel, shared oscillator converters can be used in systems where an accurate phase relationship is required between two converter channels, as is the case for monopulse tracking system down conversion.

Operating and control

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 the remote control ASCII string-based commands as well as addressable, packet-based commands are provided.

Housing options

The converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as a potential point of failure. For rack installations without any space in between the units, a fan within the converter unit is recommended. This forces airflow from the right side to left side of the units. Outdoor versions with IP 67 degree of protection are also available.

Key features

- Shared oscillator to guarantee excellent phase tracking in between channels
- 70 MHz or 140 MHz IF bands available
- Low power consumption
- Extreme low phase noise (< -60 dBc/Hz @ 10 Hz)
- Long- term stability 10^{-7} / year
- Output power +10 dBm (1 dB compression point)
- Automatic reference recognition (5 and 10 MHz)
- 0 °C to 50 °C (32 °F to 122 °F) (VSCD units)
  -30 °C to 60 °C (-22 °F to 140 °F) (VHCD units)
  -40 °C to 60 °C (-40 °F to 140 °F) (VECD units)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces. Packet command syntax supports RS485 bus systems and allows addressed operation.
- Remote control through Ethernet supporting a TCP/IP command interface (Indoor Version only)
- IF test outputs (standard on indoor units, on outdoor units with Option IFT)
- Summary alarm output with dual change over switch contacts
- Internal Fan as option for indoor units (Option FAN)
- CE compliant
- **3 years warranty**

Dual Channel, Shared Oscillator Downconverter

S-, C-, X-, Ku-, K (DBS)-, and Ka- band

Q-band on request (contact factory)

Downconverter Type:		**VHCD-S1S1T / VSCD-S1S1T**	**VHCD-S4S4T / VSCD-S4S4T**	**VHCD-CCT / VSCD-CCT**	**VHCD-XXT / VSCD-XXT**
RF-Input Frequency:		S-Band 2.2 … 2.3 GHz	S-Band 2.00 … 2.60 GHz	C-Band 3.4 … 4.2 GHz	X-Band 7.25 … 7.75 GHz
Intermediate Frequency:		2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	3050 MHz for 70 MHz IF Output 3060 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output
Phase Noise:	**10 Hz**	-70 / -67	-70 / -67	-70 / -67	-63 / -60
	100 Hz	-84 / -81	-84 / -81	-84 / -81	-83 / -80
	1 kHz	-98 / -95	-98 / -95	-98 / -95	-93 / -90
	10 kHz	-104 / -101	-104 / -101	-104 / -101	-98 / -95
	100 kHz	-107 /-104[1)]	-107 /-104[1)]	-107 /-104[1)]	-100 / -97[1)]
	1 MHz	-112 / -109[1)]	-112 / -109[1)]	-112 / -109[1)]	-110 / -107[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max. 5 dB		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ±3 dBm, SMA female	3120 MHz (70 MHz IF) 3200 MHz (140 MHz IF) -6 ±3 dBm, SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		4.65 … 4.75 GHz (70 MHz IF) 4.64 … 4.74 GHz (140 MHz IF) -7 ±3 dBm SMA female	5.05 … 5.65 GHz (70 MHz IF) 5.06 … 5.66 GHz (140 MHz IF) -7 ±3 dBm SMA female	5.55 … 6.35 GHz (70 MHz IF) 5.54 … 6.34 GHz (140 MHz IF) -7 ±3 dBm SMA female	9.40 … 9.90 GHz (70 MHz IF) 9.39 … 9.89 GHz (140 MHz IF) -7 ±3 dBm SMA female

Downconverter Type:		**VHCD-X3X3T / VSCD-X3X3T**	**VHCD-KuKuT / VSCD-KuKuT**	**VHCD-KaKaT / VSCD-KaKaT**	**VHCD-Ka1Ka1T / VSCD-Ka1Ka1T**
RF-Input Frequency:		X-Band 7.0 … 9.0 GHz	Ku-Band 10.70 … 12.75 GHz	Ka-Band 18.10 … 21.20 GHz	Ka-Band 19.70 … 20.10 GHz
Intermediate Frequency:		2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output
Phase Noise:	**10 Hz**	-63 / -60	-63 / -60	-61 / -58	-61 / -58
	100 Hz	-83 / -80	-83 / -80	-81 / -78	-81 / -78
	1 kHz	-93 / -90	-93 / -90	-91 / -88	-91 / -88
	10 kHz	-98 / -95	-98 / -95	-96 / -93	-96 / -93
	100 kHz	-100 / -97[1)]	-100 / -97[1)]	-98 / -95[1)]	-98 / -95[1)]
	1 MHz	-110 / -107[1)]	-110 / -107[1)]	-108 / -105[1)]	-108 / -105[1)]
		typ. / max. values in dBc/Hz	[1)] 0 °C ... 50 °C, outside this temperature range degraded by max 5 dB.		
Fixed Oscillator with Test Output (indoor only, optional for outdoor):		2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ±3 dBm, SMA female	2380 MHz (70 MHz IF) 2300 MHz (140 MHz IF) -6 ±3 dBm, SMA female	2080 MHz (70 MHz IF) 2000 MHz (140 MHz IF) -6 ±3 dBm, SMA female
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		9.15 … 11.15 GHz (70 MHz IF) 9.14 … 11.14 GHz (140 MHz IF) -7 ±3 dBm SMA female	12.85 … 14.90 GHz (70 MHz IF) 12.84 … 14.89 GHz (140 MHz IF) -7 ±3 dBm SMA female	15.65 … 18.75 GHz (70 MHz IF) 15.66 … 18.76 GHz (140 MHz IF) -7 ±3 dBm SMA female	17.55 … 17.95 GHz (70 MHz IF) 17.56 … 17.96 GHz (140 MHz IF) -7 ±3 dBm SMA female

Dual Channel, Shared Oscillator Downconverter

S-, C-, X-, Ku-, K (DBS)-, and Ka- band

Q-band on request (contact factory)

Common Parameters		
Conversion Scheme:	Dual down conversion, no frequency inversion. All channels with shared oscillator. Same conversion frequency for all channels. Gain setting individual for each channel.	
Phase Tracking between channels:	< 10 deg rms after 1 hour warm up, constant gain setting, constant frequency setting, signal frequency constant within 10 kHz. Initial phase difference to be compensated externally.	
Frequency Resolution:	100 Hz	
RF-Input Characteristics:	Impedance: Return loss: Operational input level: Maximum aggregate input level: LO leakage: RF-connector:	50 Ω > 20 dB -45 dBm[1)] +5 dBm (damage level) < -80 dBm SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
IF-Output Characteristics:	Frequency: Impedance: Return Loss: 1 dB compression point: Output muting: IF-signal monitor: IF-Connectors:	70 ±20 MHz or 140 ±40 MHz (optional: both → [IF-Band] = 70/140) 50 or 75 Ω > 20 dB > 10 dBm, 13 dBm typical > 60 dB (by command or sense input or by alarm condition) -20 dB of IF-output (approx.) BNC female N female (standard with option OD)
Transfer Characteristics:	Max. conversion gain: Attenuation range: Level stability: Gain flatness: Image rejection: Noise figure: Isolation between channels:	45 dB ±1.0 dB 0 … 30 dB, Step 0.1 dB ±0.25 dB/day at constant temperature ±0.5 dB max., ±0.2 dB typ. over temperature range ±0.25 dB over ±20 MHz (IF 70 MHz), ±0.40 dB over ±40 MHz (IF 140 MHz) > 80 dB < 12 dB[1)] > 60 dB
Equalizer (Gain slope):	Max. ±0.0625 dB / MHz (IF 70 MHz), Max. ±0.05 dB / MHz (IF 140 MHz) (programmable)	
Group Delay (± 18 MHz):	Linear: Parabolic: Ripple:	0.03 ns / MHz max. 0.01 ns / MHz² max. 1 ns peak to peak max.
Group Delay (± 36 MHz):	Linear: Parabolic: Ripple:	0.015 ns / MHz max. 0.005 ns / MHz² max. 2 ns peak to peak max.
Intermodulation (3rd Order):	OIP3:	> 20 dBm[1)]
AM / PM conversion:	0.1° / dB[1)]	
Spurious Outputs:	Signal related: Output harmonics: Signal independent:	< -60 dBc (Δf < 2 MHz), < -70 dBc (Δf ≥ 2 MHz)[1) 2)] < -40 dBc[1) 2)] < -75 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain

[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Dual Channel, Shared Oscillator Downconverter

S-, C-, Ku-band

K- and Q-band on request (contact factory)

Indoor Housing:

Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, 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:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 95 % non condensing	
User Interface: (Indoor only)	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (with option VFD)	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 35 W Typ.: 40 VA / 28 W	
Mains Power Input Connector:	Indoor: IEC C14	
Mains Fuse:	2 x 2.0 A, time-lag fuse	
Dimension and Weight:	Indoor: 483 x 44 x 505 mm³ (WxHxD), 1 RU (19") approx. 8.4 kg	

Outdoor Housing:

Reference Input (Option):	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern SMA female
Reference Output (Option):	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Combined Monitoring and Control Interface and Alarm Interface:	Protocol: Connection: Alarm output: Connection type: Mute Input:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector MIL-C-26482: MS 3120 E 14-19-S Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A MIL-C-26482: MS 3120 E 14-19-S TTL logic input with internal pull up
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Temperature Range:	-30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 100 %	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 35 W	
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimensions:	402 x 111 x 391 mm³ (WxHxD) (standard) 412 x 74 x 515 mm³ (WxHxD) (XL housing)	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

Test Loop Translator

Indoor / Outdoor

Single / Dual / Triple Band
Single / Dual Channel
C-, X-, Ku-, K-, Ka- and Q-Band Output

The RF test loop translator can be used to convert signals from one RF band to another for test and system evaluation purposes.

Operating and control

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 with dual change over switch contacts are provided. For the remote control ASCII string-based commands as well as addressable, packet-based commands are provided. Remote monitoring and control through a Web browser interface is also integrated.

Key features

- RF Filter on input and output
- Variable attenuator 0 ... 30 dB, 0.1 dB step size
- Signal mute function
- Integrated local oscillator with 100 Hz step size available
- Internal OCXO
- External reference input with automatic reference recognition (5 and 10 MHz)
- 10 MHz reference output
- Low power consumption
- Local control through front panel
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface.
- AC power switch on the front panel
- Summary alarm output with dual change over switch contacts
- CE compliant
- **3 years warranty**

Test Loop Translator

Indoor / Outdoor

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

Converter Type:		**VSTLT-C / VHTLT-C**	**VSTLT-X / VHTLT-X**	**VSTLT-Ku / VHTLT-Ku**	**VSTLT-K / VHTLT-K**	**VSTLT-Ka1 / VHTLT-Ka1**
RF-Input Frequency:		C-Band 5.85 … 6.65 GHz	X-Band 7.90 … 8.40 GHz	Ku-Band 13.0 … 14.5 GHz	K-Band 17.3 … 18.4 GHz	Ka-Band 27.5 … 27.7 GHz
RF-Output Frequency:		C-Band 3.4 … 4.2 GHz	X-Band 7.25 … 7.75 GHz	Ku-Band 10.95 … 12.45 GHz	Ku-Band 11.7 … 12.5 GHz	K-Band 17.7 … 17.9 GHz
Intermediate Frequency:		-	950 … 1450 MHz	-	-	-
LO1 Frequency:		2.45 GHz	6.95 GHz	2.05 GHz	4.8 … 6.7 GHz	9.8 GHz
LO2 Frequency:		-	6.30 GHz	-	-	-
Conversion Scheme:		Single conversion, no frequency inversion	Dual conversion, no frequency inversion	Single conversion, no frequency inversion	Single conversion, no frequency inversion	Single conversion, no frequency inversion
LO-Frequency Resolution:		fix frequency	fix frequency	fix frequency	100 Hz	fix frequency
Phase Noise:	**10 Hz**	-76 / -66	-65 / -55	-76 / -66	-66 / -56	-66 / -56
	100 Hz	-93 / -83	-85 / -75	-93 / -83	-83 / -73	-83 / -73
	1 kHz	-105 / -95	-95 / -85	-105 / -95	-95 / -85	-95 / -85
	10 kHz	-111 / -101	-100 / -90	-111 / -101	-101 / -91	-101 / -91
	100 kHz	-111 /-101	-103 / -93	-111 / -101	-101 / -91	-101 / -91
	1 MHz	-128 / -118	-127 / -117	-128 / -118	-118 / -108	-118 / -108
		typ. / max. values in dBc/Hz				

Converter Type:		**VSTLT-Ka / VHTLT-Ka**				
RF-Input Frequency:		Ka-Band 27.5 … 31.0 GHz				
RF-Output Frequency:		Ka-Band 17.7 … 21.2 GHz				
Intermediate Frequency:		10.70 … 12.70 GHz				
LO1 Frequency:		16.80 … 18.30 GHz				
LO2 Frequency:		7.00 … 8.50 GHz				
Conversion Scheme:		Dual conversion, no freq. inversion				
LO-Frequency Resolution:		100 Hz				
Phase Noise:	**10 Hz**	-62 / -59				
	100 Hz	-82 / -79				
	1 kHz	-90 / -87				
	10 kHz	-96 / -93				
	100 kHz	-98 / -95				
	1 MHz	-109 / -105				
		typ. / max. values in dBc/Hz				

Test Loop Translator

Indoor / Outdoor

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

Common Parameters		
RF-Input Characteristics:	Impedance: Return Loss: Max. aggregate input level: LO Leakage: Connector:	50 Ω > 18 dB +8 dBm (standard) (damage level) < -80 dBm SMA female (standard) K female (2.92 mm) (-Ka standard) WR28 waveguide (-Ka with option WR28)
Input- / Output-Monitor (Option):	Signal level in ref. to in/output: Impedance: Connector:	-20 dB 50 Ω SMA female
RF-Output Characteristics:	Impedance: Return Loss: 1 dB compression point: LO leakage: Output muting: Connector:	50 Ω > 18 dB > 5 dBm[1)] < -80 dBm > 60 dB (by command or sense input or by alarm condition) SMA female (standard) K female (2.92 mm) (-Ka standard) WR28 waveguide (-Ka with option WR28)
LO Test Output (Option):	Frequency: Signal level: Impedance: Connector:	LO Frequency standard (LO/2 Frequency on -Ka) -10 dBm ±3 dB 50 Ω SMA female
Transfer Characteristics:	Max. conversion gain: Attenuation Range: Gain variation over temp.: Gain flatness over freq.: Gain flatness over 40 MHz:	0 dB ±1 dB -10 dB ±1 dB for VSTLT-Ku / VHTLT-Ka 0 … 30 dB, Step 0.1 dB ±1.0 dB ±1.0 dB max. over band ±0.5 dB
Group Delay Variation:	Ripple:	< 1 ns peak to peak / 80 MHz (single conversion) < 2 ns peak to peak / 80 MHz (dual conversion)
Spurious Outputs:	Signal related:	< -50 dBc (within RF-Output band)[1) 2)], except < -30 dBc for VSTLT-Ka / VHTLT-Ka and VSTLT-Ku / VHTLT-Ka
Intermodulation (3rd order):	OIP3:	> 15 dBm except > 5 dBm at VSTLT-Ka / VHTLT-Ka
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain
[2)] Pout = -10 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Test Loop Translator

Indoor / Outdoor

S-, C-, Ku-, K-, Ka- and Q-band

Indoor Housing:

Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, 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:	Standard performance: 0 °C … 50 °C operating, - 30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 95 % non condensing	
User Interface: (Indoor only)	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (option VFD)	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 30 W (single conversion)	
Mains Power Input Connector:	Indoor: IEC C14	
Mains Fuse:	2 x 2.0 A, time-lag fuse	
Dimension and Weight:	Indoor: 483 x 44 x 505 mm³ (WxHxD), 1 RU (19") approx. 8.4 kg or 483 x 44 x 270 mm³ (WxHxD), 1 RU (19") approx. 6 kg (depends on converter type)	

Outdoor Housing:

Reference Input (Option):	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern SMA female
Reference Output (Option):	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Combined Monitoring and Control Interface and Alarm Interface:	Protocol: Connection: Alarm output: Connection type: Mute Input:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector MIL-C-26482: MS 3120 E 14-19-S Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A MIL-C-26482: MS 3120 E 14-19-S TTL logic input with internal pull up
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Temperature Range:	-30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 100 %	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 30 W (single conversion)	
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimensions:	322 x 108 x 391 mm³ (WxHxD) (small housing) (standard) 402 x 111 x 391 mm³ (WxHxD) (large housing) 412 x 74 x 515 mm³ (WxHxD) (XL housing)	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

Synthesized Block Up- and Downconverter

Indoor / Outdoor

Single / Dual / Triple Band
Single / Dual Channel
S-, C-, Ku-, K (DBS)-, Ka- and Q-band
Wideband to L-Band BDC (1 … 40 GHz)

WORK Microwave's synthesized block converters are designed to optimize the performance and bandwidth of satellite communications links, enabling operators to cost-effectively deliver a superior signal quality. Ideal use cases include fixed satellite ground stations as well as in satellite newsgathering (SNG) vehicles, fly-aways, and other mobile or portable applications.

The fifth-generation frequency converter series is built with the most advanced technologies available to ensure outstanding performance, high reliability and a longer lifetime.

5th-generation enhancements

Reduced phase noise: Based on a powerful new synthesizer the frequency converters achieve a phase noise significantly beyond the recommended industry specification (Intelsat's IESS-308/309).

Optional slope compensation up to +8 dB / GHz over L-band: With slope compensation users can effectively balance the losses and negative slope of augmented cable runs to ensure that all signals entering the RF processing chain are at similar levels across all frequencies.

Improved flexibility and usability: Through a new USB port, operators can now access the converter via the back panel to make copies of parameter settings, replicate selected configurations on another device or save configuration settings for future reference. In addition, a user-friendly, Web-based interface offers an intuitive user experience. When coupled with the enhanced USB port, the customizable GUI also simplifies the installation of firmware updates.

Higher reliability: An AC power consumption of 45 VA / 35 W maximizes the reliability and lifetime of the units.

High signal integrity

The very low phase noise of the oscillators guarantees an excellent signal quality. Low spurious emissions allow our customers to use the converters in the environments with demanding requirements, such as high power video uplinks. Sophisticated temperature compensation guarantees the stability over a wide temperature range.

Block converter with frequency synthesizer

In contrast to block converters with fixed or switchable LO these converters include a tunable LO with 100 Hz step size. The frequency bandwidth is selected to achieve low spurious emissions. These properties allow wideband frequency coverage with only one unit, where other concepts with fixed block converters require several different block converter modules.

Housing options

The converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as a potential point of failure. For rack installations without any space in between the units, a fan within the converter unit is recommended. This forces airflow from the right side to left side of the units. Outdoor versions with IP 67 degree of protection are also available.

The converters can be operated via the push buttons on the front panel using intuitive display menus or via remote control (RS232, RS422/485 and TCP/IP over Ethernet). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string-based commands as well as addressable, packet-based commands are provided.

Remote monitoring and control through SNMP and a Web browser interface is also available.

Customized products

In addition to standard products WORK Microwave offers custom tailored products and specialized products as follows:

- Modified or smaller housings to fit into your AC power switch on the front panel
- Existing design for mobile and portable applications.
- Different IF or RF frequency bands
- Customized M&C interface and control syntax.
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity).

Key features

- Long-term stability 10^{-7} / year
- Output power +10 dBm (1 dB compression point)
- Automatic reference recognition (5 and 10 MHz)
- Digital gain compensation
- Operating temperature range either -30 °C to 60 °C (-22 °F to 140 °F), -40 °C to 60 °C (-40 °F to 140 °F) (VECD units) or 0 °C to 50 °C (32 °F to 122 °F)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces. Packet command syntax supports RS485 bus systems and allows addressed operation.
- Remote control through Ethernet supporting a TCP/IP command interface, a Web browser interface and SNMP (MIBs are provided).
- RF test output on the front panel available
- AC power switch on the front panel
- Summary alarm output with dual change over switch contacts
- Transmit mute input
- Optional internal Fan (Option: FAN)
- CE compliant
- **3 years warranty**

Orders information

WORK Microwave offers three series of 19” rack satellite converters:
Standard-, High- and Extra High Performance. The specifications are the same for all types except the operating temperature range. The High Performance type operates between -30 °C to 60 °C (-22 °F to 140 °F), the Extra High Performance type between -40 °C to 60 °C (-40 °F to 140 °F) and the Standard type between 0 °C to 50 °C (32 °F to 122 °F). Therefore if you only need units for inside use, the standard unit is perfectly suited for this application.

Open questions, demo units

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

Synthesized Block Upconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q-band available on request (contact factory)

Upconverter Type:		**VHSBU-Ku-2 / VSSBU-Ku-2**	**VHSBU-Ka / VSSBU-Ka**	**VHSBU-Ka3 / VSSBU-Ka3**	**VHSBU-Ka1 / VSSBU-Ka1**	
RF-Output Frequency:		Ku-Band 10.70 … 12.75 GHz	Ka-Band 27.5 … 31.0 GHz	Ka-Band 25.0 … 28.0 GHz	Ka-Band 27.5 … 28.6 GHz	
Intermediate Frequency:		-	7.9 … 8.6 GHz	7.6 … 8.2 GHz	-	
MW-LO-Frequency:		9.20 … 11.10 GHz	36.1 … 38.9 GHz	33.2 … 35.6 GHz	26.05 … 26.85 GHz	
Fixed-LO-Frequency:		-	9.55 GHz	9.1 GHz	-	
Phase Noise:	**10 Hz**	-63 / -60	-50 / -47	-50 / -47	-50 / -47	
	100 Hz	-83 / -80	-60 / -57	-60 / -57	-60 / -57	
	1 kHz	-93 / -90	-85 / -82	-85 / -82	-85 / -82	
	10 kHz	-98 / -95	-92 / -89	-92 / -89	-92 / -89	
	100 kHz	-100 / -97[1)]	-95 / -92	-95 / -92	-95 / -92	
	1 MHz	-110 / -107[1)]	-105 / -102	-105 / -102	-105 / -102	
		typ. / max. values in dBc/Hz [1)] 0 °C … 50 °C, outside this temperature range degraded by max. 5 dB				
Input Frequency:		1500 … 1650 MHz	950 … 1650 MHz	900 … 1500 MHz	1450 … 1750 MHz	
Conversion Scheme:		Single up conversion, no frequency inversion	Dual up conversion, no frequency inversion		Single up conversion, no frequency inversion	
Frequency Resolution:		100 Hz				

Common Parameters		
IF-Input Characteristics:	Impedance:	50 Ω
	Return loss:	> 18 dB
	Operational input level:	-40 dBm[1)]
	Maximum aggregate input level:	+10 dBm (damage level)
	Connector:	SMA female (standard) N female (standard with option OD)
IF/RF-Monitor (Option):	Signal level in ref. to in/output:	-20 dB
	Impedance:	50 Ω
	Connector:	SMA female
RF-Output Characteristics:	Impedance:	50 Ω
	Return loss:	> 18 dB, (> 15 dB with option WR28)
	1 dB compression point:	> 10 dBm[1)]
	Output muting:	> 60 dB (by command or sense input or by alarm condition)
	Connector:	SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
LO Test Output (Option):	Frequency:	LO Frequency standard (LO > 20 GHz = LO/2 on Test Output)
	Signal level (MW-LO):	-7 dBm ±3 dB
	Signal level (Fixed-LO):	-10 dBm ±3 dB
	Impedance:	50 Ω
	Connector:	SMA female
Transfer Characteristics:	Max. conversion Gain:	40 dB ±1 dB
	Attenuation range:	0 … 30 dB, 0.1 dB steps
	Gain variation over temp.:	±0.5 dB max.
	Gain flatness over freq.:	±1.5 dB max. over band
	Gain flatness over 40 MHz:	±0.25 dB
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Transfer Characteristics with Gain Slope Equalizer (Option):	Max. conversion gain:	40 dB ±1 dB
	Attenuation range:	0 … 30 dB, 0.1 dB steps
	Gain variation over temp.:	±0.5 dB max.
	Gain flatness over freq.:	±1.5 dB max. over band
	Gain flatness over 40 MHz:	±0.25 dB
	Gain equalization:	+8.0 dB / GHz max., adjustable
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Intermodulation (3rd Order):	OIP3:	> 18 dBm[1)]
AM / PM conversion:	0.1° / dB[1)]	
Group Delay:	Ripple, slope:	< 1 ns peak to peak / 80 MHz (single up-conversion) < 2 ns peak to peak / 80 MHz (dual up-conversion)
Spurious Outputs:	Signal related:	< -60 dBc (Δf < 2 MHz), < -70 dBc (Δf ≥ 2 MHz)[1) 2)]
	Output harmonics:	< -40 dBc[1) 2)]
	Signal independent:	< -70 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain
[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Synthesized Block Downconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q-band available on request (contact factory)

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Downconverter Type:		**VHSBD-X** **VSSBD-X**	**VHSBD-Ku** **VSSBD-Ku**	**VHSBD-K** **VSSBD-K**	**VHSBD-Ka** **VSSBD-Ka**	
RF-Input Frequency:		X-Band 7.25 … 8.4 GHz	Ku-Band 10.70 … 12.75 GHz	K-Band 17.3 … 18.4 GHz	Ka-Band 18.1 … 21.2 GHz	
LO-Frequency:		6.3 … 6.9 GHz	9.75 … 11.25 GHz	16.35 … 16.90 GHz	17.15 … 19.45 GHz	
Phase Noise:	**10 Hz**	-70 / -67	-63 / -60	-63 / -60	-61 / -58	
	100 Hz	-84 / -81	-83 / -80	-83 / -80	-81 / -78	
	1 kHz	-98 / -95	-93 / -90	-93 / -90	-91 / -88	
	10 kHz	-104 / -101	-98 / -95	-98 / -95	-96 / -93	
	100 kHz	-107 /-104[1)]	-100 / -97[1)]	-100 / -97[1)]	-98 / -95[1)]	
	1 MHz	-112 / -109[1)]	-110 / -107[1)]	-110 / -107[1)]	-108 / -105[1)]	
		typ. / max. values in dBc/Hz [1)] 0 °C … 50 °C, outside this temperature range degraded by max. 5 dB				
IF-Output Frequency:		950 … 1500 MHz	950 … 1500 MHz	950 … 1500 MHz	950 … 1750 MHz	
Conversion Scheme:		Single down conversion, no frequency inversion				
Frequency Resolution:		100 Hz				

Common Parameters		
RF-Input Characteristics:	Impedance:	50 Ω
	Return loss:	> 18 dB
	Operational input level:	-40 dBm[1)]
	Maximum aggregate input level:	+5 dBm (damage level)
	LO leakage:	< -80 dBm
	Connector:	SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
IF/RF-Monitor (Option):	Signal level in ref. to in/output:	-20 dB
	Impedance:	50 Ω
	Connector:	SMA female
IF-Output Characteristics:	Impedance:	50 Ω
	Return loss:	> 18 dB
	1 dB compression point:	> 17 dBm[1)], > 10 dBm[1)] at Ka-Band
	Output muting:	> 60 dB (by command or sense input or by alarm condition)
	Connector:	SMA female (standard) N female (standard with option OD)
LO Test Output (Option):	Frequency:	LO Frequency standard (LO > 20 GHz = LO/2 on Test Output)
	Signal level (MW-LO):	-7 dBm ±3 dB
	Signal level (Fixed-LO):	-10 dBm ±3 dB
	Impedance:	50 Ω
	Connector:	SMA female
Transfer Characteristics:	Max. conversion gain:	40 dB ±1 dB
	Attenuation range:	0 … 30 dB, 0.1 dB steps
	Gain variation over temp.:	±0.5 dB max.
	Gain flatness over freq.:	±1.5 dB max. over band
	Gain flatness over 40 MHz:	±0.25 dB
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Transfer Characteristics with Gain Slope Equalizer (Option):	Max. conversion gain:	40 dB ±1 dB
	Attenuation range:	0 … 30 dB, 0.1 dB steps
	Gain variation over temp.:	±0.5 dB max.
	Gain flatness over freq.:	±1.5 dB max. over band
	Gain flatness over 40 MHz:	±0.25 dB
	Gain equalization:	+8.0 dB / GHz max., adjustable
	Image rejection:	> 80 dB
	Noise figure:	< 12 dB[1)]
Group Delay:	Ripple, Slope:	< 1 ns peak to peak / 80 MHz (single down conversion) < 2 ns peak to peak / 80 MHz (dual down conversion)
Intermodulation (3rd Order):	OIP3:	> 30 dBm[1)] > 20 dBm[1)] at Ka-Band
AM / PM conervsion:	0.1° / dB[1)]	
Spurious Outputs:	Signal related:	< -60 dBc (Δf < 2 MHz), < -70 dBc (Δf ≥ 2 MHz)[1) 2)]
	Output harmonics:	< -40 dBc[1) 2)]
	Signal independent:	< -75 dBm
Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain
[2)] Pout = 0 dBm

Specifications are subject to change

Synthesized Block
Up- and Downconverter
Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q-band available on request (contact factory)

Indoor Housing:

Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, 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:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 95 % non condensing	
User Interface: (Indoor only)	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (option VFD)	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 30 W (single converters) Typ.: 35 VA / 23 W (single converters)	
Mains Power Input Connector:	Indoor: IEC C14	
Mains Fuse:	2 x 2.0 A, time-lag fuse	
Dimension and Weight:	Indoor: 483 x 44 x 505 mm³ (WxHxD), 1 RU (19") approx. 8.4 kg	

Outdoor Housing:

Reference Input (Option):	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ± 5dB auto/extern/intern SMA female
Reference Output (Option):	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Combined Monitoring and Control Interface and Alarm Interface:	Protocol: Connection: Alarm output: Connection type: Mute Input:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector MIL-C-26482: MS 3120 E 14-19-S Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A MIL-C-26482: MS 3120 E 14-19-S TTL logic input with internal pull up
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Temperature Range:	-30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 100 %	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 45 VA / 30 W (single converters) Typ.: 35 VA / 23 W (single converters)	
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimensions:	322 x 108 x 391 mm³ (WxHxD) (small housing) (standard) 402 x 111 x 391 mm³ (WxHxD) (large housing) 412 x 74 x 515 mm³ (WxHxD) (XL housing)	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

Synthesized Block Downconverter
Indoor

Wideband to L-Band Block-Downconverter (1 … 40 GHz)

Downconverter Type:	VSSBD-WB-FAN-S0121 + VSBD-WB-FAN-S0122	
RF-Input Frequency:	1 … 40 GHz	
IF-Output Frequency:	1200 ±250 MHz (3 dB Bandwidth: ±250 MHz)	
Phase Noise: **10 Hz** **100 Hz** **1 kHz** **10 kHz** **100 kHz** **1 MHz** **3 MHz**	-50 -70 -85 -90 -100 -105 -115	
	max. values in dBc/Hz	
Conversion Scheme:	Block down conversion, no frequency inversion	
Frequency Resolution:	100 Hz	
RF-Input Characteristics:	Impedance: Return loss: Maximum Aggregate Input Level: LO leakage: Connector:	50 Ω Typ: > 10 dB; max. 8 dB 10 dBm (damage Level) < -60 dBm K (female)
IF-Output Characteristics:	Impedance: Return loss: 1 dB compression point: Output muting: Connector:	50 Ω > 18 dB > 10 dBm[1)] > 75 dB (by command or sense input or by alarm condition) SMA (female)
Transfer Characteristics: Importend: applies to the entire device combination of preconverter and synthesized converter	Max. Conversion Gain: Attenuation range: Gain Variation over Temp.: Gain Flatness over 500 MHz: Gain Flatness over 125 MHz: Gain Flatness over 40 MHz: Image Rejection: Noise Figure:	35 dB ±1 dB 0 … 30 dB, 0.1 dB steps ±1.0 dB Typ ±2.0 dB; max: ± 2.5 dB) Typ ±1.0 dB; max: ±1.75 dB) ± 1 dB > 70 dB < 18 dB[1)]
Group Delay:	Ripple, Slope:	1 ns peak to peak / 40 MHz 2 ns peak to peak / 250 MHz
Spurious Outputs:	Signal related: LO-Leakage:	< -50 dBc[1) 2)] < -75 dBm
Output Intercept Point 3rd Order:	OIP3:	> 20 dBm[1)]
Internal Frequency Stability:		±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)
Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC (female)
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC (female)
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Alarm Interface:	Two potential free contacts (DPDT), Connector DSUB09 female	
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:	75 W 120VA	
Mains Power Input Connector:	IEC C14	
Dimension and Weight:	483 x 88 x 508 mm^3 (WxHxD), 2 RU (19"), approx. 12 kg t.b.d.	

[1)] at max. conversion gain
[2)] Pout = 0 dBm

Specifications are subject to change

L-Band Block Up- and Downconverter

Indoor / Outdoor

Single / Dual / Triple Band
Single / Dual Channel
S-, C-, X-, Ku-, K- (DBS), Ka-band (Q/V-band available on request)

VSBU / VSBD Type

VSBUL / VSBDL Type

VSBUR / VSBDR Type

IP 67 Outdoor housing

WORK Microwave's block converters are designed to optimize the performance and bandwidth of satellite communications links, enabling operators to cost effectively deliver a superior signal quality. Ideal use cases include fixed satellite ground stations as well as in satellite newsgathering (SNG) vehicles, fly-aways and other mobile or portable applications.

The fifth-generation frequency converter series is built with the most advanced technologies available to ensure outstanding performance, high reliability and a longer lifetime.

5th-generation enhancements

Reduced phase noise: Based on a powerful new synthesizer the frequency converters achieve a phase noise significantly beyond the recommended industry specification (Intelsat's IESS-308/309).

Optional slope compensation up to +8 dB / GHz over L-band: With slope compensation users can effectively balance the losses and negative slope of augmented cable runs to ensure that all signals entering the RF processing chain are at similar levels across all frequencies.

Improved flexibility and usability: Through a new USB port, operators can now access the converter via the back panel to make copies of parameter settings, replicate selected configurations on another device or save configuration settings for future reference. In addition, a user-friendly, Web-based interface offers an intuitive user experience. When coupled with the enhanced USB port, the customizable GUI also simplifies the installation of firmware updates.

Higher reliability: An AC power consumption of typically 35 VA / 20 W maximizes the reliability and lifetime of the units.

High signal integrity

The very low phase noise of the oscillators guarantees an excellent signal quality. Low spurious emissions allow our customers to use the converters in the environments with demanding requirements, such as high power video uplinks. Sophisticated temperature compensation guarantees the stability over a wide temperature range.

Housing options

The converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as a potential point of failure. For rack installations without any space in between the units, a fan within the converter unit is recommended. This forces airflow from the right side to left side of the units. Outdoor versions with IP 67 degree of protection are also available.

The converters can be operated via the 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 the remote control either ASCII string-based commands as well as addressable, packet-based commands are provided.

Remote monitoring and control through SNMP and a Web browser interface is also available.

Customized products

In addition to standard products WORK Microwave offers custom tailored products and specialized products as follows:

- Modified or smaller housings to fit into your AC power switch on the front panel
- Existing design for mobile and portable applications.
- Different IF or RF frequency bands
- Customized M&C interface and control syntax.
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity).

Key features

- Three indoor unit types are available:
  VSBU* Type – with front panel commands
  VSBUL* Type – attenuator selector on front panel
  VSBUR* Type – remote control operation only
  **VSBD, VSBDR, VSBDR also*
- Low phase noise
- Adjustable attenuator (typ. range: 0 … 20 dB or 0 … 30 dB, 0.1 dB step size)
- Gain slope Equalizer available
- Output power +10 dBm (1 dB compression point)
- Low spurious emissions
- Internal OCXO with long term stability 10^{-7} / year
- External reference input 5 or 10 MHz
- Local control through push buttons on front panel and display menu
- Stored alarms with time stamps
- Reference output 10 MHz
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces. Packet command syntax supports RS485 bus systems and allows addressed operation. TCP/IP over Ethernet, Web browser interface, SNMP with MIBs downloadable form the device
- Summary alarm output (DPDT)
- Low power consumption, typically less than 20 W
- CE compliant
- Up to 4 channels / frequency bands per unit are possible
- **3 years warranty**

Orders information

WORK Microwave offers two series of 19” rack satellite converters, Standard and High Performance. The specifications are the same for both types except the operating temperature range. The High Performance type operates between -30 °C to 60 °C (-22 °F to 140 °F) and the Standard type between 0 °C to 50 °C (32 °F to 122 °F). Therefore if you only need units for inside use, the standard unit is perfectly suited for this application.

Open questions, demo units

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

L-Band Block Upconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka- band
Q/V-band available on request (contact factory)

Upconverter Type:		**VHBU- / VSBU- / VHBUR- / VSBUR- / VSBUL- / VHBUL-**					
		C, C2, C3	**X**	**Ku1, Ku2, Ku3**		**Ku4, Ku5, Ku6**	
RF-Output Frequency:		C-Band C: 5.85 … 6.45 GHz C2: 5.78 … 6.52 GHz C3: 6.45 … 7.05 GHz	X-Band 7.90 … 8.40 GHz	Ku-Band Ku1: 13.75 … 14.50 GHz Ku2: 12.75 … 13.75 GHz Ku3: 12.75 … 13.50 GHz		Ku-Band Ku4: 12.90 … 13.50 GHz Ku5: 10.70 … 11.75 GHz Ku6: 11.70 … 12.75 GHz	
LO Frequency:		C: 4.90 GHz C2: 4.83 GHz C3: 5.50 GHz	6.95 GHz	Ku1: 12.80 GHz Ku2: 11.80 GHz Ku3: 11.80 GHz		Ku4: 11.95 GHz Ku5: 9.75 GHz Ku6: 10.75 GHz	
Phase Noise:	**10 Hz**	-70 / -60	-68 / -58	-65 / -55[1)]	-65 / -55[2)]	-65 / -55[1)]	-65 / -55[2)]
	100 Hz	-90 / -80	-88 / -78	-85 / -75[1)]	-85 / -75[2)]	-85 / -75[1)]	-85 / -75[2)]
	1 kHz	-100 / -90	-98 / -88	-95 / -85[1)]	-95 / -85[2)]	-95 / -85[1)]	-95 / -85[2)]
	10 kHz	-105 / -95	-103 / -93	-100 / -90[1)]	-100 / -93[2)]	-100 / -90[1)]	-100 / -93[2)]
	100 kHz	-110 / -100	-106 / -96	-103 / -93[1)]	-123 / -113[2)]	-103 / -93[1)]	-123 / -113[2)]
	1 MHz	-133 / -123	-130 / -120	-127 / -117[1)]	-140 / -130[2)]	-127 / -117[1)]	-140 / -130[2)]
		typ. / max. values in dBc/Hz		[1)] standard values		[2)] values with low phase noise option LPN	
IF-Input Frequency:		C: 950 …1550 MHz C2: 950 …1690 MHz C3: 950 …1550 MHz	950 …1450 MHz	Ku1: 950 …1700 MHz Ku2: 950 …1950 MHz Ku3: 950 …1700 MHz		Ku4: 950 …1550 MHz Ku5: 950 …2000 MHz Ku6: 950 …2000 MHz	
Conversion Scheme:		Block up conversion, no frequency inversion					

Upconverter Type:		**VHBU- / VSBU- / VHBUR- / VSBUR- / VSBUL- / VHBUL-**			
		Ku7	**K1, K2, K3**	**K4**	**Ka1, Ka2, Ka4**
RF-Output Frequency:		Ku-Band 14.50 … 14.80 GHz	K-Band K1: 17.30 …18.10 GHz K2: 17.60 …18.40 GHz K3: 17.30 …18.10 GHz	K-Band 17.30…18.40 GHz	Ka-Band Ka1: 29.00 … 30.00 GHz Ka2: 27.50 … 28.60 GHz Ka4: 28.50 … 29.10 GHz
LO Frequency:		13.40 GHz	K1: 16.05 GHz K2: 16.35 GHz K3: 16.35 GHz	16.35 GHz	Ka1: 28.05 GHz Ka2: 26.55 GHz Ka4: 27.55 GHz
Phase Noise:	**10 Hz**	-65 / -55	-60 / -50	-60 / -50	-57 / -47
	100 Hz	-85 / -75	-80 / -70	-80 / -70	-77 / -70
	1 kHz	-95 / -85	-90 / -80	-90 / -80	-90 / -83
	10 kHz	-100 / -90	-97 / -87	-97 / -87	-93 / -90
	100 kHz	-103 / -93	-117 / -107	-117 / -107	-103 / -95
	1 MHz	-127 / -117	-135 / -125	-135 / -125	-125 / -115
		typ. / max. values in dBc/Hz			
IF-Input Frequency:		1100 … 1400 MHz	K1: 1250 … 1750 MHz K2: 1250 … 1750 MHz K3: 950 … 1750 MHz	950 … 2050 MHz	Ka1: 950 … 1950 MHz Ka2: 950 … 2050 MHz Ka4: 950 … 1550 MHz
Conversion Scheme:		Block up conversion, no frequency inversion			

Upconverter Type:		**VHBU- / VSBU- / VHBUR- / VSBUR- / VSBUL- / VHBUL-**			
		Ka6, Ka7	**Ka8, Ka9**	**Ka10, Ka11**	
RF-Output Frequency:		Ka-Band Ka6: 27.50 … 28.70 GHz Ka7: 28.30 … 29.50 GHz	Ka-Band Ka8: 30.00 … 31.00 GHz Ka9: 27.00 … 28.00 GHz	Ka-Band Ka10: 28.00 … 29.00 GHz Ka11: 29.50 … 30.00 GHz	
LO Frequency:		Ka6: 26.55 GHz Ka7: 27.35 GHz	Ka8: 29.05 GHz Ka9: 26.05 GHz	Ka10: 27.05 GHz Ka11: 28.55 GHz	
Phase Noise:	**10 Hz**	-57 / -47	-57 / -47	-57 / -47	
	100 Hz	-77 / -70	-77 / -70	-77 / -70	
	1 kHz	-90 / -83	-90 / -83	-90 / -83	
	10 kHz	-93 / -90	-93 / -90	-93 / -90	
	100 kHz	-103 / -95	-103 / -95	-103 / -95	
	1 MHz	-125 / -115	-125 / -115	-125 / -115	
		typ. / max. values in dBc/Hz			
IF-Input Frequency:		Ka6: 950 … 2150 MHz Ka7: 950 … 2150 MHz	Ka8: 950 … 1950 MHz Ka9: 950 … 1950 MHz	Ka10: 950 … 1950 MHz Ka11: 950 … 1450 MHz	
Conversion Scheme:		Block up conversion, no frequency inversion			

Specifications continued next page

L-Band Block Upconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q/V-band available on request (contact factory)

Common Parameters		
IF-Input Characteristics:	Impedance: Return loss: Maximum aggregate input level: Connector:	50 Ω > 18 dB 0 dBm (damage Level) SMA female (standard) N female (standard with option OD)
IF/RF-Monitor (Option):	Signal level in ref. to in/output: Impedance: Connector:	-20 dB 50 Ω SMA female
RF-Output Characteristics:	Impedance: Return loss: 1 dB compression point: Output muting: Connectors:	50 Ω > 18 dB > 10 dBm[1)] > 75 dB (by command or sense input or by alarm condition) SMA female (standard) K female (2.92 mm) (-Ka standard) WR28 waveguide (-Ka with option WR28)
LO Test Output (Option):	Frequency: Signal level: Impedance: Connector:	LO Frequency standard (LO/2 Frequency on -Ka) -10 dBm ±3 dB 50 Ω SMA female
Transfer Characteristics (standard):	Max. conversion gain: Attenuation range: Gain variation over temp.: Gain flatness over freq.: Gain flatness over 40 MHz: Image rejection: Noise figure:	35 dB ±1 dB 0 … 20 dB, 0.1 dB steps 0 … 19 dB, 1 dB steps (Option VSBx**L**) ±0.5 dB max ±1.0 dB max. over band ±0.5 dB > 80 dB < 11 dB[1)] (on Ka < 15 dB[1)])
Transfer Characteristics with Gain Slope Equalizer: **(Option EQ,** **only for VHBU, VSBU, VHBUR, VSBUR)**	Max. conversion gain: Attenuation range: Gain variation over Temp.: Gain flatness over Freq.: Gain flatness over 40 MHz: Gain equalization: Image rejection: Noise figure:	35 dB ±1 dB 0 … 30 dB, 0.1 dB steps ±0.5 dB max ±1.0 dB max. over band ±0.5 dB +8.0 dB / GHz max., adjustable > 80 dB < 11 dB[1)] (on Ka < 15 dB[1)])
Group Delay:	Ripple, Slope:	< 1 ns peak-peak / 80 MHz
Spurious Outputs:	Signal related: Output harmonics: Signal independent:	< -65 dBc (< -60 dBc for Ka-Band and BW > 800 MHz)[1) 2)] < -40 dBc[1) 2)] < -85 dBm (< -75 dBm on -Ka)
Output Intercept Point 3rd Order:	OIP3:	> 20 dBm[1)]
Internal Frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain
[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

L-Band Block Downconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q/V-band available on request (contact factory)

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Downconverter Type:		**VHBD- / VSBD- / VHBDR- / VSBDR- / VHBDL- / VSBDL-**				
		C	**C3**	**C-NI**	**X**	**Ku1, Ku2, Ku3, Ku4, Ku5**
RF-Input Frequency:		C-Band 3.40 … 4.20 GHz	C-Band 5.85 … 6.45 GHz	C-Band 3.40 … 4.20 GHz	X-Band 7.25 … 7.75 GHz	Ku-Band Ku1: 10.95 … 11.70 GHz Ku2: 10.70 … 11.70 GHz Ku3: 11.70 … 12.75 GHz Ku4: 11.55 … 12.75 GHz Ku5: 12.25 … 12.75 GHz
LO Frequency:		5.15 GHz	4.90 GHz	LO1: 10.0 GHz LO2: 7.55 GHz	6.30 GHz	Ku1: 10.00 GHz Ku2: 9.75 GHz Ku3: 10.75 GHz Ku4: 10.60 GHz Ku5: 11.30 GHz
Phase Noise:	**10 Hz**	-70 / -60	-70 / -60	-65 / -55	-68 / -58	-65 / -55[1)] -65 / -55[2)]
	100 Hz	-90 / -80	-90 / -80	-85 / -75	-88 / -78	-85 / -75[1)] -85 / -75[2)]
	1 kHz	-100 / -90	-100 / -90	-95 / -85	-98 / -88	-95 / -85[1)] -95 / -85[2)]
	10 kHz	-105 / -95	-105 / -95	-100 / -90	-103 / -93	-100 / -90[1)] 100 / -90[2)]
	100 kHz	-110 / -100	-110 / -100	-103 / -93	-106 / -96	-103 / -93[1)] -123 / -113[2)]
	1 MHz	-133 / -123	-133 / -123	-125 / -117	-130 / -120	-127 / -117[1)] -140 / -130[2)]
		typ. / max. values in dBc/Hz		[1)] standard values	[2)] values with low phase noise option LPN	
IF-Output Frequency:		950 … 1750 MHz	950 …1550 MHz	950 …1750 MHz	950 … 1450 MHz	Ku1: 950 … 1700 MHz Ku2: 950 … 1950 MHz Ku3: 950 … 2000 MHz Ku4: 950 … 2150 MHz Ku5: 950 … 1450 MHz
Conversion Scheme:		frequency inversion	no frequency inversion			

Downconverter Type:		**VHBD- / VSBD- / VHBDR- / VSBDR- / VHBDL- / VSBDL-**			
		Ku2Ku3	**Ka2, Ka3, Ka5, Ka7**	**Ka8, Ka9, Ka10, Ka11**	**Ka4**
RF-Input Frequency:		Ku-Band Ku2: 10.70 … 11.70 GHz Ku3: 11.70 … 12.75 GHz (switchable)	Ka-Band Ka2: 18.30 … 19.30 GHz Ka3: 18.20 … 19.30 GHz Ka5: 19.20 … 20.30 GHz Ka7: 20.20 … 21.30 GHz	Ka-Band Ka8: 18.60 … 19.70 GHz Ka9: 21.20 … 22.20 GHz Ka10: 18.25 … 19.45 GHz Ka11: 17.20 … 18.30 GHz	Ka-Band 28.50 … 29.10 GHz
LO Frequency:		Ku2: 9.75 GHz Ku3: 10.75 GHz	Ka2: 17.35 GHz Ka3: 17.25 GHz Ka5: 18.25 GHz Ka7: 19.25 GHz	Ka8: 17.65 GHz Ka9: 20.25 GHz Ka10: 17.30 GHz Ka11: 16.25 GHz	27.55 GHz
Phase Noise:	**10 Hz**	-60 / -50	-60 / -50	-60 / -50	-57 / -47
	100 Hz	-80 / -72	-80 / -72	-80 / -72	-77 / -70
	1 kHz	-93 / -85	-93 / -85	-93 / -85	-90 / -83
	10 kHz	-97 / -93	-97 / -93	-97 / -93	-93 / -90
	100 kHz	-107 / -100	-107 / -100	-107 / -100	-103 / -95
	1 MHz	-127 / -120	-127 / -120	-127 / -120	-125 / -115
		typ. / max. values in dBc/Hz	[1)] standard values	[2)] values with low phase noise option LPN	
IF-Output Frequency:		Ku2: 950 … 1950 MHz Ku3: 950 … 2000 MHz	Ka2: 950 … 1950 MHz Ka3: 950 … 2050 MHz Ka5: 950 … 2050 MHz Ka7: 950 … 2050 MHz	Ka8: 950 … 2050 MHz Ka9: 950 … 1950 MHz Ka10: 950 … 2150 MHz Ka11: 950 … 2050 MHz	950…1550 MHz
Conversion Scheme:		no frequency inversion			

Specifications continued next page

L-Band Block Downconverter

Indoor / Outdoor

S-, C-, X-, Ku-, K- (DBS), Ka-band
Q/V-band available on request (contact factory)

Common Parameters		
RF-Input Characteristics:	Impedance: Return loss: Maximum aggregate input level: LO leakage: RF-connector:	50 Ω > 18 dB 0 dBm (damage level) < -80 dBm SMA female (standard) K female (2.92 mm) (-Ka standard) WR28 waveguide (-Ka with option WR28)
IF/RF-Monitor (Option):	Signal level in reference to input: Impedance: Connector:	-20 dB 50 Ω SMA female
IF-Output Characteristics:	Impedance: Return Loss: 1 dB Compression Point: IF-Connectors:	50 Ω > 18 dB > 17 dBm[1)] SMA female (standard) N female (standard with option OD)
LO Test Output (Option):	Frequency: Signal level: Impedance: Connector:	LO Frequency standard (LO/2 Frequency on -Ka) -10 dBm ±3 dB 50 Ω SMA female
Transfer Characteristics (standard):	Max. conversion gain: Attenuation range: Gain Variation over Temp.: Gain Flatness over Freq.: Gain Flatness over 40 MHz: Image Rejection: Noise Figure:	35 dB ±1 dB 0 … 20 dB, 0.1 dB steps 0 … 19 dB, 1 dB steps (Option VSBD**L**) ±0.5 dB ±1.0 dB max. over band ±0.5 dB > 80 dB < 11 dB[1)] (-on Ka <15 dB[1)])
Transfer Characteristics with Gain Slope Equalizer: **(Option EQ,** **only for VHBD, VSBD, VHBDR, VSBDR)**	Max conversion gain: Attenuation range: Gain Variation over Temp.: Gain Flatness over Freq.: Gain Flatness over 40 MHz: Gain Equalization: Image Rejection: Noise Figure:	35 dB ±1 dB 0 … 30 dB, 0.1 dB steps ±0.5 dB ±1.0 dB max. over band ±0.5 dB +8.0 dB / GHz max. adjustable > 80 dB < 11 dB[1)] (-on Ka <15 dB[1)])
Group Delay:	Ripple, Slope:	< 1 ns peak-peak / 80 MHz
Spurious Outputs:	Signal related: Output harmonics: Signal independent:	< -65 dBc[1) 2)] < -40 dBc[1) 2)] < -75 dBm
Output Intercept Point 3rd Order:	OIP3:	> 30 dBm[1)]
Internal frequency Stability:	±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)	

[1)] at max. conversion gain
[2)] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

L-Band Block Up- and Downconverter

Indoor / Outdoor

Single / Dual / Triple Band
Single / Dual Channel
Q/V-band available on request (contact factory)

Indoor Housing:

Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB BNC female
Monitoring and Control Interface (VHBU/VSBU only):	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Diagnostic Interface (VHBUL/VSBUL only):	RS232, connector DSUB09 female	
Alarm Interface:	Alarm: two potential free contacts (DPDT), Connector DSUB09 female	
Temperature Range:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 95 % non condensing	
User Interface (VHBU/VSBU only):	LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys (with option VFD)	
User Interface (VHBUL/VSBUL only):	Attenuator selector on front panel	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 35 VA / 20 W	
Mains Power Input Connector:	IEC C14	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimension and Weight:	483 x 44 x 270 mm^3 (WxHxD), 1 RU (19"), approx. 6 kg	

Outdoor Housing:

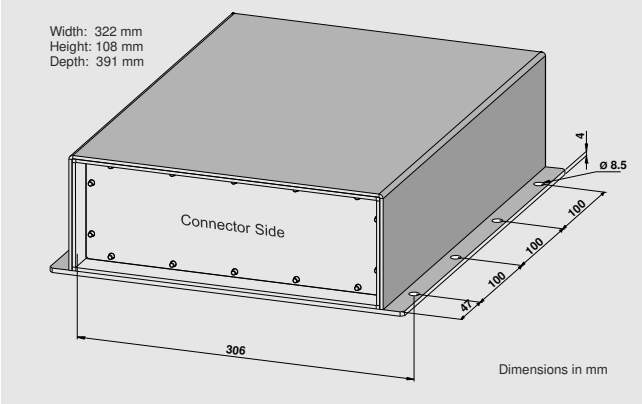
Reference Input (Option):	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern SMA female
Reference Output (Option):	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Combined Monitoring and Control Interface and Alarm Interface:	Protocol: Connection: Alarm output: Connection type: Mute Input:	Multipoint packet format commands RS232 or RS422/RS485 (configurable), connector MIL-C-26482: MS 3120 E 14-19-S Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A MIL-C-26482: MS 3120 E 14-19-S TTL logic input with internal pull up
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Temperature Range:	-30 °C … 60 °C operating (10 minutes warm up at -30 °C)	
Relative Humidity:	< 100 %	
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 35 VA / 20 W	
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimensions:	322 x 108 x 391 mm^3 (WxHxD) (small housing) (standard) 402 x 111 x 391 mm^3 (WxHxD) (large housing) 412 x 74 x 515 mm^3 (WxHxD) (XL housing)	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

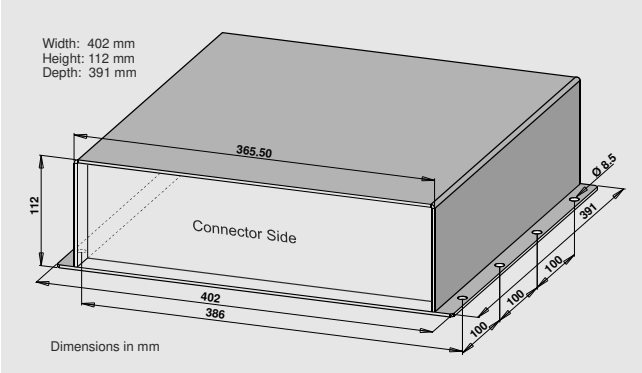
Outdoor Housings
Frequency Converter

WORK Microwave offers its proven satellite communication equipment in different outdoor housings, which can be used under all weather conditions. The units can be operated over a temperature range of -40 °C to 60 °C (-40 °F to 140 °F). In the non-operating modus they survive temperatures of -50 °C to 80 °C (-58 °F to 176 °F) without any damage. Same as the 19" rack mount units, they meet the demanding requirements of modern satellite transmission applications, such as for TV uplinks and high-speed data network installations. Because of their rugged construction and low power consumption, they are perfect for fixed satellite earth stations, satellite newsgathering (SNG) vehicles and fly-aways.

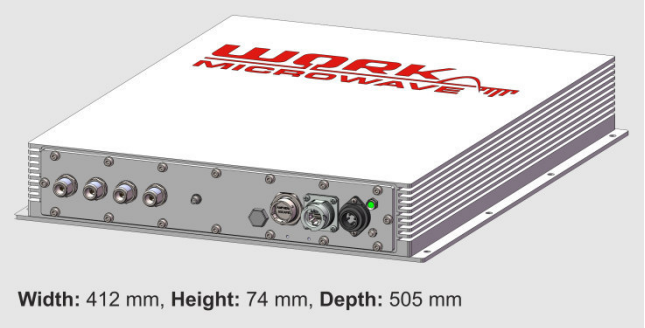
WORK Microwave outdoor units are ideally meant to be mounted directly to the antenna. They do not require additional protection against water. The housing provides environmental protection according to IP67 (temporary flooding) when all cables are connected and sealed appropriately. Special environmental protection sleeves for the coaxial connectors allow optimal sealing from the housing to the cable. The housing should be mounted with the connector side down. Alternatively, the connector panel can be in a vertical position.



Dimensions of small Outdoor Housing



Dimensions of large Outdoor Housing

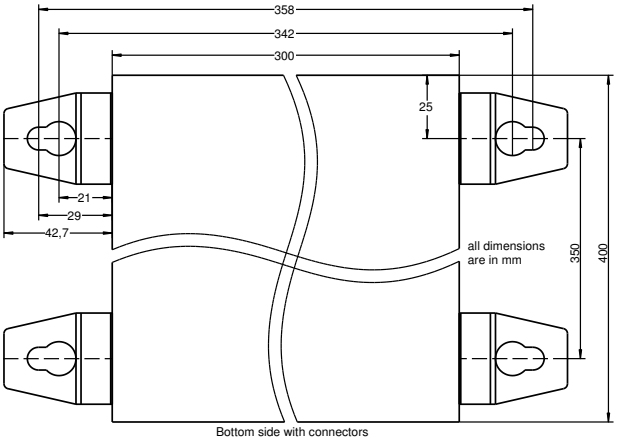


Dimensions of XL Outdoor Housing

Monitoring and Control Interface:	RS232 or RS422/RS485 Alarm output: Two potential free contacts (DPDT) 24 V DC output: max. 0.3 A 6.5 V DC output: max. 0.2 A Mute Input: TTL logic input with internal pull up (Connector type: MIL-C-26482: MS 3120 E 14-19 S)
Temperature Range:	-40 °C … 60 °C operating
Relative Humidity:	< 100 %
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max, 50 … 60 Hz
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male
Dimensions:	322 x 108 x 391 mm^3 (WxHxD) (small housing) 402 x 112 x 391 mm^3 (WxHxD) (large housing) 412 x 74 x 505 mm^3 (WxHxD) (XL housing)
Degree of Protection:	IP 67 (acc. IEC 529)

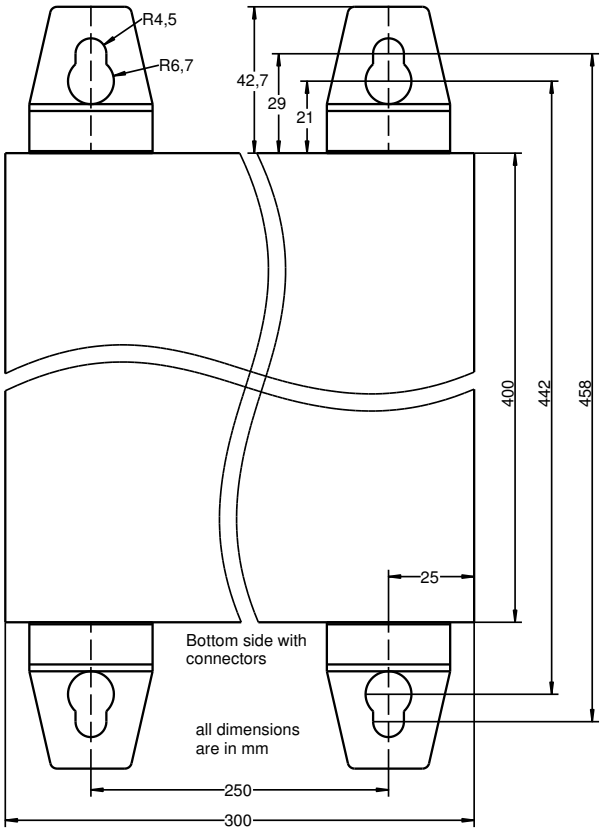
Outdoor Housings
Redundancy Switches

OSB-2

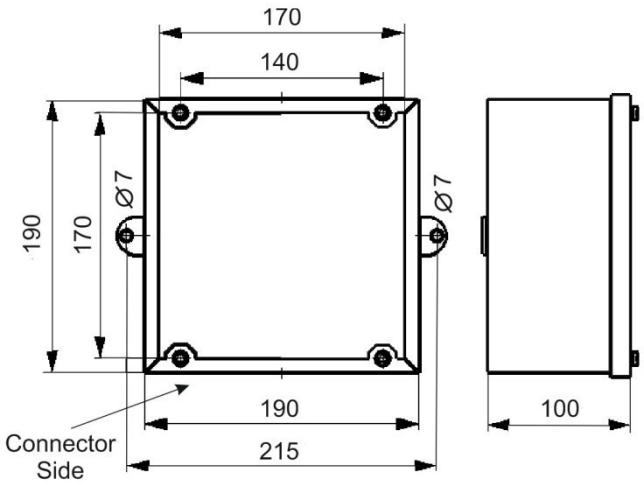


OSB-2 with horizontally mounted brackets

RSB1



OSB-2 with vertically mounted brackets



Dimensions of RSB1

Dimensions of OSB-2

Temperature Range:	**-40 °C … 60 °C operating**
Relative Humidity:	**< 100 %**
Degree of Protection:	**IP 67 (acc. IEC 529)**

Redundant L-Band Block Converter

Indoor

S-, C-, X-, Ku-, K- (DBS)-Band

1+1 Redundant Block Converter System (cover not shown)

WORK Microwave's 1+1 redundant block converter system combines a redundancy switching system and two block converters in one unit, increasing operators efficiencies and cost savings. By consolidating previously separate capabilities into a single, compact, 19" housing, the WORK Microwave system dramatically reduces power consumption, providing operators with an innovative approach to redundant block converter systems. The hot plugging capability of the slide-in converters allows changing the spare unit without any downtime. Ideal use cases include fixed satellite ground stations as well as in satellite newsgathering (SNG) vehicles, fly-aways and other mobile or portable applications.

The fifth-generation frequency converter series is built with the most advanced technologies available to ensure outstanding performance, high reliability and a longer lifetime.

5th-generation enhancements

Reduced phase noise: Based on a powerful new synthesizer the frequency converters achieve a phase noise significantly beyond the recommended industry specification (Intelsat's IESS-308/309).

Improved flexibility and usability: Through a new USB port, operators can now access the converter via the back panel to make copies of parameter settings, replicate selected configurations on another device, or save configuration settings for future reference. In addition, a user-friendly, Web-based interface offers an intuitive user experience. When coupled with the enhanced USB port, the customizable GUI also simplifies the installation of firmware updates.

Higher reliability: An AC power consumption of typically 45 VA / 30 W maximizes the reliability and lifetime of the system.

High signal integrity

The very low phase noise of the oscillators guarantees an excellent signal quality. Low spurious emissions allow our customers to use the converters in the environments with demanding requirements, such as high power video uplinks. Sophisticated temperature compensation guarantees the stability over a wide temperature range.

Housing

The redundant block converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as a potential point of failure. For rack installations without any space in between the units, a fan within the converter unit is recommended. This forces airflow from the right side to left side of the units.

Each part of the systems can be operated separately via remote control by using TCP/IP over Ethernet. By using the serial interface (RS485) for remote control, all parts can be controlled via one interface. Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string-based commands as well as addressable, packet-based commands are provided. Remote monitoring and control through SNMP and a Web browser interface is also available.

Redundancy Switch System

The redundancy switch system includes a coaxial signal splitter for the input signal and a coaxial signal switch for the output signal. The system can operate in automatic mode, whereby an automatic switchover unit is performed upon detection of an alarm generated by the active unit. In addition, a manual switchover of the standby unit can be initiated.

Redundant Power Supply

Each slide-in converter comes with a separate power supply, capable to supply the redundancy controller and the second converter to guarantee highest possible availability.

Key features

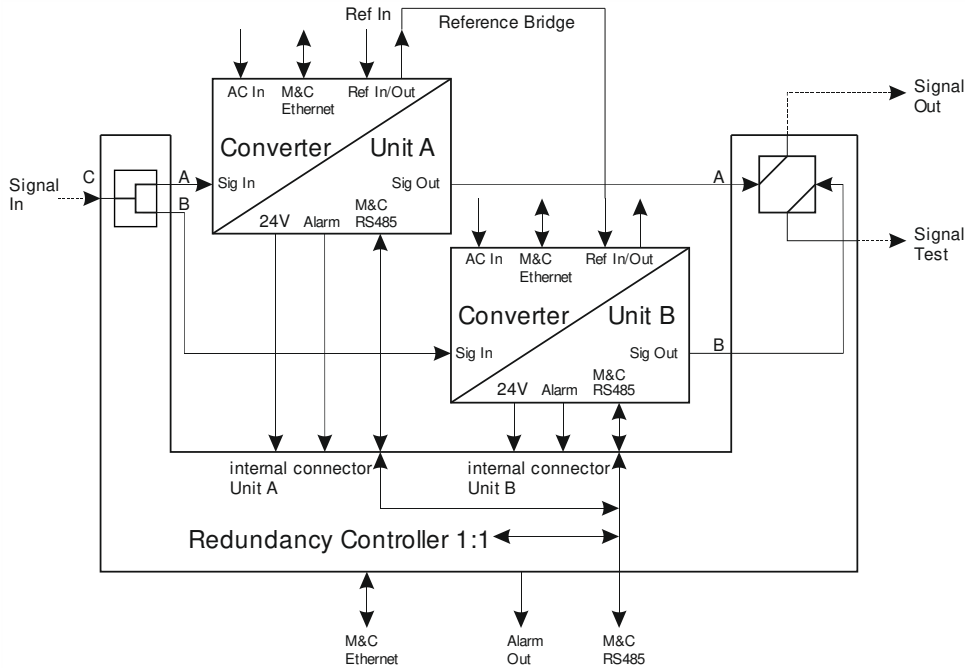
- Previously three devices in one 19” housing
- Hot pluggable slide-in converters
- Redundant power supplies
- Low phase noise
- Adjustable attenuator (range: 0 … 20 dB, 0.1 dB step size)
- Output power +10 dBm (1 dB compression point)
- Low spurious emissions
- Internal OCXO with long term stability 10^{-7} / year
- External reference input 5 or 10 MHz
- Reference output 10 MHz
- Local control through push buttons on front panel
- Stored alarms with time stamps
- Remote controls through RS485 interface. Packet command syntax supports RS485 bus systems and allows addressed operation. TCP/IP over Ethernet, Web browser interface, SNMP with MIBs downloadable form the device
- Summary alarm output (DPDT)
- Low power consumption, typically 30 W
- CE compliant
- **3 years warranty**

Orders information

WORK Microwave offers two series of 19” rack satellite converters, Standard and High Performance. The specifications are the same for both types except the operating temperature range. The High Performance type operates between -30 °C to 60 °C (-22 °F to 140 °F) and the Standard type between 0 °C to 50 °C (32 °F to 122 °F). Therefore if you only need units for inside use, the standard unit is perfectly suited for this application.

Open questions, demo units

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



Functional Block Diagram 1+1 Redundant Block Converter System

Redundant L-Band Block Upconverter
Indoor

S-, C-, X-, Ku-, K- (DBS)-Band

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Upconverter Type:		**VHBU- / VSBU-**				
		C	**C3**	**X**	**Ku1, Ku2, Ku3, Ku7**	**K2, K3, K4**
RF-Output Frequency:		C-Band 5.85 … 6.45 GHz	C-Band 6.45 … 7.05 GHz	X-Band 7.90 … 8.40 GHz	Ku-Band Ku1: 13.75 … 14.50 GHz Ku2: 12.75 … 13.75 GHz Ku3: 12.75 … 13.50 GHz Ku7: 14.50 … 14.80 GHz	K-Band K2: 17.6 … 18.4 GHz K3: 17.3 … 18.1 GHz K4: 17.3 … 18.4 GHz
LO Frequency:		4.90 GHz	5.50 GHz	6.95 GHz	Ku1: 12.80 GHz Ku2: 11.80 GHz Ku3: 11.80 GHz Ku7: 13.40 GHz	K2: 16.35 GHz K3: 16.35 GHz K4: 16.35 GHz
Phase Noise:	**10 Hz**	-70 / -60	-70 / -60	-68 / -58	-65 / -55[1] -65 / -55[2]	-60 / -50
	100 Hz	-90 / -80	-90 / -80	-88 / -78	-85 / -75[1] -85 / -75[2]	-80 / -70
	1 kHz	-100 / -90	-100 / -90	-98 / -88	-95 / -85[1] -95 / -85[2]	-90 / -80
	10 kHz	-105 / -95	-105 / -95	-103 / -93	-100 / -90[1] -100 / -93[2]	-97 / -87
	100 kHz	-110 / -100	-110 / -100	-106 / -96	-103 / -93[1] -123 / -113[2]	-117 / -107
	1 MHz	-133 / -123	-133 / -123	-130 / -120	-127 / -117[1] -140 / -130[2]	-135 / -125
		typ. / max. values in dBc/Hz [1] standard values [2] values with low phase noise option LPN				
IF-Input Frequency:		950 …1550 MHz	950 …1550 MHz	950 …1450 MHz	Ku1: 950 …1700 MHz Ku2: 950 …1950 MHz Ku3: 950 …1700 MHz Ku7: 1100 … 1400 MHz	K2: 1250 … 1750 MHz K3: 950 … 1750 MHz K4: 950 … 2050 MHz
Conversion Scheme:		Block up conversion, no frequency inversion				
IF-Input Characteristics:		Impedance: 50 Ω Return loss: > 18 dB Maximum aggregate input level: 0 dBm (damage Level) Connector: SMA female (standard)				
RF-Output Characteristics:		Impedance: 50 Ω Return loss: > 18 dB 1 dB compression point: > 10 dBm[1] Output muting: > 75 dB (by command or sense input or by alarm condition) Connectors: SMA female (standard) K female (2.92 mm) (f > 18 GHz)				
Transfer Characteristics:		Max. conversion gain: 35 dB ±1 dB Attenuation range: 0 … 20 dB, 0.1 dB steps Gain variation over temp.: ±0.5 dB max. Gain flatness over freq.: ±1.0 dB max. over band Gain flatness over 40 MHz: ±0.5 dB Image rejection: > 80 dB Noise figure: < 11 dB[1]				
Group Delay:		Ripple, Slope: < 1 ns peak to peak / 80 MHz				
Spurious Outputs:		Signal related: < -65 dBc[1] [2] Output harmonics: < -40 dBc[1] [2] Signal independent: < -85 dBm				
Output Intercept Point 3rd Order:		OIP3: > 20 dBm[1]				
Internal Frequency Stability:		±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)				

[1] at max. conversion gain
[2] Pout = 0 dBm

Specifications are subject to change

Redundant L-Band Block Downconverter

Indoor

S-, C-, X-, Ku-, K- (DBS)-Band

Downconverter Type:		**VHBD- / VSBD-**				
		C	**X**	**Ku1, Ku2, Ku3**		
RF-Input Frequency:		C-Band 3.4 … 4.2 GHz	X-Band 7.25 … 7.75 GHz	Ku-Band Ku1: 10.95 … 11.70 GHz Ku2: 10.70 … 11.70 GHz Ku3: 11.70 … 12.75 GHz		
LO Frequency:		5.15 GHz	6.30 GHz	Ku1: 10.00 GHz Ku2: 9.75 GHz Ku3: 10.75 GHz		
Phase Noise:	**10 Hz**	-70 / -60	-68 / -58	-65 / -55[1]	-65 / -55[2]	
	100 Hz	-90 / -80	-88 / -78	-85 / -75[1]	-85 / -75[2]	
	1 kHz	-100 / -90	-98 / -88	-95 / -85[1]	-95 / -85[2]	
	10 kHz	-105 / -95	-103 / -93	-100 / -90[1]	-100 / -93[2]	
	100 kHz	-110 / -100	-106 / -96	-103 / -93[1]	-123 / -113[2]	
	1 MHz	-133 / -123	-130 / -120	-127 / -117[1]	-140 / -130[2]	
		typ. / max. values in dBc/Hz		[1] standard values	[2] values with low phase noise option LPN	
IF-Output Frequency:		950 … 1750 MHz	950 … 1450 MHz	Ku1: 950 … 1700 MHz Ku2: 950 … 1950 MHz Ku3: 950 … 2000 MHz		
Conversion Scheme:		frequency inversion	no frequency inversion			
RF-Input Characteristics:		Impedance: 50 Ω Return loss: > 18 dB Maximum aggregate input level: 0 dBm (damage level) LO leakage: < -80 dBm RF-connector: SMA female (standard) K female (2.92 mm) (f > 18 GHz)				
IF-Output Characteristics:		Impedance: 50 Ω Return Loss: > 18 dB 1 dB Compression Point: > 17 dBm[1] IF-Connectors: SMA female				
Transfer Characteristics:		Max. conversion gain: 35 dB ±1 dB Attenuation range: 0 … 20 dB, 0.1 dB steps Gain Variation over Temp.: ±0.5 dB Gain Flatness over Freq.: ±1.0 dB max. over band Gain Flatness over 40 MHz: ±0.5 dB Image Rejection: > 80 dB Noise Figure: < 11 dB[1]				
Group Delay:		Ripple, Slope: < 1 ns peak to peak / 80 MHz				
Spurious Outputs:		Signal related: < -65 dBc[1] [2] Output harmonics: < -40 dBc[1] [2] Signal independent: < -75 dBm				
Output Intercept Point 3rd Order:		OIP3: > 30 dBm[1]				
Internal frequency Stability:		±1 x 10^{-7}, -30 °C … 60 °C ±1 x 10^{-8}, -30 °C … 60 °C (after 30 min warm up) ±1 x 10^{-9} per day (fixed temperature after 24 h warm up)				

[1] at max. conversion gain
[2] Pout = 0 dBm

Specifications are subject to change

These converter types are only a small selection of what is available. Please contact us for further frequency bands and features.

Redundant L-Band Block Converter
Indoor

S-, C-, X-, Ku-, K- (DBS)-Band

General Information:

Slide-in Block Converters		
Reference Input:	Frequency: Level: Modes: Connector:	5 or 10 MHz sine wave 5 dBm ±5 dB auto/extern/intern SMA female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 dBm ±3 dB SMA female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max., 50 … 60 Hz	
Mains Power Consumption:	Max.: 30 VA / 20 W, Typ.: 25 VA / 15 W	
Mains Power Input Connector:	IEC C14	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimension and Weight:	134 x 36 x 416 mm^3 (WxHxD), approx. 1.8 kg	

Redundancy Controller		
Switching:	Manual or Automatic	
Switching Time:	< 100 ms	
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint packet format commands RS422/RS485, connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
Summary Alarm Interface:	Two potential free contacts (DPDT), connector DSUB09 female	
Configuration:	16 DIP switches on rear side	
Signal Splitter:	Frequency range: Connectors: Return loss: Attenuation:	1 ... 18 GHz SMA female > 14 dB 1.2 dB max. above 3 dB
Signal Switch:	 Frequency Range: Connectors: Return loss: Attenuation:	Transfer Relay 0 ... 18 GHz SMA female > 15 dB 0.5 dB max.

Housing	
User Interface:	10 LEDs, 4 Function Keys
Temperature Range:	Standard performance: 0 °C … 50 °C operating, -30 °C … 80 °C storage High performance: -30 °C … 60 °C operating (10 minutes warm up at -30 °C)
Relative Humidity:	< 95 % non condensing
Dimension and Weight:	483 x 44 x 460 mm^3 (WxHxD), 1 RU (19”), approx. 8.0 kg with two slide in converters

Order Information
Frequency Converter

IF Converter ([typ]=C)

-1st item-	*-2nd item-*	*-3rd item-*	*-4th item-*	*-5th item-*	*-6th item-*	*-7th item-*	*-8th item-*	*-9th item-*
[generation]	**[temp.range]**	**[typ]**	**[direction]**	**-[RF-band(s)]-**	**-[IF-band]-**	**-[IF-imp.]-**	**-[options]-**	**-[s-number]-**
V	S=Standard Performance	C	U=Upconv.	S	70 MHz ±20 MHz	50 Ω	see description below	for special devices
	H=High Performance		D=Downconv.	C	140 MHz ±40 MHz	75 Ω		
	E=Extra High Performance (-40°C ... 60°C)			X	70_140 MHz			
				Ku	720 MHz ±200 MHz			
				K				
				Ka				
				Q				

Synthesized Blockconverter ([typ]=SB), L-Band Blockconverter ([typ]=B), Test Loop Translator ([typ]=TLT)

-1st item-	*-2nd item-*	*-3rd item-*	*-4th item-*	*-optional item- (only for L-Band Blockconverter)*	*-5th item-*	*-6th item-*	*-7th item-*	*-8th item-*	*-9th item-*
[generation]	**[temp.range]**	**[typ]**	**[direction]**	**[frontpanel]**	**[switchable]**	**-[RF-band(s)]-**	**-[IF-band]-**	**-[options]-**	**-[s-number]-**
V	S=Standard Performance	SB	U=Upconv.	-	-	S	-	see description below	for special devices
	H=High Performance	B	D=Downconv.	R=Remote	2	C	1200 MHz ±300 MHz		
	E=Extra High Performance (-40°C ... 60°C)	TLT		L=Local control	3	X			
				see description below		Ku			
						K			
						Ka			
						Q			

Redundant L-Band Blockconverter ([typ]=B)

-1st item-	*-2nd item-*	*-3rd item-*	*-4th item-*	*-5th item-*	*-6th item-*	*-7th item-*	*-8th item-*
[generation]	**[temp.range]**	**[typ]**	**[direction]**	**-[RF-band(s)]-**	**-[switch/splitter]-**	**-[options]-**	**-[s-number]-**
V	S=Standard Performance	B	U=Upconv.	S	Red1=50 Ω Input Splitter, 50 Ω Output Transfer Switch Red2=50 Ω Input Switch, 50 Ω Output Transfer Switch	FAN	for special devices
	H=High Performance		D=Downconv.	C		LPN	
	E=Extra High Performance (-40°C ... 60°C)			X		No additional options available	
				Ku			
				K			
Additional Slide-in Converter (e.g. as Spare Unit):							
[generation]	**[temp.range]**	**[typ]**	**[direction]**	**-[RF-band(s)]-**	**-SLOT-**	**-[options]-**	**-[s-number]-**
V	S=Standard Performance	B	U=Upconv.	S		LPN	for special devices
	H=High Performance		D=Downconv.	C		No additional options available	
	E=Extra High Performance (-40°C ... 60°C)			X			
				Ku			
				K			

Order Information
Frequency Converter

description [frontpanel]:

code:	description:	
R		The extension "R" describes an option available for all indoor fixed frequency block converter. This option comes without a front panel and has full remote control capability.
L		The extension "L" describes an option available for all indoor fixed frequency block converter without equalizer option. This option comes with an attenuator selector instead of the front panel and has no remote control capability (Monitoring via serial interface is possible).

description [options]:

code:	description:
WR28	WR28 Waveguide Output, Ka-Band only (f > 26.5 GHz)
OD	Outdoor housing
VFD	VFD display for indoor units
FAN	Fan for indoor units
EQ	Equalizer, standard on IF-Converters
LPN	Low phase noise
RIN	external reference Input, outdoor unit only
ROUT	10 MHz reference Output, outdoor unit only
IFT	IF test output, standard on IF Down converters
RFT	RF test output, standard on IF Up converters
LOT	LO test output, standard on IF Converters
LSS	Low Step Size (10 Hz frequency resolution)

Examples:

Order Code:	Order code description:
VSCU-Ku-70-50	Ku Band IF up converter, standard performance, IF 70 MHz, impedance 50 Ω
VHCD-X-140-75	X Band IF down converter, high performance, IF 140 MHz, impedance 75 Ω
VSSBU-Ka	Ka Band Synthesized Block up converter
VSBD-K-OD	K Band Block down converter, Outdoor housing
VSBD-Ku2Ku3-IFT-RFT-LOT-LPN	Ku Band dual channel Block down converter, IF-, RF- and LO- test output, low phase noise
VSBU2-Ku1Ku3-VFD	Ku Band dual band Block Up converter (switchable), VFD Display
VHTLT-S-FAN	S Band Test Loop Translator, high performance, internal Fan
VSCD-KuKuT-70-50	Ku Band Tracking Downconverter, standard performance, IF 70 MHz, impedance 50 Ω
VSBUL-Ku1	Ku1-Band Block up converter, local control (without display, only attenuation switch, no remote control)
VSBDR-K	K-Band Block down converter, Remote (without display, configurable only via remote control)
VSBD-C-Red1	C-Band Block Downconverter with Input Splitter and Output Transfer Switch
VSBU-Ku1-Red2-FAN	Ku1-Band Block Upconverter with Input Switch and Output Transfer Switch
VSBU-Ku1-SLOT	Spare Unit for VSBU-Ku1-Red2-FAN

Redundancy Switch Controller 1:1
RSCM1

The WORK Microwave redundancy switch 1:1 is used for 1:1 redundancy configurations for Upconverters, Downconverters, Modulator-Upconverters, Transport Stream Modulators, Demodulators, and Modems. It comes standard with a coaxial signal splitter for the input signal and a coaxial signal switch for the output signal. An input signal switch instead of the signal splitter is available as an option. For IP modem applications a similar device, RSCI1 is available.

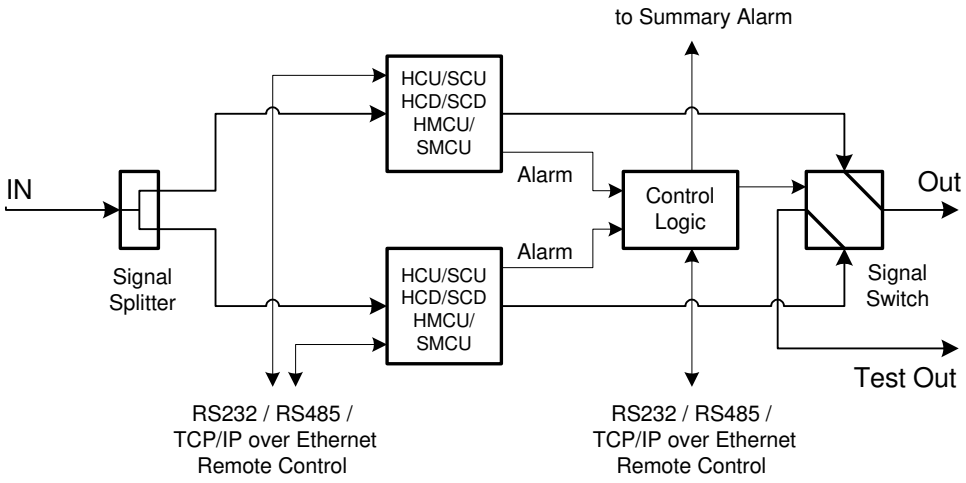
LNAs or even HPAs can be included within the system, as the switch is capable to control external waveguide transfer switches as option. DC power to LNAs can also be provided as option. The switch accepts alarm signals from two types of equipment, so that it can be used for redundancy configurations with e.g. a video encoder and a modulator within one chain.

The unit can be controlled from the front panel or remotely via RS 232, RS422/485, or IP over Ethernet.

The unit can operate in automatic mode, whereby an automatic switchover to the standby unit is performed upon detection of an alarm generated by the active unit. In addition, a manual switchover to the standby unit can be initiated.

Two power supplies and two AC input connectors guarantee high availability of the unit.

The 1:1 redundancy is also available in an outdoor version, where the signal splitter and the signal transfer relay is mounted within an outdoor switch box. The control unit is similar to the indoor redundancy controller, but does not include any signal splitters or signal switches. The outdoor switch box also includes interfaces for alarms and M&C of outdoor units. A control cable runs from the outdoor switch box to the indoor redundancy controller.



1:1 Redundancy with Signal Splitter

Redundancy Switch Controller 1:1
RSCM1

Model	RSCM1-xx-xx Redundancy Switch 1:1	RSCM1-OD Redundancy Controller 1:1 for outdoor switch box RSB1-xx-xx
Control Interface to Outdoor Switch Box RSB1-xx-xx:		Alarm inputs, control outputs (Connector Type: MIL-C-26482: MS 3120 E 16-26 P)
Signal Input Splitter RSCM1-50K-xx:	Connector Type: 3 x SMA female Impedance: 50 Ω Power Handling: 3 W Frequency Range: 6 …18 GHz Total Insertion Loss: ≤ 4.4 dB Return Loss: ≥ 13 dB Amplitude Balance: 0.4 dB	
Signal Input Splitter RSCM1-50C-xx:	Connector Type: 3 x SMA female Impedance: 50 Ω Power Handling: 3 W Frequency Range: 4 … 8 GHz Total Insertion Loss: ≤ 4.2 dB Return Loss: ≥ 15 dB Amplitude Balance: 0.4 dB	
Signal Input Splitter RSCM1-50L-xx:	Connector Type: 3 x SMA female Impedance: 50 Ω Power Handling: 3 W Frequency Range: 800 … 2500 MHz Total Insertion Loss: ≤ 4.0 dB Return Loss: ≥ 17 dB Amplitude Balance: 0.3 dB	
Signal Input Splitter RSCM1-50V-xx:	Connector Type: 3 x BNC female Impedance: 50 Ω Power Handling: 1 W Frequency Range: 5 … 300 MHz Total Insertion Loss: ≤ 4.0 dB Return Loss: ≥ 15 dB Amplitude Balance: 0.4 dB	
Signal Input Splitter RSCM1-75V-xx:	Connector Type: 3 x BNC female Impedance: 75 Ω Power Handling: 1 W Frequency Range: 5 … 300 MHz Total Insertion Loss: ≤ 4.0 dB Return loss: ≥ 15 dB Amplitude Balance: 0.4 dB	
Signal Input or Output Transfer Switch RSCM1-50KT-xx, RSCM1-xx-50K:	Connector Type: 4 x SMA female Impedance: 50 Ω Power Handling: 1 W (switching) Frequency Range: 0 … 18 GHz Insertion Loss (max.): 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 4 GHz) 0.3 dB (4 … 8 GHz) 0.4 dB (8 … 12 GHz) 0.6 dB (12 … 18 GHz) Isolation (min.): 85 dB (0 … 1 GHz) 80 dB (1 … 4 GHz) 70 dB (4 … 8 GHz) 65 dB (8 … 12 GHz) 60 dB (12 … 18 GHz) Return Loss (min.): 26 dB (0 … 1 GHz) 20 dB (1 … 4 GHz) 17 dB (4 … 8 GHz) 15 dB (8 … 12 GHz) 14 dB (12 … 18 GHz)	
Signal Input or Output Transfer Switch RSCM1-75LT-xx, RSCM1-xx-75L:	Connector Type: 4 x 1.6/5.6 female (Adapters to external BNC female connectors are provided) Impedance: 75 Ω Power Handling: 1 W (switching) Frequency Range: 0 … 2.5 GHz Insertion Loss (max.) 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 2.5 GHz) Isolation (min.) 80 dB (0 … 1 GHz) 70 dB (1 … 2.5 GHz) Return Loss (min.): 20 dB (0 … 1 GHz) 17 dB (1 … 2.5 GHz)	
Switching:	Manual or Automatic	
Delay from unit alarm occurrence until IF/RF relay switching:	Typical 8 ms, max. 20 ms	

Specifications continued next page

Redundancy Switch Controller 1:1
RSCM1

Remote M&C Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45	
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45	
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45	
Summary Alarm Interface:	Two potential free contacts (DPDT, Connector DSUB09 female)		
Internal M&C Interface:	RS485 (Connector DSUB09 male)		RS485 (Connector Type: MIL-C-26482: MS 3120 E 16-26 P)
Configuration:	16 DIP switches on rear side for serial interfaces		
Temperature Range:	-30 °C … 60 °C operating -30 °C … 80 °C storage		
Relative Humidity:	< 95 % non condensing		
User Interface:	10 LEDs, 4 Function Keys		
DC Output (Option DC):	2x 23.5 V / 0.7 A max.		
Mains Power Input:	2 x 100 … 240 V AC nominal, 90…264 V AC max, 50…60 Hz, Redundant Power Supply, Hot swap		
Mains Power Consumption:	Max: 16 VA / 8 W Typ.: 10 VA / 5 W		
Mains Power Input Connector:	2 x IEC C14		
Mains Fuse:	2 x 2 x 2.0 A time-lag fuse		
Dimension and Weight:	483 x 44 x 270 mm³ or with option L 483 x 44 x 470 mm^3 (WxHxD), 1 RU (19") approx. 3 kg		

Specifications are subject to change

Order Information:

RSCM1-[Input Splitter or Switch Type]-[Output Switch Type]-[Options]
Redundancy Switch with splitter, switches included

RSCM1-[Input Splitter or Switch Type]-[Output Switch Type]-OD-[Options]
Redundancy Controller with Outdoor Switch Box

RSCM1-OD-[Options]
Redundancy Controller for Outdoor Switch Box

Possible Options are:

L housing depth 470 mm
DC redundant 24V DC output

Examples:

RSCM1-75VHF-50K	75 Ω Input Splitter VHF band, 50 Ω Output Transfer Switch 18 GHz
RSCM1-0-50K	without Input Splitter, 50 Ω Output Transfer Switch 18 GHz
RSCM1-50KT-50K-L	50 Ω Input Transfer Switch 18 GHz, 50 Ω Output Transfer Switch 18 GHz, housing depth 470 mm
RSCM1-OD	Controller without Splitter and Switch for Outdoor Switch Box RSB1

Outdoor Redundancy Switch Box 1:1

Outdoor Redundancy Switch Box 1:1 RSB1

Model	RSB1-xx-xx Outdoor Switch Box 1:1	
Signal Input Splitter RSB1-50Ka-xx:	Connector Type: Impedance: Power Handling: Frequency Range: Total Insertion Loss: Return Loss: Amplitude Balance:	3 x SMA female 50 Ω 3 W 18 … 26.5 GHz ≤ 6.0 dB ≥ 10.8 dB 0.4 dB
Signal Input Splitter RSB1-50K-xx:	Connector Type: Impedance: Power Handling: Frequency Range: Total Insertion Loss: Return Loss: Amplitude Balance:	3 x N female 50 Ω 3 W 6 … 18 GHz ≤ 5.0 dB ≥ 13 dB 0.4 dB
Signal Input Splitter RSB1-50C-xx:	Connector Type: Impedance: Power Handling: Frequency Range: Total Insertion Loss: Return Loss: Amplitude Balance:	3 x N female 50 Ω 3 W 4 … 8 GHz ≤ 5.0 dB ≥ 14 dB 0.4 dB
Signal Input Splitter RSB1-50L-xx:	Connector Type: Impedance: Power Handling: Frequency Range: Total Insertion Loss: Return Loss: Amplitude Balance:	3 x N female 50 Ω 3 W 800 … 2500 MHz ≤ 5.0 dB ≥ 16 dB 0.3 dB
Signal Input Splitter RSB1-75V-xx:	Connector Type: Impedance: Power Handling: Frequency Range: Total Insertion Loss: Return Loss: Amplitude Balance:	3 x N female 75 Ω 1 W 5 … 300 MHz ≤4.5 dB ≥ 14 dB 0.4 dB

Outdoor Redundancy Switch Box 1:1

Signal Input or Output Transfer Switch RSB1-50KT-xx, RSB1-xx-50K (without internal cabling):	Connector Type:	4 x SMA female
	Impedance:	50 Ω
	Power Handling:	1 W (switching)
	Frequency Range:	0 … 18 GHz
	Insertion Loss (max.):	0.2 dB (0 … 1 GHz)
		0.3 dB (1 … 4 GHz)
		0.3 dB (4 … 8 GHz)
		0.4 dB (8 … 12 GHz)
		0.6 dB (12 … 18 GHz)
	Isolation (min.):	85 dB (0 … 1 GHz)
		80 dB (1 … 4 GHz)
		70 dB (4 … 8 GHz)
		65 dB (8 … 12 GHz)
		60 dB (12 … 18 GHz)
	Return Loss (min.):	26 dB (0 … 1 GHz)
		20 dB (1 … 4 GHz)
		17 dB (4 … 8 GHz)
		15 dB (8 … 12 GHz)
		14 dB (12 … 18 GHz)
Signal Input or Output Transfer Switch RSB1-50KaT-xx, RSB1-xx-50Ka26, RSB1-xx-50Ka40:	Connector Type:	4 x K female (2.9 mm, SMK)
	Impedance:	50 Ω
	Power Handling:	1 W (switching)
	Frequency Range:	0 … 40 GHz
	Insertion Loss (max.)	0.3 dB (0 … 6 GHz)
		0.4 dB (6 … 12.4 GHz)
		0.5 dB (12.4 … 18 GHz)
		0.7 dB (18 … 26.5 GHz)
		0.8 dB (26.5 … 40 GHz)
	Isolation (min.)	70 dB (0 … 6 GHz)
		60 dB (6 … 12.4 GHz)
		60 dB (12.4 … 18 GHz)
		55 dB (18 … 26.5 GHz)
		50 dB (26.5 … 40 GHz)
	Return Loss (min.):	17 dB (0 … 6 GHz)
		15 dB (6 … 12.4 GHz)
		14 dB (12.4 … 18 GHz)
		11 dB (18 … 26.5 GHz)
		10 dB (26.5 … 40 GHz)
Signal Input or Output Transfer Switch Additional Attenuation by internal cabling:	Attenuation (max.)	1.6 dB (0.5 GHz)
		1.7 dB (1 GHz)
		2.8 dB (10 GHz)
		3.4 dB (18 GHz)
		3.9 dB (27 GHz)
Switching:	Controlled by RSCM1-OD	
Control Interface to Indoor Control Unit RSCM1-OD:	Alarms, control signals, internal M&C (RS485) (Connector Type: MIL-C-26482: MS 3120 E 16-26 S)	
Interface to Converter Units:	2 Alarm Interfaces to sense contact closures at alarm outputs of converter units, internal M&C (RS485) (Connector Type: MIL-C-26482: MS 3120 E 14-19 P)	
Temperature Range:	-30 °C … 60 °C operating -30 °C … 80 °C storage	
Relative Humidity:	< 100 %	
Dimension and Weight:	190 x 100 x 190 mm³ (WxHxD) approx. 2 kg	
Degree of Protection:	IP 67 (acc. IEC 529)	

Specifications are subject to change

Order Information:

RSB1-[Input Splitter or Switch Type]-[Output Switch Type]

Example:

RSB1-50L-50Ka 50 Ω Input Splitter L band, 50 Ω Output Transfer Switch 40 GHz

Redundancy Switch 1:1 for IP Modems RSCI1

This version of WORK Microwave's 1:1 redundancy switch is specifically designed for IP modems and IP demodulators. In addition to this version, a standard 1:1 redundancy switch RSCM1 is available, which can be used for modulators, demodulators, and modems with ASI transport stream inputs and outputs.

For Gigabit Ethernet traffic interfaces, the 1:1 redundancy switch RSCI1 includes a special type of form C (SPDT) Ethernet switch compatible with RJ45 interfaces to allow switchover from one IP modem or IP demodulator to the redundant one. This operates together with MAC address announcing methods, initiated automatically by the Gigabit Ethernet traffic interfaces. The IP modulator that detects a port is active (after switchover) sends a broadcast message to signal that the MAC address has changed. Equipment receiving this message, typically the next router, needs to react to this message and update its ARP resolution table. The details of this are defined in IPv4, an extension to RFC 826, called Gratuitous ARP. For IPv6, it is defined by RFC 4861, clause 7.2.6 and is called Unsolicited Neighbor Advertisement. The downtime after switchover is approximately less than 5 seconds, typically only 2 to 3 seconds and depends mainly on the Ethernet auto negotiation time.

IP modems and demodulators need to be configured in the same way and have different MAC addresses, but the same IP address.

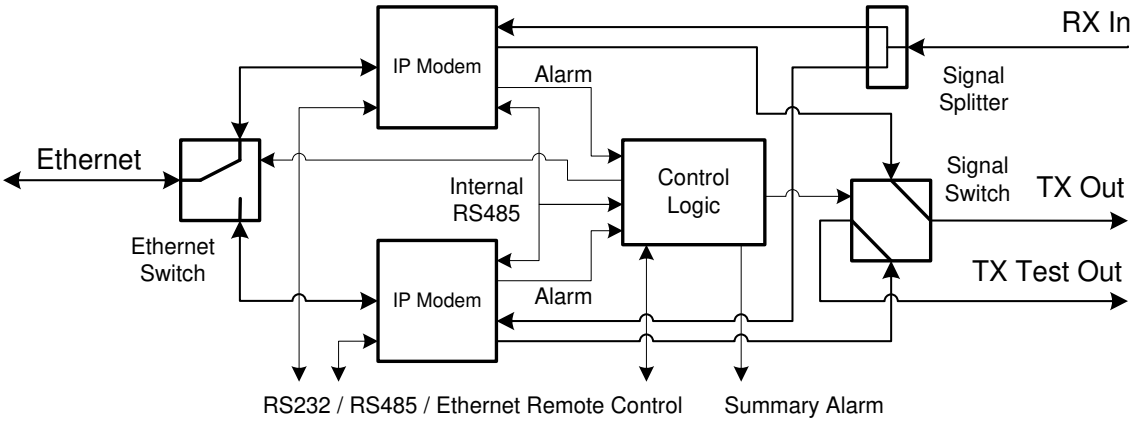
For the RF transmit signal, a transfer relay is included. For the RF receive signal, a transfer relay or signal splitter is available, which can be mounted externally to the unit. For L-band receive signals, a special signal splitter with an integrated switch is available, which allows operators to always provide DC and a 22 kHz tone signal from the active unit to the LNB.

The 1:1 redundancy switch accepts alarm signals from the two IP devices. The unit can operate in automatic mode, whereby an automatic switchover to the standby unit is performed upon detection of an alarm generated by the active unit.

For configurations including a splitter on the receive signal side, where both IP devices can receive the RF signal, monitoring of the receive conditions of both units is implemented.

In addition, a manual switchover to the standby unit can be initiated.

The units can be controlled from the front panel or remotely via RS232, RS422/485, or Ethernet. Two power supplies and two AC input connectors guarantee high availability of the unit.



Redundancy Switch 1:1 for IP Modems
RSCI1

Model	Item	
RSCI1-0-xx:	**-**	no internal signal splitter or switch is included
RSCI1-50K-xx **or** **RSCI1-50K:**	**Internal Signal Transfer Switch**	Connector Type: 4 x SMA female Impedance: 50 Ω Power Handling: 1 W (switching) Frequency Range: 0 … 18 GHz Insertion Loss (max.): 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 4 GHz) 0.3 dB (4 … 8 GHz) 0.4 dB (8 … 12 GHz) 0.6 dB (12 … 18 GHz) Isolation (min.): 85 dB (0 … 1 GHz) 80 dB (1 … 4 GHz) 70 dB (4 … 8 GHz) 65 dB (8 … 12 GHz) 60 dB (12 … 18 GHz) Return Loss (min.): 26 dB (0 … 1 GHz) 20 dB (1 … 4 GHz) 17 dB (4 … 8 GHz) 15 dB (8 … 12 GHz) 14 dB (12 … 18 GHz)
RSCI1-xx:	**-**	no external signal splitter or switch is included
RSCI1-xx-75LD:	**External Signal Splitter** **(including diodes for DC)**	Connector Type: 3 x F female Impedance: 75 Ω Power Handling: 100 mW Frequency Range: 500 … 2400 MHz Total Insertion Loss: ≤ 6.2 dB Return Loss: > 15 dB DC Path: max 30 V, 1 A, diode decoupling
RSCI1-xx-75LR:	**External Signal Splitter** **(including DC relay switch)**	Connector Type: 3 x F female Impedance: 75 Ω Power Handling: 100 mW Frequency Range: 500 … 2400 MHz Total Insertion Loss: ≤ 6.2 dB Return Loss: > 15 dB DC Path: max 30 V, 500 mA Form C (SPDT) relay
RSCI1-xx-50V:	**External Signal Splitter**	Connector Type: 3 x BNC female Impedance: 50 Ω Power Handling: 1 W Frequency Range: 5 … 300 MHz Total Insertion Loss: ≤ 4.0 dB Return Loss: > 15 dB Amplitude Balance: 0.4 dB
RSCI1-xx-75V:	**External Signal Splitter**	Connector Type: 3 x BNC female Impedance: 75 Ω Power Handling: 1 W Frequency Range: 5 … 300 MHz Total Insertion Loss: ≤ 4.0 dB Return Loss: > 15 dB Amplitude Balance: 0.4 dB
RSCI1-xx-50KT:	**External Signal Transfer Switch**	Connector Type: 4 x SMA female Impedance: 50 Ω Power Handling: 1 W (switching) Frequency Range: 0 … 18 GHz Insertion Loss (max.): 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 4 GHz) 0.3 dB (4 … 8 GHz) 0.4 dB (8 … 12 GHz) 0.6 dB (12 … 18 GHz) Isolation (min.): 85 dB (0 … 1 GHz) 80 dB (1 … 4 GHz) 70 dB (4 … 8 GHz) 65 dB (8 … 12 GHz) 60 dB (12 … 18 GHz) Return Loss (min.): 26 dB (0 … 1 GHz) 20 dB (1 … 4 GHz) 17 dB (4 … 8 GHz) 15 dB (8 … 12 GHz) 14 dB (12 … 18 GHz)

Specifications continued next page

Redundancy Switch 1:1 for IP Modems
RSCI1

Ethernet Hardware Switch:	Connector: Type:	3 x RJ45 10/100/1000 Mbps
	MAC Address announcing scheme, initiated by IP traffic ports of IP devices after switchover:	IPv4: according to extension of RFC 826, Gratuitous ARP IPv6: according to RFC 4861, clause 7.2.6, Unsolicited Neighbor Advertisement
Switching:	Manual or Automatic	
Delay from unit alarm occurrence until IF/RF relay switching:	Typical 8 ms, max. 20 ms	
Remote M&C Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10/100 Mbps, auto sensing), IPv4, connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10/100 Mbps, auto sensing), IPv4, connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10/100 Mbps, auto sensing), IPv4, connector RJ-45
Summary Alarm Interface:	Two potential free contacts (DPDT, Connector DSUB09 female)	
Internal M&C Interface:	RS485 (Connector DSUB09 male)	
Configuration:	16 DIP switches on rear side / serial interface	
Temperature Range:	-30 °C … 60 °C operating -30 °C … 80 °C storage	
Relative Humidity:	< 95 % non condensing	
User Interface:	10 LEDs, 4 Function Keys	
Mains Power Input:	2 x 100 … 240 V AC nominal, 90 … 264 V AC max, 50 … 60 Hz, Redundant Power Supply, Hot swap	
Mains Power Consumption:	Max: 16 VA / 8 W Typ.: 10 VA / 5 W	
Mains Power Input Connector:	2 x IEC C14	
Mains Fuse:	2 x 2 x 2.0 A time-lag fuse	
Dimension and Weight:	483 x 44 x 270 mm³ or with option L 483 x 44 x 470 mm^3 (WxHxD), 1 RU (19") approx. 3 kg	

Specifications are subject to change

Order Information:

RSCI1-[internal RF Switch Type] -[external RF Splitter or Switch Type]-[Options]

Possible Options are:

L housing depth 470 mm

Examples:

RSCI1-50K-75LD External Signal Splitter with diodes
RSCI1-50K-75LR External Signal Splitter with DC relay switch
RSCI1-50K-50KT External Signal Transfer Switch 18 GHz

Compact Redundancy Switch 2:1
RSCC-2

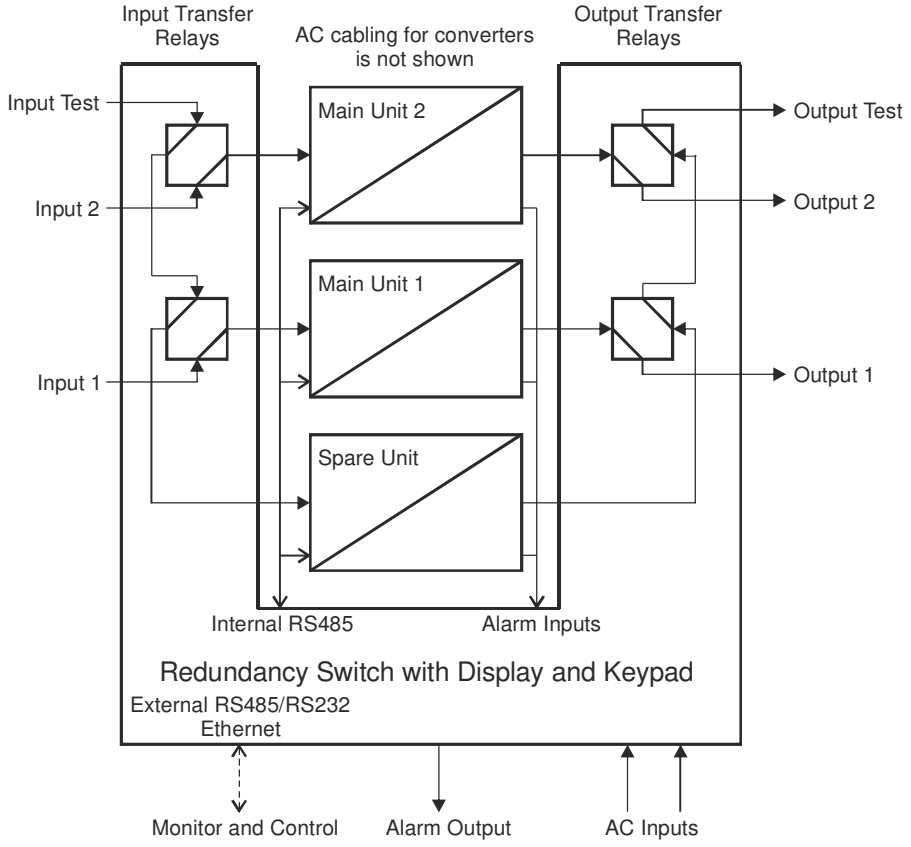
The WORK Microwave Redundancy Switch RSCC-2 is a compact solution for a 2:1 redundancy system. It can be used for Upconverters and Downconverters. The system includes four coaxial transfer switches, which are integrated into the housing.

The system can be configured from the front panel or remotely via RS232, RS422/485, or TCP/IP over Ethernet.

The switching system can be set in automatic mode, whereby an automatic switchover to the spare unit is performed upon detection of an alarm generated by the main unit. In addition, a manual switchover to the spare unit and back can be initiated.

Two power supplies and two AC input connectors within the unit guarantee high availability.

The Redundancy Switch RSCC-2 is also available with integrated uplink power control (Option UPC). For functional details see separate datasheet for Remote Control Unit / Satellite Uplink Power Control Unit.



2:1 Redundancy Switch System with RSCC-2

Compact Redundancy Switch 8:1
RSCC-8
with Switch Matrix ISM-8

The WORK Microwave Redundancy Switch RSCC-8 is a compact solution for an 8:1 redundancy system. It can be used for Upconverters and Downconverters. The system consists of the controller and an indoor switch matrix integrated in separate 19” 1 RU housing.

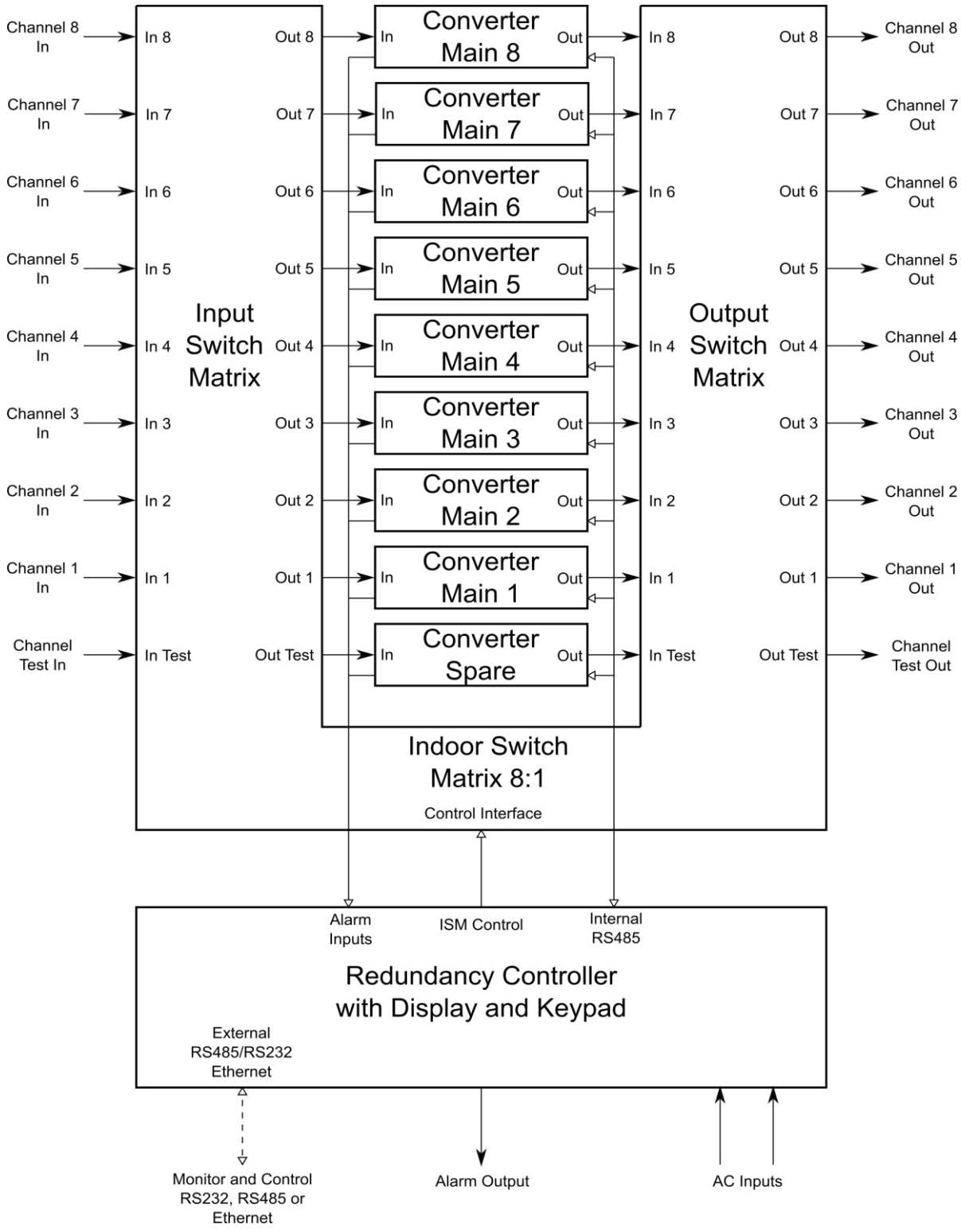
The system can be configured from the front panel or remotely via RS232, RS422/485, or TCP/IP over Ethernet.

The switching system can be set in automatic mode, whereby an automatic switchover to the spare unit is performed upon detection of an alarm generated by the main unit. In addition, a manual switchover to the spare unit and back can be initiated.

Two power supplies and two AC input connectors within the unit guarantee high availability.

The Redundancy Switch RSCC-8 is also available with integrated uplink power control (Option UPC). For functional details see separate datasheet for Remote Control Unit / Satellite Uplink Power Control Unit.

Compact Redundancy Switch 8:1 RSCC-8 with Switch Matrix ISM-8



Modular Redundancy Switch N:1 RSCM

The WORK Microwave Redundancy Switch System N:1 can be configured for redundancy configurations with a maximum of eight main units and one spare unit. The redundancy system can be used for Upconverters and Downconverters.

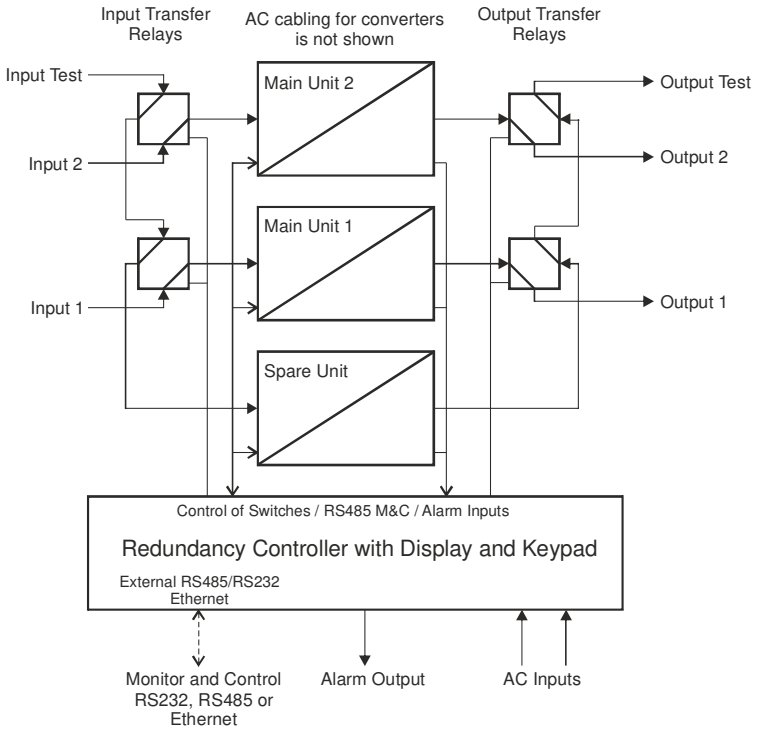
The core of the solution is based on a highly flexible control unit. The required coaxial transfer switches, waveguide transfer switches, and signal splitters are mounted on separate panels or within an outdoor housing. When used in a rack mount installation, redundant switching panels can be added to the system in a modular way if the number of required channels increases over time.

The system can be configured from the front panel of the controller or remotely via RS232, RS422/485, or TCP/IP over Ethernet.

The switching system can be set in automatic mode, whereby an automatic switchover to the spare unit is performed upon detection of an alarm generated by the main unit. In addition, a manual switchover to the spare unit and back can be initiated.

Two power supplies and two AC input connectors within the controller unit guarantee high availability.

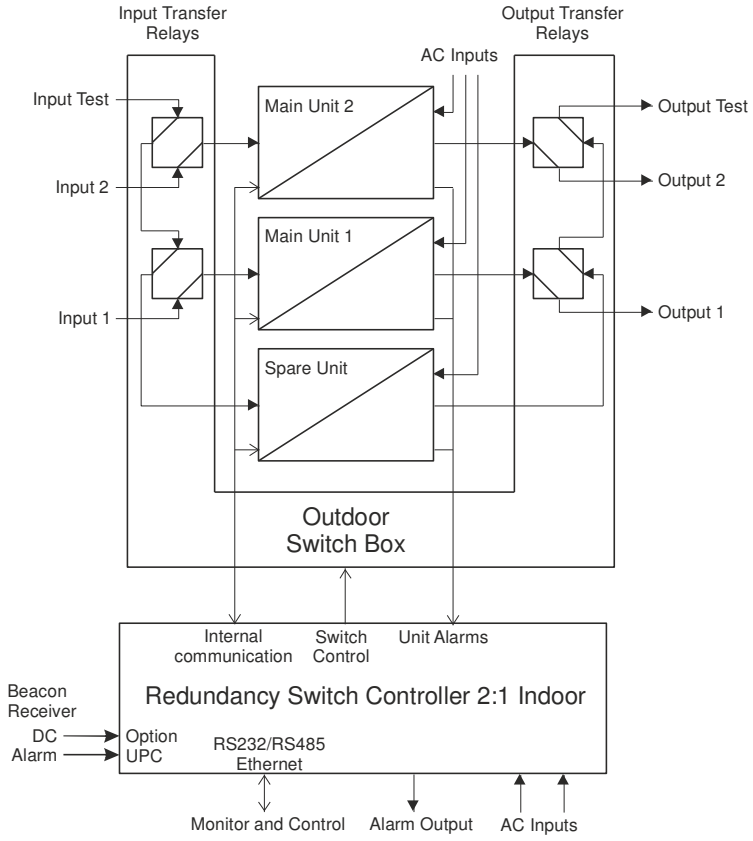
The Redundancy Switch System is also available with integrated uplink power control (Option UPC). For functional details see separate datasheet for Remote Control Unit / Satellite Uplink Power Control Unit.



2:1 Modular Redundancy Switch System with RSCM-2

Outdoor Redundancy Switch 2:1
RSCM-2-OD

This picture shows an Outdoor Switch Box of a 2:1 redundant switching system. The Switch Box is connected to the control unit, which is installed indoors. The Outdoor Switch Box includes alarm and status indication via LEDs, manual switchover and easy access to the serial control interfaces of the converter units. The picture below shows a typical 2:1 configuration with converters, built as an outdoor solution.



2:1 Redundancy Switch System with Outdoor Switch Unit

Redundancy Switch System N:1

Remote M&C Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
User Interface:	LCD (VFD as option), 2 x 40 characters, 4 cursor keys, 2 function keys, Status LED's	
Alarm Interface:	Two potential free contacts (DPDT, connector DSUB09 female)	
Insertion loss compensation:	For each channel attenuation and equalization offsets can be set to compensate for influences of cable and relay differences in case of a replacement.	
Delay from unit alarm occurrence until IF/RF relay switching:	Typical 270 ms, max. 400 ms (depending on connected spare unit)	
Uplink Power Control Algorithm: (only with Option UPC)	Configurable parameters	• Uplink power control on/off • Maximum gain increase in reference to clear sky gain • Sampling and update period in 0.1 seconds • Ratio between decrease of beacon signal and increase of transmission signal • Clear sky value of DC beacon receiver signal • Sustain period in seconds (up 3600 s) for which the uplink power control keeps the last gain increase value (in case of deep fade conditions where the beacon receiver can lose lock for some period of time)
	Monitors for	• DC signal from beacon receiver • Calculated attenuation of beacon signal • Current gain increase of transmission signal
Beacon Receiver Interface: (only with Option UPC)	connector DSUB9 male (on Y-cable connected to spare unit interface), inputs for Beacon receiver voltage 0 … 12 V and Beacon receiver alarm relay	
Maximum number of switches per each switch panel:	4 (Indoor switch panel)	
Signal Transfer Switches: (Input and/or Output) **RSCC-2-50K-xx** **RSCM-n-50K-xx** **RSCC-2-xx-50K** **RSCM-n-xx-50K**	Connector Type: Impedance: Power Handling: Frequency Range: Insertion Loss (max.): Isolation (min.): Return Loss (min.): (waveguide switches and other transfer switches on request)	4 x SMA female (Indoor switch panel) (N female on IF interfaces, SMA female on RF interfaces of outdoor switch unit) 50 Ω 1 W (switching) 0 … 18 GHz 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 4 GHz) 0.3 dB (4 … 8 GHz) 0.4 dB (8 … 12 GHz) 0.6 dB (12 … 18 GHz) 85 dB (0 … 1 GHz) 80 dB (1 … 4 GHz) 70 dB (4 … 8 GHz) 65 dB (8 … 12 GHz) 60 dB (12 … 18 GHz) 26 dB (0 … 1 GHz) 20 dB (1 … 4 GHz) 17 dB (4 … 8 GHz) 15 dB (8 … 12 GHz) 14 dB (12 … 18 GHz)
Signal Transfer Switches: (Input and/or Output) **RSCC-2-75L-xx** **RSCM-n-75L-xx** **RSCC-2-xx-75L** **RSCM-n-xx-75L**	Connector Type: Impedance: Power Handling: Frequency Range: Insertion Loss (max.): Isolation (min.): Return Loss (min.): 	4 x 1.6/5.6 female (Indoor switch panel) (Adapters to external BNC female connectors are provided) 75 Ω 1 W (switching) 0 … 2.5 GHz 0.2 dB (0 … 1 GHz) 0.3 dB (1 … 2.5 GHz) 80 dB (0 … 1 GHz) 70 dB (1 … 2.5 GHz) 20 dB (0 … 1 GHz) 18 dB (1 … 2.5 GHz)
Temperature Range:	-30 °C … 60 °C operating -25 °C … 60 °C operating (for RSCM-n-75L…) (the LCD display is operational: -20 °C … 60 °C) -30 °C … 80 °C storage	
Relative Humidity:	<95% non condensing	
Mains Power Input:	2 x 100 … 240 V AC nominal, 90…264 V AC max, 50…60 Hz, Redundant Power Supply, Hot swap	
Mains Power Consumption:	Max: 16 VA / 8 W Typ: 10 VA / 5 W	
Mains Power Input Connector:	2 x IEC C14	
Mains Fuse:	2 x 2 x 2.0 A time-lag fuse	
Dimension and Weight of Redundancy Controller:	483 x 44 x 270 mm³ or with option L 483 x 44 x 470 mm^3 (WxHxD), 1 RU (19") approx. 4 kg (with option L approx. 5.5 kg)	
Dimension and Weight of Outdoor Switch Box:	300 x 150 x 400 mm³ (WxHxD) approx. 7 kg	

Specifications are subject to change

Outdoor Switch Box RSP-2-50K-50K-OD, RSP-2-50K-50Ka-OD, RSP-2-50Ka-50K-OD							
Interface to Indoor Controller:	Connector MIL-C-26482: MS 3120 E 16-26 S, unit alarms, RS485 communication interface to units, IF/RF-relay-control, 24V supply						
Interface to Outdoor Converters:	3 connectors MIL-C-26482: MS 3120 E 14-19 P, unit alarm, RS485 communication interface, 24V supply						
IF Connectors:	Impedance: 50 Ω Connectors: N female						
RF Connectors:	Impedance: 50 Ω Connectors: SMA female (standard) K female (2.92 mm) (-Ka40)						
IF/RF Relays 0 … 18 GHz (K), RF Relays 0 … 26.5 GHz (Ka26) (without cabling):	Power handling max.: 1 W (switching)						
	Frequency (GHz):	0 … 1	1 … 4	4 … 8	8 … 12.4	12.4 … 18	18 … 26.5
	V.S.W.R. (max.):	1.1	1.15	1.25	1.35	1.5	1.7
	Insertion loss (dB max.):	0.2	0.2	0.3	0.4	0.5	0.8
	Isolation (dB min.):	85	80	70	65	60	55
RF Relays 0 … 40 GHz (Ka40) (without cabling):	Power handling max.: 1 W (switching)						
	Frequency (GHz):	0 … 6	6 … 12.4	12.4 … 18	18 … 26.5	26.5 … 40	
	V.S.W.R. (max.):	1.3	1.4	1.5	1.7	1.9	
	Insertion loss (dB max.):	0.3	0.4	0.5	0.7	0.8	
	Isolation (dB min.):	70	60	60	55	50	
Insertion Loss Compensation:	For each channel attenuation and equalization offsets can be set on the controller to compensate for influences of cable and relay differences in case of a replacement.						
Local Control Possibilities:	Only with disconnected indoor controller: - RS232 M&C interface to converter units with RS232 to RS485 converter - IF- and RF-relay switching to replace main unit 1, main unit 2 or none						
Temperature Range:	-30°C … 60°C operating						
Relative Humidity:	< 100 %						
Dimension and Weight:	300 x 150 x 400 mm³ (WxHxD) approx. 7 kg						

Specifications are subject to change

Indoor Switch Matrix ISM-8				
Interface to Indoor Controller:	connector DSUB15 male			
IF Connectors:	Impedance: 75 Ω Connector: BNC female			
RF Connectors:	Impedance: 50 Ω Connector: SMA female			
Monitor Connectors IF and RF:	Impedance: 50 Ω Connector: BNC female			
IF Switches 40 … 240 MHz:	Power handling max.: 15 dBm			
	Path:	normal	replaced	
	Insertion loss (dB typ.):	2.0	2.4	
	Isolation (dB typ.):	80	90	
	Return Loss on Inputs (dB typ.):	19.1	21.9	
	Return Loss on Outputs (dB typ.):	17.8	16.5	
RF Switches 1.8 … 2.2 GHz:	Power handling max.: 15 dBm			
	Path:	normal	replaced	
	Insertion loss (dB typ.):	2.7	3.3	
	Isolation (dB typ.):	68	75	
	Input Return Loss (dB typ.):	11.0	14.9	
	Output Return Loss (dB typ.):	14.9	17.0	
Insertion Loss Compensation:	For each channel attenuation and equalization offsets can be set on the controller to compensate for influences of cable and relay differences in case of a replacement.			
Temperature Range:	-30°C … 60°C operating - 30°C … 80°C storage			
Relative Humidity:	< 95 % non condensing			
Dimension and Weight:	483 x 44 x 470 mm³ (WxHxD), 1 RU (19") approx. 5 kg			

Specifications are subject to change

Redundancy Switch System N:1

Order Information:

RSCC-2-[Input Switch Type]-[Output Switch Type]-[Options]
Compact Redundancy Switch

RSCC-[Number of signal channels]-[Input Switch Type]-[Output Switch Type]-[Options]
Compact Redundancy Switch with Indoor Switch Matrix

RSCM-[Number of signal channels]-[Input Switch Type]-[Output Switch Type]-[Options]
Modular Redundancy System

Possible Options are:

OD	with outdoor switch unit, available only for two channels on RSCM
UPC	Uplink Power control included
VFD	VF Display
L	Controller housing depth 470 mm

Examples:

RSCC-2-50K-50K-L	Compact Switch with 50 Ω 18 GHz Input and Output Transfer Switches, housing depth 470 mm
RSCM-2-50K50K-50K	Modular 2:1 System with two 50 Ω 18 GHz Input Transfer Switches and one 50 Ω 18 GHz Output Transfer Switch per channel for converters with two inputs
RSCM-2-50K-50K-OD	2:1 Outdoor system with 50 Ω 18 GHz Input and Output Transfer Switches
RSCC-8-75VHF-50L-VFD	Compact 8:1 Switch with VF Display and 75 Ω input switch matrix for VHF band and 50 Ω output switch matrix for L band

Remote Control Unit
Satellite Uplink Power Control Unit

WORK Microwave's remote control unit is perfect for use with outdoor converter units. Via the front panel, operators can manually control the configuration of an outdoor converter similar way to what is possible for indoor converter units.

Versions that enable the operator to control more than one converter from the same unit are available (Options Dual and Multi).

Remote control of the complete setup via RS232, RS485, or IP over Ethernet is possible utilizing this control unit. In addition, alarm relay outputs are provided. For connection to the outdoor unit or to the remote controlled unit in general, an RS485 connection is used.

Uplink power control

Uplink power control is a hardware and software option for the Remote Control Unit.

This feature senses a DC signal from a beacon receiver. If due to additional atmospheric attenuation caused by rain, snow, clouds, fog, or an antenna misalignment the beacon signal is attenuated, the transmitted signal is increased proportionally until a configurable maximum additional gain is reached or the maximum gain of the Upconverter is reached.

The uplink power control uses a DC signal from a beacon receiver and also provides an input for a lock signal or alarm signal from a beacon receiver.

The following parameters can be configured:

- Uplink power control on/off
- Maximum gain increase in reference to clear sky gain
- Sampling and update period in seconds
- Ratio between decrease of beacon signal and increase of transmission signal (due to difference of rain attenuation effect for different frequencies)
- Clear sky value of DC beacon receiver signal
- Sustain period in seconds (up to 3600 seconds) for which the uplink power control keeps the last gain increase value (in case of deep fade conditions where the beacon receiver can lose lock for some period of time).

The following specifications can be monitored:

- DC signal from beacon receiver
- Calculated attenuation of beacon signal
- Current gain increase of transmission signal

As LNAs or LNBs may show gain variation over temperature, which would mislead the uplink power control algorithm, there is an optional input for a temperature sensor. A temperature sensor can be mounted close to these LNAs or LNBs. The characteristic for the temperature compensation can be configured (only on Standard Remote Controller).

Remote Control Unit
Satellite Uplink Power Control Unit

Model	RC-CO Remote Control for Outdoor Units
Monitoring and Control Interface:	RS232 or RS422/RS485 (Connectors DSUB09 female) (selectable by customer), IP over Ethernet
Internal Monitor and Control Interface to controlled unit(s):	Standard: RS422/RS485 Alarm Signal DC Supply from ODU 12…24 V Connector: DSUB25 male Option PS: RS422/RS485 Alarm Signal DC Supply to ODU 24 V Connector: DSUB25 female Option Dual/Multi: RS422/RS485 Connector: DSUB09 male
Beacon Receiver Interface: (Option UPC or UPC/TS)	Differential DC Input: Voltage Range for DC-In+ and DC-In-: -12 … +12 V related to GND DC-In+ - DC-In-: max. 12 V DC-In+ ≥ DC-In- Input Impedance: approx 10 kΩ Beacon Receiver Alarm Input: TTL Input, Pull-Up to 5 V with 1 kΩ, suitable for external relay closure to GND Connector: DSUB09 male
Temperature Sensor Interface: (Option UPC/TS)	Output Current: 1 mA, DC Voltage Sensing Suitable for Temperature Sensor: KTY19-6M (2 kΩ @ 25 °C) Connector: DSUB09 female
Temperature Range:	-30 °C … 60 °C operating (the LCD display is operational: -20 °C … 60 °C) -30 °C … 80 °C storage
Relative Humidity:	< 95% non condensing
User Interface:	LCD, 2 x 40 characters, 4 cursor keys, 2 function keys, Status LEDs
Mains Power Input:	Option PS, Dual, Multi: 100 … 240 V AC nominal, 90 … 264 V AC max 50 … 60 Hz Option PS can supply DC power from remote control to converter unit
Mains Power Consumption:	Option PS, Dual, Multi: Typ: 10 VA / 6 W, Max: 55 W
Mains Power Input Connector:	IEC C14
Mains Fuse:	2.0 A time-lag fuse
Dimension and Weight:	483 x 44 x 270 mm³ (WxHxD), 1 RU (19") approx. 4 kg

Specifications are subject to change

Order Information:

RC-CO-[Options]

Possible Options are:		**Cannot be combined with:**
UPC	Uplink power control	T
UPC/TS	Uplink power control with temperature sensor	DUAL, MULTI, T
PS	Power supply on RC-CO	DUAL, MULTI
DUAL	Remote Control for two frequency converters	UPC/TS, PS
MULTI	Remote Control for up to 8 frequency converters	UPC/TS, PS
T	Remote Control for dual channel tracking converters	UPC, UPC/TS

Examples:

RC-CO
RC-CO-UPC
RC-CO-PS
RC-CO-Dual

Automatic Level Control (ALC) Filter Amplifier

WORK Microwave now offers ALC filter amplifiers as a stand-alone unit or as an application-specific option within its downconverters. The picture above shows the stand-alone unit.

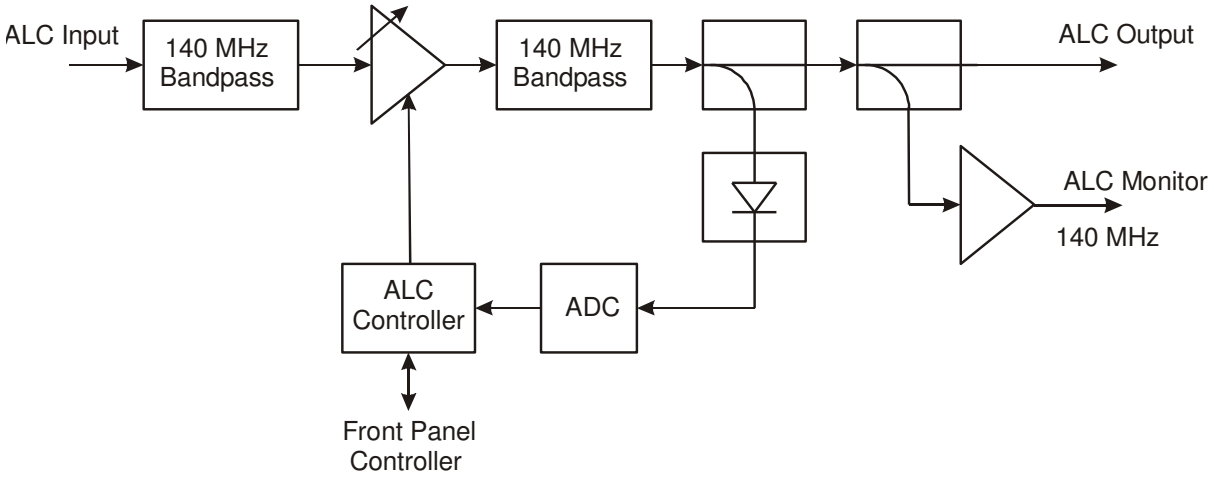
The input of this unit can be connected to the IF output of the downconverter.

The picture below shows a block diagram of the application-specific ALC filter amplifier. The signal is bandpass filtered on the input as well as on the output. Both bandpass filters are identical.

The pictures on the next page show typical amplitude frequency responses of such filters. The overall filter characteristic of the complete unit results from a series connection of the two identical filters, doubling all attenuation values in dB, which means that e.g. a stop-band suppression of 50 dB for one filter results in a overall stop-band suppression for the complete unit of about 100 dB (for the same frequency point).

In between these filters a variable gain stage allows adjustment of the signal level. A small portion of the output signal level is coupled to an RMS detector.

A digitally implemented control algorithm using a microprocessor allows operators to select a specified output level and keeps the output level constant, even if the input signal varies within the allowed level range. The operational parameters of the ALC amplifier can be configured from the front panel processor as well as remotely. Monitoring of the ALC amplifier is also possible from the front panel processor as well as remotely. Besides the main ALC output, an ALC monitor output is available on the rear panel.



Automatic Level Control (ALC)
Filter Amplifier

IF Input:	Center Frequency:	140 MHz
	Frequency Range:	80 … 200 MHz
	Signal Level:	-50 … -20 dBm
	Return Loss:	> 18 dB (within filter passband bandwidth)
	Connector:	SMA female
	Impedance:	50 Ω
IF Output:	Center Frequency:	140 MHz
	Bandwidth:	34 MHz or 41 MHz or 54 MHz or 75 MHz or 110 MHz
	Signal Level:	-5 dBm …10 dBm (adjustable, 0.1 dB step size)
	Return Loss:	> 18 dB (within filter passband bandwidth)
	Connector:	SMA female
	Impedance:	50 Ω
IF Monitor Output:	Signal similar to IF Output	
	Signal Level:	20 dB lower than IF Output
	Return Loss:	> 20 dB
	Connector:	SMA female
	Impedance:	50 Ω
Transfer Characteristics:	Gain:	15 … 60 dB (automatically or manual adjustable, 0.1 dB step size)
	Group delay:	< 0.5 ns / 25 kHz within 54 MHz bandwidth
	Bandwidth:	54 MHz (3 dB)
	Frequency Range:	113 … 167 MHz (3 dB)
Interrmodulation (3rd Order):	< -55 dBc, (Pout: 2 x +4 dBm)	
ALC Control:	Fast attack for required gain adjustment > configurable value (0.1 … 5 dB) with configurable time constant up to 1000 s. Gradual adjustment for required gain adjustment < configurable value (0.1 … 5 dB) with configurable time constant up to 1000 s Control cycle approx. 100 ms. No interruption of the signal during adjustment.	
Monitoring and Control Interfaces:	Ethernet/IP (10 or 100 Mbps, auto sensing) RS232 or RS422/RS485 (Connectors DSUB09 female) (configurable)	
Alarm Interface:	Two potential free contacts (DPDT, Connector DSUB09 female)	
Temperature Range:	-25 °C … 60 °C operating the LCD display is operational: -20 °C … 60 °C -30 °C … 80 °C storage	
Relative Humidity:	< 95 % non condensing	
User Interface:	LCD, 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:	Max: 16 VA / 8 W Typ.: 12 VA / 5 W	
Mains Power Input Connector:	IEC C14	
Mains Fuse:	2.0 A time-lag fuse	
Dimension and Weight:	483 x 44 x 270 mm³ (WxHxD), 1 RU (19") approx. 3 kg	

Specifications are subject to change

Order Information: **ALC-[IF Frequency in MHz]-[Filter BW in MHz]**

Examples:

ALC-140-34
ALC-140-41
ALC-140-54
ALC-140-75
ALC-140-110

Handheld Satcom Test Source

The Handheld Test Source is an easy to use all-in-one test instrument that eliminates the need for several independent test sources. It is the ideal solution for the following applications:

- Signal source for measurement of different parameters of satellite upconverters, including intermodulation, 1 dB compression point, and conversion gain
- Ordinary low phase noise dual carrier signal generator
- Combined source for block upconverters (L-band, 10 MHz and 24 V DC)

Key Features

- Single and two tone output
- 50 MHz to 180 MHz and 950 MHz to 2150 MHz output frequency
- Step size 0.5 MHz
- -45 dBm to -5 dBm output power / 0.5 dB step size
- Both synthesizers independently adjustable in frequency and power
- Low system intermodulation
- 10 MHz reference output with adjustable power
- Remote control via USB using PC software (GUI) supplied together with the device
- Power supply options: internal battery, USB or external SMPS

Product Design

The Test Source consists of a single main module, which contains the RF section, the reference section and the power supply. The internal lithium ion battery is directly connected to the main module.

RF and reference section

The main parts of the RF section are the two low spurious PLL synthesizers. The synthesizers use a high stable internal reference of 10 MHz to generate a frequency from 50 MHz to 180 MHz and from 950 MHz to 2150 MHz with a step size of 0.5 MHz. Each signal is filtered by a frequency depended low pass filter before it is amplified and attenuated by a high dynamic attenuator to reach the desired output level in the range of -45 dBm to -5 dBm (step size: 0.5 dB).

To create a two tone signal at the RF output, the two single tone signals are combined by a wideband power combiner. The output signal can be muted as well as each synthesizer. In addition to a two tone signal, a 10 MHz reference, adjustable in power (-10 dBm to 10 dBm, 0.5 dB steps) and a 24 V DC signal can be switched to the RF out port.

Open questions, demo units

If you need more information about the Handheld Satcom Test from WORK Microwave or if you would like to have demo unit, please contact us via e-mail: sales@work-microwave.com or call us on +49 8024 6408 0. We are glad to assist you.

Handheld Satcom Test Source

Frequency Range:	50 MHz to 180 MHz and 950 MHz to 2150 MHz			
Frequency Resolution:	0.5 MHz			
Output level:	-45 dBm to -5 dBm			
Output level resolution:	0.5 dB			
Level tolerance:	±1 dB			
Output impedance:	50 Ohm			
Output mute:	< -60 dBc			
Phase Noise:	**50 MHz**	**180 MHz**	**950 MHz**	**2150 MHz**
100 Hz	< -103 dBc/Hz	< -93 dBc/Hz	< -80 dBc/Hz	< -73 dBc/Hz
1 kHz	< -110 dBc/Hz	< -100 dBc/Hz	< -87 dBc/Hz	< -80 dBc/Hz
10 kHz	< -113 dBc/Hz	< -103 dBc/Hz	< -90 dBc/Hz	< -83 dBc/Hz
100 kHz	< -130 dBc/Hz	< -120 dBc/Hz	< -107 dBc/Hz	< -100 dBc/Hz
1 MHz	< -137 dBc/Hz	< -135 dBc/Hz	< -135 dBc/Hz	< -128 dBc/Hz
Spurious (single tone):	**50 MHz to 180 MHz**		**950 MHz to 2150 MHz**	
< 1 MHz offset	< -75 dBc		< -70 dBc	
elsewhere	<- 75 dBc		< -70 dBc	
Harmonics (single tone):	< -30 dBc			
System Intermodulation:	**50 MHz**	**180 MHz**	**950 MHz**	**2150 MHz**
Pout < -5 dBm	< -65 dBc	< -65 dBc	< -65 dBc	< -65 dBc
Pout < -18 dBm	< -80 dBc	< -80 dBc	< -80 dBc	< -70 dBc
Pout < -25 dBm	< -90 dBc	< -90 dBc	< -80 dBc	< -70 dBc
Reference Output:	10 MHz, -10 dBm to +10 dBm, 0.5 dB steps			
Reference Frequency stability:	± 1 x 10^{-7}, 0 °C to 50 °C ± 2 x 10^{-9} per day			
Temperature range:				
charging battery	0 °C to +40 °C			
operating	0 °C to +50 °C			
storage	-20 °C to 50 °C			
Interface:	USB 2.0			
Power supply:	ext. 24 V DC SMPS, USB, internal Li-Poly-Battery			
Power consumption:				
charging battery	max. 12 W			
else	max. 6 W			
Connectors:				
RF out:	50 Ohm SMA female			
REF out:	50 Ohm BNC female			
USB 2.0	USB Standard type B			
Weight:	approx. 1.5 kg			
Dimensions (L x W x H):	250 x 125 x 74 mm			

Specifications are subject to change

Order Information: **HTS-VL**

Digital Products

DVB-S / S2 / S2X
Modulators
Modems
Demodulators

A-Series AX-60
All-IP Platform

The A-Series is a next generation FPGA-based family of satellite modem, modulator and demodulator platforms. The AX-60 product line is based on a powerful architecture that supports the new DVB-S2X standard, providing users with a future-proof solution. Advanced features and benefits include higher modulation schemes up to 256APSK, a finer granularity of ModCods and advanced filtering.

Beyond DVB-S2X, the AX-60 platform can be extended to customized waveforms and user-defined data processing. Through an all-IP structure, the platform supports both native network operation as well as data streaming over IP. Built-in encapsulators and decapsulators provide support for the standard formats, such as GSE and MPE plus specialized streaming like transparent baseband data, raw IQ information, space data formats and more.

A-Series devices are based on a new processing architecture that offers signal based advancements, a flexible software platform and improved access from monitoring and control to the transmission parameters. This allows direct real-time monitoring and quick adaptation to specific customer requirements. Scalable hardware ensures that operators can serve all applications from very low up to extremely high throughput.

Key features

- DVB-S2X - ETSI EN 302 307-2
- DVB-S2 - ETSI EN 302 307-1
- DVB-S2X modulations:
  QPSK to 256APSK; normal, short, linear
- DVB-S2 modulations:
  QPSK to 32APSK; normal, short
- Symbol rates from 100 ksps to 75 Msps
- Data rate up to 360 Mbit/s integrated
- Roll-Off: 35 %, 25 %, 20 %, 15 %, 10 %, 5 %
- Low spurious output
- Operates as Layer 3 Bridge or Layer 3 Router
- Predistortion ready for automatic group delay and nonlinearity compensation
- OptiACM controller (open for other ACM systems)
- Real-time M&C capabilities
- IP and baseband traffic shaping
- Generic Stream Encapsulation (GSE)
- Multiprotocol Encapsulation (MPE)
- CE compliant
- **3 years warranty**

A-Series AX-60
All-IP Platform

Modulator Parameters:		**AX-60 / AT-60**	
Signal Outputs:		1x L-band output 950 … 2150 MHz 1x IF output 50 … 180 MHz (option IF)	
		IF Output	**L-band Output**
IF-Output Frequency:		50 … 180 MHz	950 … 2150 MHz
Frequency Resolution:		1 Hz	1 Hz
Phase Noise:	**10 Hz**	-45	-45
	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 Return Loss: > 18 dB Output Power: -25 dBm … 5 dBm, 0.1 dB steps, ±0.5 dBm accuracy Output Power muted: < -85 dBm Connector: BNC female	Impedance: 50 Ω Return Loss: > 18 dB Output Power: -30 dBm … 0 dBm, 0.1 dB steps, ±0.5 dBm accuracy Output Power muted: < -85 dBm Connector: N female 50 Ω 10 MHz reference output: 1.5 ±1.5 dBm (can be switched on/off)
Spurious Outputs:		Signal related: < -70 dBc, unmodulated carrier, 50 … 90 MHz or 100 … 180 MHz < -45 dBc, unmodulated carrier harmonics, out of band	Signal related: < -70 dBc, unmodulated carrier, 950 … 1900 MHz < -55 dBc, unmodulated carrier, 1900 … 2150 MHz < -45 dBc, unmodulated carrier harmonics, out of band
Frequency and Clock Stability:		Standard: ±2 x 10^{-7} (0°C ... 50°C, after warm up), aging: ±2 x 10^{-8} per day, ±1 x 10^{-6} per year Option EXT: ±2 x 10^{-8} (-30°C ... 60°C, after warm up), aging: ±1 x 10^{-9} per day, ±1 x 10^{-7} per year	
Symbol Rate:		Max. Range: 100 ksps … 75 Msps (depending on firmware option) Step size: 1 sps	
DVB-S2X Modulation / Coding:		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	
DVB-S2 Modulation / Coding:		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	
Carrier ID:		DVB-CID according to ETSI TS 103129	
Signal Spectrum Mask:		α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according ETSI EN 302307	

Specifications continued next page

A-Series AX-60
All-IP Platform

Demodulator Parameters:	**AX-60 / AR-60**		
Signal Inputs:	1x L-band input 950 … 2150 MHz 1x IF input 50 … 180 MHz (option IF)		
	IF Input		**L-band Input**
IF-Input Frequency:	50 … 180 MHz		950 … 2150 MHz
IF-Input Characteristics:	Impedance: 50 Ω / 75 Ω switchable Return Loss: >18 dB Input Power: -60 dBm … -15 dBm (total aggregate power) IF-Connector: BNC female 50 Ω		Impedance: 75 Ω Return Loss: >13 dB Input Power: -70 dBm … -20 dBm (total aggregate power) IF-Connector: F female 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:	100 ksps … 75 Msps	
	Step size:	1 sps	
DVB-S2X Demodulation / Decoding:	ModCods non-linear: (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 non-linear: (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, 2/3, 31/45, 11/15
	all according to ETSI EN 302307-2		
DVB-S2 Demodulation / Decoding:	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
	Demodulator auto detection:	Modulation- and FEC-type, pilots on/off are automatically detected	
	Physical Layer Scrambling:	N = 0 … 262141	
	all according to ETSI EN 302307-1		
Signal Spectrum Mask:	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according ETSI EN 302307-2		
Common Parameters:	**AX-60 / AT-60 / AR-60**		
Data Interfaces:	2x Ethernet RJ-45, 10/100/1000 Mbps auto sensing arbitrarily assignable for M&C and/or traffic operation		
Network Operation:	Layer 3 Bridge or Router for IPv4 and IPv6 packet transmission 256 IP/subnet routes towards satellite 64 baseband channels with independent DVB-S2X and encapsulation settings		
Data Encapsulation:	Generic Stream Encapsulation (GSE) according ETSI TS 102606 Multiprotocol Encapsulation (MPE) according to ETSI EN 301192		
IP Data Rate:	up to 360 Mbps or 80000 pps rx+tx processing, subject to prevailing modem limits data rates/packet rates can vary in combination with complex internal processing (i.e. traffic shaping)		
Traffic Shaper/QoS on BB level:	configurable baseband channel limits based on symbol rate guaranteed and limited bandwidth individually configurable		
Traffic Shaper/QoS on IP level:	(contact factory for options)		
Transport Stream Output:	1x RTP/UDP IP over Ethernet according to IETF RFC 2250 1x ISI selectable from multistream carrier; null packet reinsertion		
OptiACM:	CCM / VCM / ACM functionality for point-to-point and point-to-multipoint links 64 ACM channels with separate MODCOD range and Es/N0 sensitivity		
Predistortion:	(contact factory for options)		
Monitoring and Control:	Protocol: SNMP Connection: UDP/IP over Ethernet/RJ-45 or in-band via satellite link		
	Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet/RJ-45 or in-band via satellite link		
Internal Fan	FAN included		
Temperature Range:	0°C ... 50°C operating or -30°C ... 60°C operating (option EXT) -30°C ... 80°C storage		
Relative Humidity:	< 95% non condensing		
User Interface:	LCD-Display 2 x 40 characters, 4 cursor keys, 2/4 function keys VFD-Display 2 x 40 characters, 4 cursor keys, 2/4 function keys (option EXT)		
Mains Power Input:	100 … 240 V AC nominal, 90 … 264 V AC max, 50 … 60 Hz		
Mains Power Consumption:	Typ.: 65 VA / 45 W		
Mains Power Input Connector:	IEC C14		
Mains Fuse:	2 x 3.15 A time-lag fuse		
Dimension and Weight:	483 x 44 x 505 mm³ (WxHxD), 1 RU (19") up to approx. 8 kg depending on device type		

Specifications are subject to change

A-Series AX-60
All-IP Platform

Order Information:

AX-60	IP Modem
AT-60	IP Modulator
AR-60	IP Demodulator

Hardware options:

IF50	additional 50 Ω IF output and 50 Ω/75 Ω switchable IF input
IF75	additional 75 Ω IF output and 50 Ω/75 Ω switchable IF input
RT	support for external 10 MHz reference and time stamp synchronization for output data
EXT	extended operating temperature range of -30°C … +60°C

Hardware options may only be available for certain device types and are not field-upgradable. Please contact factory with specific requests.

License based options:

License based options are field-upgradable by a license file.

TXDxxx	transmission data rate limit / applicable to AX-60 and AT-60 devices	
	TXD10	max 10 Mbps throughput towards satellite
	TXD30	max 30 Mbps throughput towards satellite
	TXD100	max 100 Mbps throughput towards satellite
	TXD160	max 160 Mbps throughput towards satellite
	TXDmax	max throughput according to specification
TXSxxx	transmission symbol rate limit / applicable to AX-60 and AT-60 devices	
	TXS15	max 15 Msps Tx carrier
	TXS30	max 30 Msps Tx carrier
	TXS45	max 45 Msps Tx carrier
	TXS60	max 60 Msps Tx carrier
	TXSmax	max Tx carrier according to specification

Either a symbol rate or a data rate based license has to be selected. License model can be changed in field.

RXDxxx	reception data rate limit / applicable to AX-60 and AR-60 devices	
	RXD10	max 10 Mbps throughput from satellite
	RXD30	max 30 Mbps throughput from satellite
	RXD100	max 100 Mbps throughput from satellite
	RXD160	max 160 Mbps throughput from satellite
	RXDmax	max throughput according to specification
RXSxxx	reception symbol rate limit / applicable to AX-60 and AR-60 devices	
	RXS15	max 15 Msps Rx carrier
	RXS30	max 30 Msps Rx carrier
	RXS45	max 45 Msps Rx carrier
	RXS60	max 60 Msps Rx carrier
	RXSmax	max Rx carrier according to specification

Either a symbol rate or a data rate based license has to be selected. License model can be changed in field.

BBO	baseband frame output interface over IP
BBI	baseband frame input interface over IP
TSO	transport stream over IP output

Digital Video Broadcasting

DVB Satellite Broadcast Modulator

70/140 MHz IF Output
L-band Output

Fully compliant with DVB standards, the DVB Satellite Broadcast Modulator supports a wide range of DTH broadcast, video contribution, and distribution applications over satellite.

Through an advanced feature set, the broadcast modulator helps operators get the most out of expensive satellite bandwidth, optimize data transport, and considerably improve satellite signal quality.

Innovative features include Carrier ID, DVB-S2 multistream, TSoIP, and wideband (up to 80 Mbaud). In addition, the DVB Satellite Broadcast Modulator platform supports next-generation DVB-S2X, providing operators with a future-proof solution.

MPEG transport stream input – L-band or IF output

The modulator accepts MPEG transport streams on ASI, SPI, or TS over IP inputs from a video encoder or MPEG multiplexer and provides a DVB-S, DVB-S2 or DVB-S2X modulated carrier output between 50 to 180 MHz or L-band. Additionally a baseband frame input is available for VCM and ACM modes in combination with external multiplexers and encapsulators.

High signal integrity

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

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.

Flexibility, backward compatibility

Mode adaptation, FEC encoding, and modulation is compliant with the DVB-S2/S2X standard ETSI EN 302307. QPSK, 8PSK, 16APSK, 32APSK and 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 modulator 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). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the 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.

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 / 128 APSK / 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
- 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
- Dual ASI interfaces with automatic cable equalizer and auto-switchover
- DVB-S2 Multistream support with capacity management with two input streams supported. Optional a hex ASI interface is 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 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 contacts
- Transmit mute input
- 10 MHz Reference OCXO included
- L-band Monitor Output
- 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 Broadcast Modulator

Indoor Unit

Modulator Type:	**HDM2-Vx / SDM2-Vx**	**HDM2-Lx / SDM2-Lx**	**HDM2-Vx/Lx / SDM2-Vx/Lx**
IF-Output Frequency:	50 … 180 MHz	950 … 2150 MHz	50 … 180 MHz and 950 … 2150 MHz (2 outputs, can be alternatively enabled)
Frequency Resolution:	1 Hz		
Phase Noise: 10 Hz	-70	-65	see HDM2-Vx and HDM2-Lx
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 (VHF-band output) 50 Ω or 75 Ω (L-band output)	
	Return Loss:	>20 dB typ > 18 dB min	
	Output Power:	-25 dBm … 5 dBm, 0.1 dB steps (V-Band output) -30 dBm ... 0 dBm, 0.1 dB steps (L-band output)	
	Accuracy:	± 0.5 dB	
	Stability:	± 0.5 dB	
	Output Power muted:	<-85 dBm	
	Connector:	BNC female (V-Band output) N female (L-band output 50 Ω) F female (L-band output 75 Ω)	
	DC supply over L-band output:	24 V DC or 48 V DC, max 4 A, switchable (option DC24 or DC48)	
	10 MHz reference over L-band output:	1.5 ±1.5 dBm, switchable	
Monitoring Output (on front panel):	Output Power:	-20 dB of IF Output	on SDM2-Vx / HDM2-Vx and HDM2-Vx-Lx / SDM2-Vx-Lx
		-20 dB of L-band Output	on SDM2-Lx / HDM2-Lx and
	Impedance:	50 Ω	
	Return Loss:	>20 dB	
	Connector:	SMA female	
L-band Monitoring: (on rear panel):	Output Frequency:	1.4 GHz	available only on HDM2-Vx / SDM2-Vx and HDM2-Vx-Lx / SDM2-Vx-Lx
	Output Power:	-45 dBm approx	
	Impedance:	75 Ω	
	Return Loss:	>15 dB	
	Connector:	BNC female	
Spurious Outputs:	Signal related:	<-67 dBc (unmodulated carrier, in band) <-45 dBc (unmodulated carrier harmonics, out of band)	
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		
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 … 356 Mbps (SPI interface) *) 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 (devices with option MT6 limited to 32APSK)		
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)	
Carrier ID:	DVB-CID according to ETSI TS 103 129		

Specifications continued next page

DVB Satellite Broadcast Modulator

Indoor Unit

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.
Baseband Frame Input:	Through DVB-ASI inputs or DVB-SPI input alternatively to Transport stream input, configurable Support of VCM/ACM in band signaling according to ETSI EN 302307-1, Annex I.2 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 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, ETSI EN 301210, ETSI EN 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, 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 female
Temperature Range:	HDM2: -30 °C ... 60 °C operating (10 minutes warm up at -30°C) SDM2: 0 °C ... 50 °C operating -30 °C ... 80 °C storage
Relative Humidity:	<95% non condensing
User Interface:	SDM2: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HDM2: VFD-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 2x 100 … 240 V AC nominal, 90 … 264 V AC max, 50 … 60 Hz (with option 2PSU)
Mains Power Consumption:	Typ.: 38 VA / 25 W without BUC Power and TSOIP modules Max 170 W (with option DC24, DC power on) Max 280 W (with option DC48, DC power on)
Mains Power Input Connector:	IEC C14
Mains Fuse:	2 x 2 A (or 2.5 A) time-lag fuse 2 x 5 A time lag fuse (with option DC24 or DC 48)
Dimension and Weight:	483 x 44 x 470 mm³ (WxHxD), 1 RU (19") approx. 8 kg approx. 10 kg (with option DC24 or DC 48)

Specifications are subject to change

DVB Satellite Broadcast Modulator
Indoor Unit

Order Information:

HDM2-[Output Band and Impedance]-[Options] or SDM2-[Output Band and Impedance]-[Options]
Modulator with VHF-band or L-band output

HDM2-V[Impedance]/L[Impedance]-[Options] or SDM2-V[Impedance]/L[Impedance]-[Options]
Modulator with VHF-band and L-band output

Possible Options are:		Cannot be combined with:	Requires:
FAN	internal Fan	-	-
BBR	Baseband Frame flow control as RS232 signal	MT6	-
BI	BISS scrambling	MT6	-
DC24	24 V DC power on L-band output	DC48	FAN
DC48	48 V DC power on L-band output	DC24	FAN
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, BBR	-
XB	Broadcast Predistortion	-	-
XE	Extended Predistortion	-	-
2PSU	Dual Power Supply	DC24, DC48	-

Examples:

SDM2-V75	Modulator with VHF-band Output 75 Ω
HDM2-L50	Modulator with L-band Output 50 Ω,
HDM2-V75-FAN	Modulator with VHF-band Output 75 Ω with Fan
HDM2-V75/L50-TI2-MT6-FAN	Modulator with VHF-band and L-band output with 2 TS over IP inputs, support of 6 multiple input streams, Fan

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**
		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: > 20 dB or > 17 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 *) 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			
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 … 356 Mbps (SPI interface) *) 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 8PSK 16APSK 32APSK 64APSK 128APSK 256APSK	13/45, 9/20, 11/20 23/36, 25/36, 13/18 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 32/45, 11/15, 7/9 11/15, 7/9, 4/5, 5/6 3/4, 7/9 32/45, 3/4
		ModCods: (short FEC frame)	QPSK 8PSK 16APSK 32APSK	11/45, 4/15, 14/45, 7/15, 8/15, 32/45 7/15, 8/15, 26/45, 32/45 7/15, 8/15, 26/45, 3/5, 32/45 2/3, 32/45
		ModCods linear: (normal FEC frame)	8PSK 16APSK 32APSK 64APSK 256APSK	5/9-L, 26/45-L 1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 25/36-L 32/45-L 29/45-L, 2/3-L, 31/45-L, 11/15-L
		all according to ETSI EN 302307-2 (devices with option MT6 limited to 32APSK)		
Modulation / Encoding **DVB-S2:**		ModCods: (normal and short FEC frame; except 9/10 short FEC frame only)	QPSK 8PSK 16APSK 32APSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 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.
Baseband Frame Input:	Through DVB-ASI inputs or DVB-SPI input alternatively to Transport stream input, configurable Support of VCM/ACM in band signaling according to ETSI EN 302307-1, Annex I.2 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 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]-[Options] [Firmware Option]**	Single Band modulator-upconverter
	VHM2CU-[RF Band]-[Options] [Firmware Option]	Single Band modulator-upconverter
	VHM2CUx-[RF Band(s)]-[Options]-[Firmware Option]	Multiband modulator-upconverter
	x=2: Dualband modulator-upconverter, x=3: Triband modulator-upconverter	

Possible Options are:		**Cannot be combined with:**	**Requires:**
VFD	VFD display, standard with HCU-type converters	-	-
LT	L-band test output	-	-
FAN	internal Fan	-	-
BBR	Baseband Frame flow control as RS232 signal	MT6	-
BI	BISS scrambling	MT6	-
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, BBR	-
XB	Broadcast Predistortion	-	-
XE	Extended Predistortion	-	-

Examples:

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

Digital Video Broadcasting

DVB-S2X Wideband Modulator

L-band Output

WORK Microwave's Wideband Modulator provides operators a platform for transferring Transport Streams in DVB-S2 multicast format as well IP/Ethernet data over DVB-S2/DVB-S2X satellite connections. Ethernet frames and IP packets are encapsulated directly within DVB-S2 baseband frames, resulting in low encapsulation overhead. For maximum bandwidth efficiency and ease of operation the device uses Generic Stream Encapsulation according to TS 102 606.

An aggregate data throughput of more than 1 Gbps can be achieved. Symbol rates up to 400 Msps are supported.

The unit is suitable for uplinks of High Throughput Satellites. It supports Broadcast, Broadband or hybrid Broadcast/Broadband systems.

OptiACM

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

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.

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). Detailed monitoring of system parameters is possible.

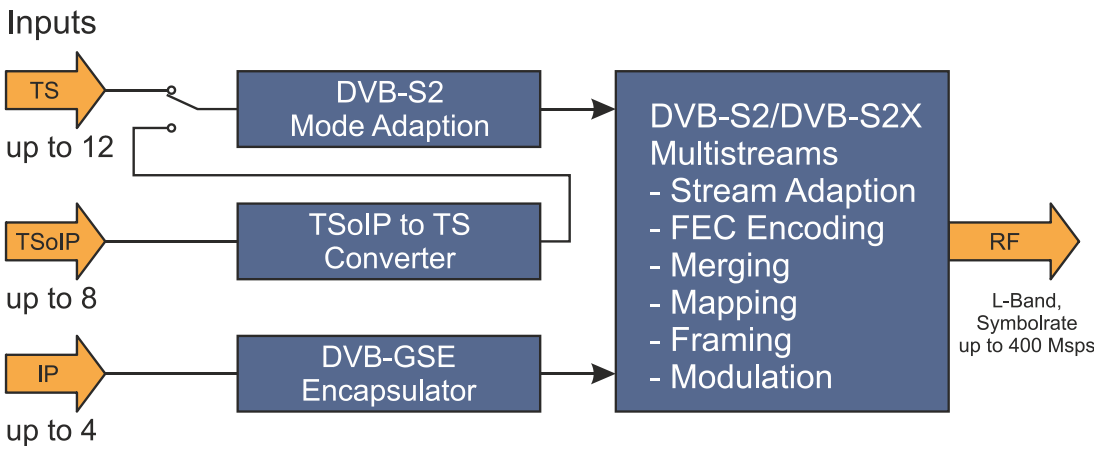
Key features

- Up to 12 ASI Input Interfaces for Multiple Transport Stream Inputs
- Up to 8 Transport Stream over IP Inputs
- Up to 4 Inputs for GSE encapsulators
- DVB-S2 - ETSI EN 302 307
  DVB-S2X - ETSI EN 302 307-2
- DVB-S2/S2X modulations:
  QPSK / 8PSK / 16APSK / 32APSK
  64APSK / 128APSK / 256APSK coming soon
- Normal and short FEC frames, pilots on or off
- Broadcast Predistortion including automatic group delay and dynamic constellation predistortion for QPSK and 8PSK (preliminary option XB)
- Extended Predistortion including automatic group delay and static constellation predistortion up to 32APSK (preliminary option XE)
- Physical layer framing with scrambling codes 0 to 262141 according to DVB-S2
- Physical layer framing according DVB-S2 Annex M (time-slicing)
- Physical layer framing according DVB-S2X Annex E, Format 4: "Flexible Format with VL-SNR PLH Tracking"
- Symbol rates from 1 Msps to 400 Msps
- Roll-Off: 35 %, 25 %, 20 %, 15 %, 10 %, 5 %
- Adjustable digital gain slope equalizer

- Low spurious output
- 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
- Capacity calculator, optional capacity limitation per TS input
- 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
- 10 MHz Reference OCXO included
- Ext. 10 MHz reference input
- 10 MHz reference output
- 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-S2X Wideband Modulator

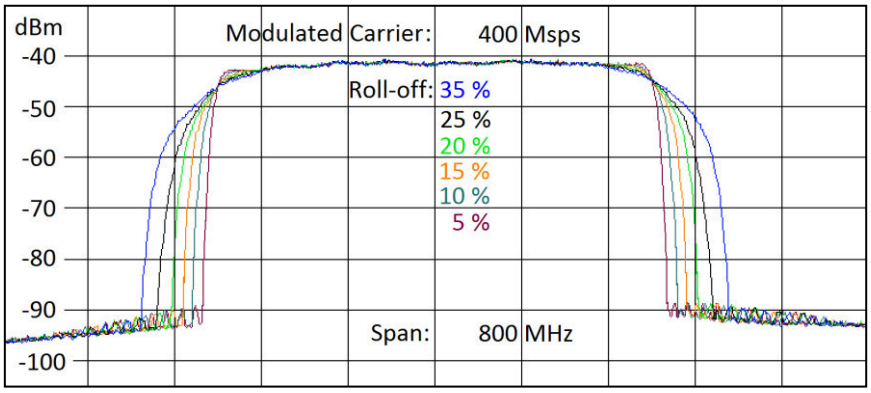
Modulator Type:		**SDMW**
IF-Output Frequency:		L-band Output 950 … 2150 MHz
Frequency Resolution:		1 Hz
Phase Noise:	10 Hz	-65
	100 Hz	-75
	1 kHz	-88
	10 kHz	-90
	100 kHz	-100
	1 MHz	-120
	10 MHz	-125
	100 MHz	-130
		max. values in dBc/Hz
IF-Output Characteristics:		Impedance: 50 Ω Return Loss: > 18 dB Output Power: -30 dBm … 0 dBm, 0.1 dB steps, ±0.5 dBm accuracy Output Power muted: < -85 dBm Connector: SMA female
Monitoring Output (on front panel):		Output Power: -20 dB of L-band Output Impedance: 50 Ω Return Loss: > 18 dB Connector: SMA female
Spurious Outputs:		Signal related: < -55 dBc, nearby carrier < -50 dBc, unmodulated carrier, 950 … 2150 MHz
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
Symbol Rate:		Max. Range: 1 Msps … 400 Msps Step size: 1 sps
Modulation / Encoding DVB-S2X:		ModCods non-linear: QSPK 13/45, 9/20, 11/20 (normal FEC frame) 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 ModCods non-linear: QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 (short FEC frame) 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: 8PSK 5/9-L, 26/45-L (normal FEC frame) 16APSK 1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 32APSK 2/3-L, 25/36-L (contact factory for 64APSK, 128APSK, 256 APSK modulation types) Physical Layer Framing: According ETSI EN 302307 ETSI EN 302307 Annex M: Time-slicing ETSI EN 302307-2, Annex E, Format 4 Physical Layer Signaling: yes Pilots Insertion: on / off Physical Layer Scrambling: N = 0 … 262141 (ETSI EN 302307) N = 0…1048575 for reference and payload scrambler (ETSI EN 302307-2, Annex E)
Modulation / Coding DVB-S2:		Outer BCH Code: FEC-Frames nldpc = 64800 (normal FEC Frame) nldpc = 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
Packet Stuffing:		Dummy PLFRAME insertion when the data rate to transmit is higher than the data rate at the inputs.
Signal Spectrum Mask:		α = 0.35, 0.25, 0.20 according ETSI EN 302307 α = 0.15, 0.10, 0.05 according ETSI EN 302307-2
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.
Stream Adaption:		Stream Adaption: yes Baseband Scrambling: yes (according ETSI EN 302307)
Transport Stream Inputs:		Up to 12 x ASI (BNC female 75 Ω) Supporting up to 12 Multiple Transport Stream Input (auto switching dual input) Alternatively for 8 out of 12 inputs 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.
Multiple Transport Stream Input Operation:		Individual modulation and FEC (MODCOD) configuration per TS input. capacity calculator, capacity limitation per TS input can be activated.
Transport Stream Frames Size:		188 or 204 bytes
Data Rate:		3 kbps … 213 Mbps (ASI interface) 10 kbps … 213 Mbps (TS over IP interface)
Transport Stream Mode Adaption DVB-S2:		Input Stream Synchroniser yes (according ETSI EN 302307 Annex D.2) Null-Packet Deletion yes (according ETSI EN 302307 Annex D.3) CRC-8 Encoder: yes Baseband Header Insertion: yes

Specifications continued next page

GSE Encapsulator	Up to 4
Baseband Channels:	16 baseband channel with separate DVB-S2 baseband settings (MODCOD, FEC frame length, pilots, encapsulation type, multistream ID, timeout)
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
BB Traffic Shaper:	Baseband channel limits based on symbol rate for virtual share of the carrier Guaranteed and limited bandwidth individually configurable
Data Interface:	Ethernet (1xRJ-45, 10/100/1000 Mbps auto sensing)
IP Data Rate:	up to 400 Mbps or 80000 pps
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
Data Encapsulation:	Generic Stream Encapsulation (GSE) according ETSI TS 102606 Multiprotocol Encapsulation (MPE) according to ETSI EN 301192
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)

Monitoring and Control Interface:	Protocol: Connection:	SNMP (tbc) UDP over Ethernet (10/100 Mbps auto sensing) IPv4, IPv6, connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10/100 Mbps, auto sensing) IPv4, IPv6, connector RJ-45
	Protocol: Connection:	Multipoint 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 78 W / 115 VA (2 x GSE Encapsulator, 2x TSoIP ;Module)	
Mains Power Input Connector:	IEC C14	
Mains Fuse:	2 x 5 A time lag fuse	
Dimension and Weight:	483 x 98 x 470 mm³ (WxHxD), 2 RU (19") approx. 15 kg max	

Specifications are subject to change



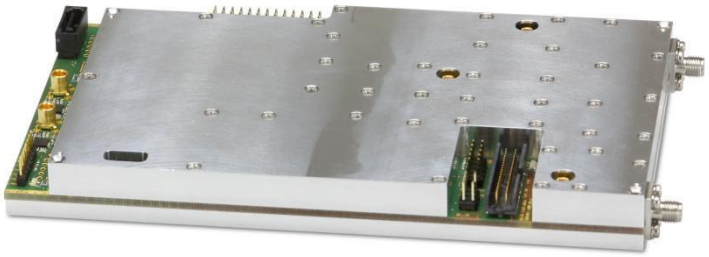
Order Information:

SDMW Wideband Modulator with L-band Output 50 Ω (customized options on request)

Digital Video Broadcasting

Trade Mark of the DVB Digital Video Broadcasting Project

DVB Satellite Modulator
OEM Module SDMO



The DVB Satellite Modulator OEM Module SDMO is a cost effective, high performance OEM solution designed to be easily integrated into any kind of platform.

The board is in compliance with DVB-S2X standard offering an advanced feature set including Carrier ID and symbol rates up to 80 Msps.

Benefiting from WORK Microwave's years of experience in digital design the modulator board has been developed to provide a highly compact solution to fit into third-party vendors' products such as video encoders and fly-away systems.

Additionally the board will also serve for rack-mount and module-based versions of WORK Microwave's A-Series product line.

The board's design integrates all required subsystems without compromising modulation performance. Furthermore, low power consumption combined with intelligent housing enable the module to be operated in challenging thermal environments.

Available as standard size or customized dimensions the SDMO is easily integrated into any third-party products.

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
- 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
- Dual ASI interfaces with automatic cable equalizer and auto-switchover
- DVB-S2 Multistream support with capacity management with two input streams supported
- Null packet insertion and deletion with PCR correction
- Symbol rates from 8 ksps to 80 Msps
- Data rate max 213 Mbps per ASI Interface
- Extended operating temperature range option -30 °C to 60 °C (-22 °F to 140 °F)

DVB Satellite Modulator
OEM Module SDMO

Modulator Type:	**SDMO**		
IF-Output Frequency:	50 … 180 MHz (option V)		950 … 2150 MHz
Frequency Resolution	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	
	Return Loss:	>20 dB typ > 18 dB min	
	Output Power:	-25 dBm … 5 dBm, 0.1 dB steps (V-Band output)	
		-30 dBm ... 0 dBm, 0.1 dB steps (L-band output)	
	Accuracy:	± 0.5 dB	
	Stability:	± 0.5 dB	
	Output Power muted:	<-85 dBm	
	Connector:	SMA female	
	10 MHz reference over L-band output:	1.5 ±1.5 dBm, switchable	
Spurious Outputs:	Signal related:	<-67 dBc (unmodulated carrier, in band)	
		<-45 dBc (unmodulated carrier harmonics, out of band)	
Frequency/Clock Stability:	Standard:	±2 x 10^{-7} (0°C ... 50°C, after warm up), aging: ±2 x 10^{-8} per day, ±1 x 10^{-6} per year	
	Option EXT:	±2 x 10^{-8} (-30°C ... 60°C, after warm up), aging: ±1 x 10^{-9} per day, ±1 x 10^{-7} per year	
Symbol Rate:	Max Range:	8 ksps … 80 Msps	
	Step size:	1 sps	
Data Rate:	3 kbps … 213 Mbps (ASI interface) *		*) max 170 Mbps, when BISS-1/E active
Modulation / Encoding DVB-S2X:	ModCods:	QSPK	13/45, 9/20, 11/20
	(normal FEC frame)	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:	QPSK	11/45, 4/15, 14/45, 7/15, 8/15, 32/45
	(short FEC frame)	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:	8PSK	5/9-L, 26/45-L
	(normal FEC frame)	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:	QPSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	(normal and short FEC frame;	8PSK	3/5, 2/3, 3/4, 5/6, 8/9, 9/10
	except 9/10 short FEC frame only)	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)	
Carrier ID:	DVB-CID according to ETSI TS 103 129		
Signal Spectrum Mask:	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05		
Transport Stream Inputs:	Dual DVB-ASI-electrical (2 x Connector MCX 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)		
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!		

Specifications continued next page

DVB Satellite Modulator
OEM Module SDMO

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, ETSI EN 301210, ETSI EN 302307-1 and -2, ETSI TS 103129 EN 50083-9 (ASI electrical, SPI Interface)
Monitoring:	Faults, stored faults with time stamps
Monitoring and Control Interface:	Protocol: Multipoint Connection: RS232 over 2.54mm pin header
Temperature Range:	0°C ... 50 °C operating -30°C ... 60 °C operating with 10 minutes warm up at -30°C (option EXT) -30°C ... 80 °C storage
Relative Humidity:	<95% non condensing
Mains Power Input:	12 … 24 V DC nominal, 11 … 26 V DC max
Mains Power Consumption:	Standard: 14 W typ. Option EXT: 17 W typ.
Mains Power Input Connector:	2.54mm pin header
Dimension and Weight:	185 x 17 x 100 mm³ (WxHxD) standard module 185 x 25 x 100 mm³ (WxHxD) with cables and/or option EXT approx. 0.45 kg

Specifications are subject to change

Order information:

SDMO-[options]

Possible options are:		**Cannot be combined with:**	**Requires:**
V	additional VHF-band output	-	-
EXT	extended temperature range and clock stability	-	-
BI	BISS scrambling	-	-

Examples:

SDMO-V	Modulator with 50 Ω L-band output and 50 Ω VHF-band output
SDMO-EXT	Modulator with extended temperature range, including higher clock stability

DVB
Digital Video Broadcasting

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 60 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 Return Loss: > 18 dB Output Power: -25 dBm … 5 dBm, 0.1 dB steps, ±0.5 dBm accuracy Output Power muted: < -85 dBm Connector: BNC female	Impedance: 50 Ω or 75 Ω Return Loss: > 18 dB Output Power: -30 dBm … 0 dBm, 0.1 dB steps, ±0.5 dBm accuracy Output Power muted: < -85 dBm 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 Impedance: 50 Ω Return Loss: > 20 dB Connector: SMA female	Output Power: -20 dB of L-band Output Impedance: 50 Ω Return Loss: > 20 dB 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	
Symbol Rate:		Max. Range: 60 ksps … 80 Msps (depending on firmware option) Step size: 1 sps	
Modulation / Coding DVB-S2:		Outer BCH Code: FEC-Frames nldpc = 64800 (normal FEC Frame), nldpc = 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: 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) (according ETSI EN 300421, 301210) 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)	

Specifications continued next page

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: >18 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: 60 ksps … 76 Msps (QPSK, 8PSK, 16APSK) 60 ksps … 62 Msps (32APSK) Step size: 1 sps	
Demodulation / Decoding DVB-S2:	Outer BCH Code: FEC-Frames nldpc = 64800 (normal FEC Frame) nldpc = 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)	

Specifications continued next page

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]-[Options]-[Modulator Firmware Option]

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

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

Modulator Firmware 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%

Examples:

SK-IP-L50-L75-DC24-A2H	IP Modem with L-band Output 50 Ω and L-band Input 75 Ω, DC24 Volt
SK-IP-L50-L75-DC24-A2HS	IP Modem with L-band Output 50 Ω and L-band Input 75 Ω, DC24 Volt, Roll-Off-Filters down to 5 %
SK-IP-V50/L50-V75/L75-P2N	IP Modem with VHF-band and L-band Output, VHF-band and L-band Input
SK-DV-V75/L50-V75/L75-A2L	DaVid Technology Modem with VHF-band and L-band Output and Input

DVB Digital Video Broadcasting

DVB-S2 Demodulator

SDD-IP / SDD-DV / SDD-TS

WORK Microwave's high-speed DVB-S2 demodulator SDD is designed to provide demodulation of DVB-S and DVB-S2 signals.

The SDD-IP demodulator provides operators with a platform for receiving IP/Ethernet data over DVB-S2 satellite connections. The device is the corresponding demodulator unit to the DVB-S2 IP modem SK-IP and supports low overhead Generic Stream Encapsulation and Multiprotocol Encapsulation. In combination with the integrated support of OptiACM and VideoACM, the demodulator provides adaptive or variable FEC and modulation setting for point-to-point or point-to-multipoint applications.

The SDD-TS device can be used for receiving digital video broadcast contribution or distribution signals as MPEG transport streams and is suitable for a wide range of applications, including video reception sites, monitoring facilities, and program exchange points.

The SDD-DV device combines both operation types in a single device.

The demodulator has two L-band inputs in the range from 950 to 2150 MHz or alternatively one L-band input and one VHF-band input in the range from 50 to 180 MHz, with one input being selected. On L-band inputs, LNBs can be powered directly.

Operating and control – easy integration into your system

The configuration of the demodulator can be controlled via the front panel keys or remotely via RS232, RS422/485 and TCP/IP (over Ethernet). For the remote control addressable packet-based commands, an HTTP Web browser interface, or SNMP can be used. Detailed monitoring of system parameters is possible.

Key features

- DVB-S2 - ETSI EN 302 307-1
  DVB-S - ETSI EN 300 421
- DVB-S2 demodulation QPSK / 8PSK / 16APSK / 32APSK
- DVB-S demodulation QPSK
- Normal and short FEC frames, pilots on or off (DVB-S2)
- Physical layer framing with descrambling codes 0 to 262141 according to DVB-S2 standard
- Automatic reception of Roll-Off: 35 %, 25 %, 20 %, 15 %, 10 %, 5 %
- Symbol rates from 60 ksps to 80 Msps
- Data rate max 356 Mbps
- OptiACM and VideoACM
- Gigabit Ethernet data interface
- 2 ASI Output Interfaces (SDD-TS / SDD-DV)
- 6 ASI Output Interfaces for up to 6 Multiple Transport Streams (Option MT6) (SDD-TS / SDD-DV)
- Generic Stream Encapsulation (GSE), Multiprotocol Encapsulation (MPE)
- Network layer 2 or layer 3 operation
- 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 contacts
- Operating temperature range 0° C to 50 °C (32 °F to 122 °F)
- CE compliant
- 3 years warranty

DVB-S2 Demodulator

SDD-IP / SDD-DV / SDD-TS

Demodulator Type:	**SDD-IP / SDD-DV / SDD-TS**	
Signal Inputs:	SDD-xx-L75: 2x L-band input (950..2150 MHz) SDD-xx-Vx/L75: 1x L-band input (950..2150 MHz), 1x VHF-band input (50..180 MHz), can be alternatively enabled	
	VHF-band Input	**L-band Input**
Input Characteristics:	Frequency: 50 … 180 MHz Impedance: 50 Ω or 75 Ω Return Loss: > 18 dB Input Power: -60 dBm … -15 dBm (total aggregate power) IF-Connector: BNC female	Frequency: 950 … 2150 MHz Impedance: 75 Ω Return Loss: > 13 dB Input Power: -70 dBm … -20 dBm (total aggregate power) IF-Connector: F female LNB DC-Feed: 13.5 V or 18 V (450 mA) switchable, 22 kHz tone on/off, DISEqC 1.1 short circuit protected
Symbol Rate:	Max. Range: 60 ksps … 76 Msps (QPSK, 8PSK, 16APSK) 60 ksps … 62 Msps (32APSK) Max. Range (option S80): 500 ksps … 80 Msps (QPSK, 8PSK, 16APSK, 32APSK) Step size: 1 sps	
Demodulation / Decoding DVB-S2:	Outer BCH Code: FEC-Frames nldpc = 64800 (normal FEC Frame) nldpc = 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 302307-1	
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 (SDD-TS only)	
OptiACM:	CCM / VCM / ACM functionality for point-to-point and point-to-multipoint links	
Signal Spectrum Mask:	α = 0.35, 0.25, 0.20 according ETSI EN 302307-1, 301210 α = 0.15, 0.10, 0.05 (compatible)	
Data Interfaces:	1x Ethernet (RJ-45, 10/100/1000 Mbps auto sensing) 2x ASI (BNC female 75 Ω; SDD-TS, SDD-DV only) 6x ASI (BNC female 75 Ω; SDD-TS, SDD-DV only; Option MT6)	
Data Rate:	up to 356 Mbps	
Network Operation:	Layer 2 (Ethernet frame reception) or Layer 3 (IP packet reception), IPv4 and IPv6 dual stack	
Data Encapsulation:	Generic Stream Encapsulation (GSE) according ETSI TS 102606 (SDD-IP, SDD-DV only) Multiprotocol Encapsulation (MPE) according to ETSI EN 301192 (SDD-IP, SDD-DV only)	
Transport Stream Output:	2x ASI (BNC female 75 Ω) (SDD-TS, SDD-DV only) Supporting Single Transport Stream Operation or 1 Multiple Transport Stream Operation (Dual Output) 1x RTP/UDP IP over Ethernet according to IETF RFC 2250 With Option MT6 (SDD-TS, SDD-DV only): Processing of 6 Multiple Transport Streams Support of Null Packet Reinsertion according to ETSI EN 302 307 Annex G.3 6x ASI (BNC female 75 Ω) Outputs, can be assigned arbitrarily Up to 6x RTP/UDP IP over Ethernet according to IETF RFC 2250	
Transport Stream Frame Size:	188 bytes (SDD-TS and SDD-DV only)	
Transport Stream Security: (Option BI)	BISS-E Descrambler, compliant to EBU Tech 3292 rev.2 (SDD-TS only) Supports single or multi program transport stream in BISS Modes 0, 1 and E BISS Mode 0: no descrambling, MPEG transport stream is transferred untouched BISS Mode 1: MPEG transport stream is descrambled using 48-bit Clear Session Word BISS Mode E: MPEG transport stream is descrambled using 64-bit Encrypted Session Word and 56-bit Injected Identifier Max. input rate for Session Words: 1 time per 10 seconds 10 times per 5 minutes **Important note**: Option BI operates exclusively with single stream operation	
DVB-S2 Baseband Frame Output: (Option BBO)	Instead of Transport Stream over ASI (SDD-TS, SDD-DV only) RTP/UDP IP over Ethernet, Jumbo Frames over GbE (SDD-IP, SDD-DV only)	
DVB-S2 CCSDS CADU Output: (Option CCSDS)	Streaming of CADU frames according to CCSDS blue book 131. 3-B -1 Automatic detection of CADU packet size RTP/UDP IP over Ethernet, Jumbo Frames over GbE, one CADU frame per IP packet (SDD-IP, SDD-DV only)	

Specifications continued next page

DVB-S2 Demodulator

SDD-IP / SDD-DV / SDD-TS

Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10/100 Mbps, auto sensing),IPv4, IPv6, connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10/100 Mbps, auto sensing), IPv4, IPv6,connector RJ-45
	Protocol: Connection:	Multipoint 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:	Alarm: two potential free contacts (DPDT), Connector DSUB09	
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, 2 function keys	
Mains Power Input:	100 … 240 V AC nominal, 90…264 V AC max, 50…60 Hz	
Mains Power Consumption:	Typ.: 35 VA / 25 W	
Mains Power Input Connector:	IEC C14	
Mains Fuse:	2 x 2 A time-lag fuse	
Dimension and Weight:	483 x 44 x 470 mm³ (WxHxD), 1 RU (19") approx. 5.5 kg	

Specifications are subject to change

Order Information:

SDD-[Device Type]-[Input Band Input Imp]-[Options]

Device Types:

IP	DVB-S2 IP Demodulator
DV	DaVid Technology Demodulator (switchable combination of TS and IP)
TS	DVB-S/S2 Transport Stream Demodulator

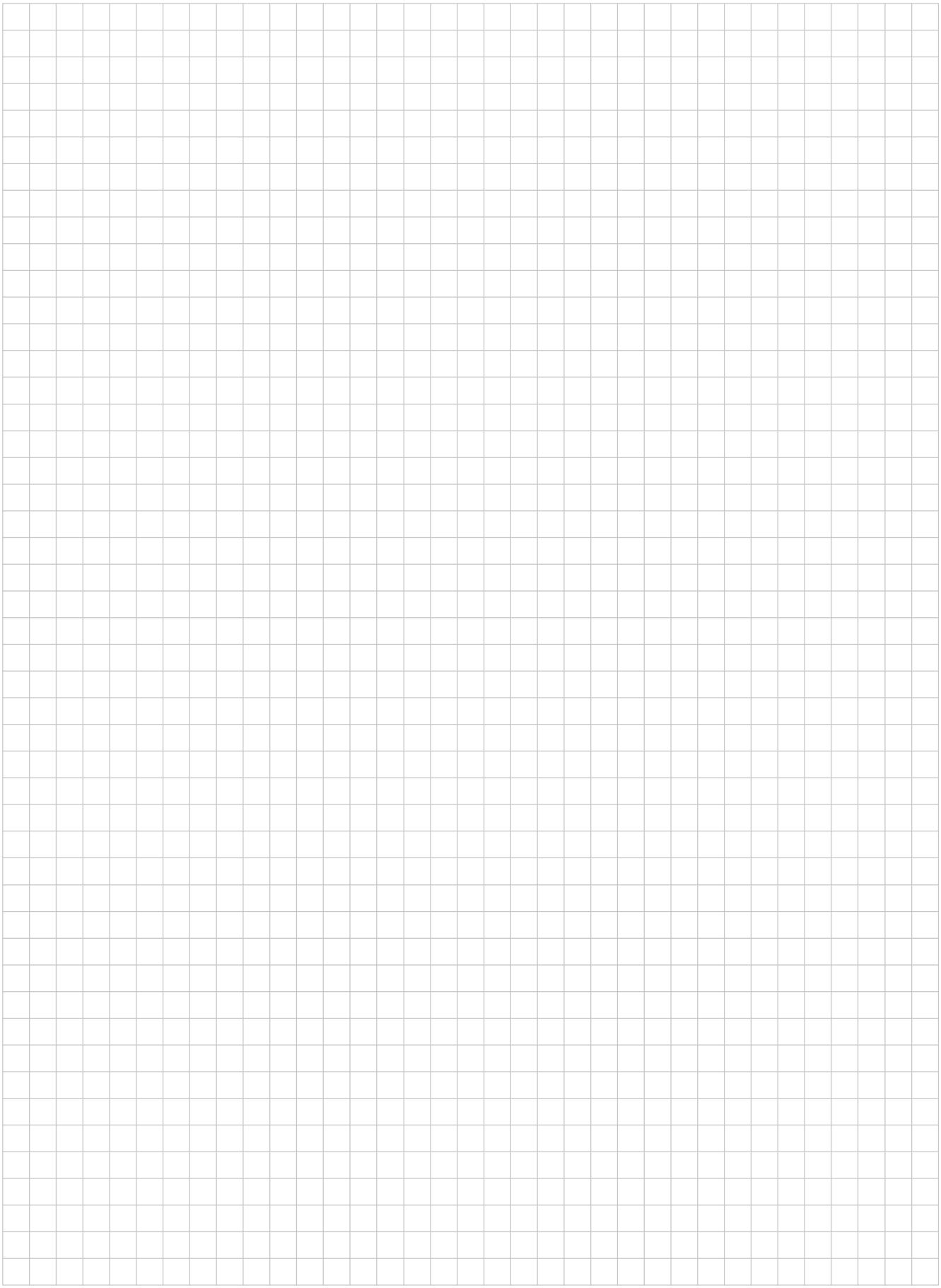
Possible Options are:		**Cannot be combined with:**	**Available for:**
BBO	Baseband frame output	-	SDD-IP, SDD-DV, SDD-TS
BI	BISS decryption	MT6	SDD-DV, SDD-TS
MT6	Support of 6 Multiple Transport Stream outputs	BI	SDD-DV, SDD-TS
S80	Support of symbol rates up to 80 Msps for 32APSK	-	SDD-IP, SDD-DV
CCSDS	Output of CCSDS CADU frames -	-	SDD-IP, SDD-DV

Examples:

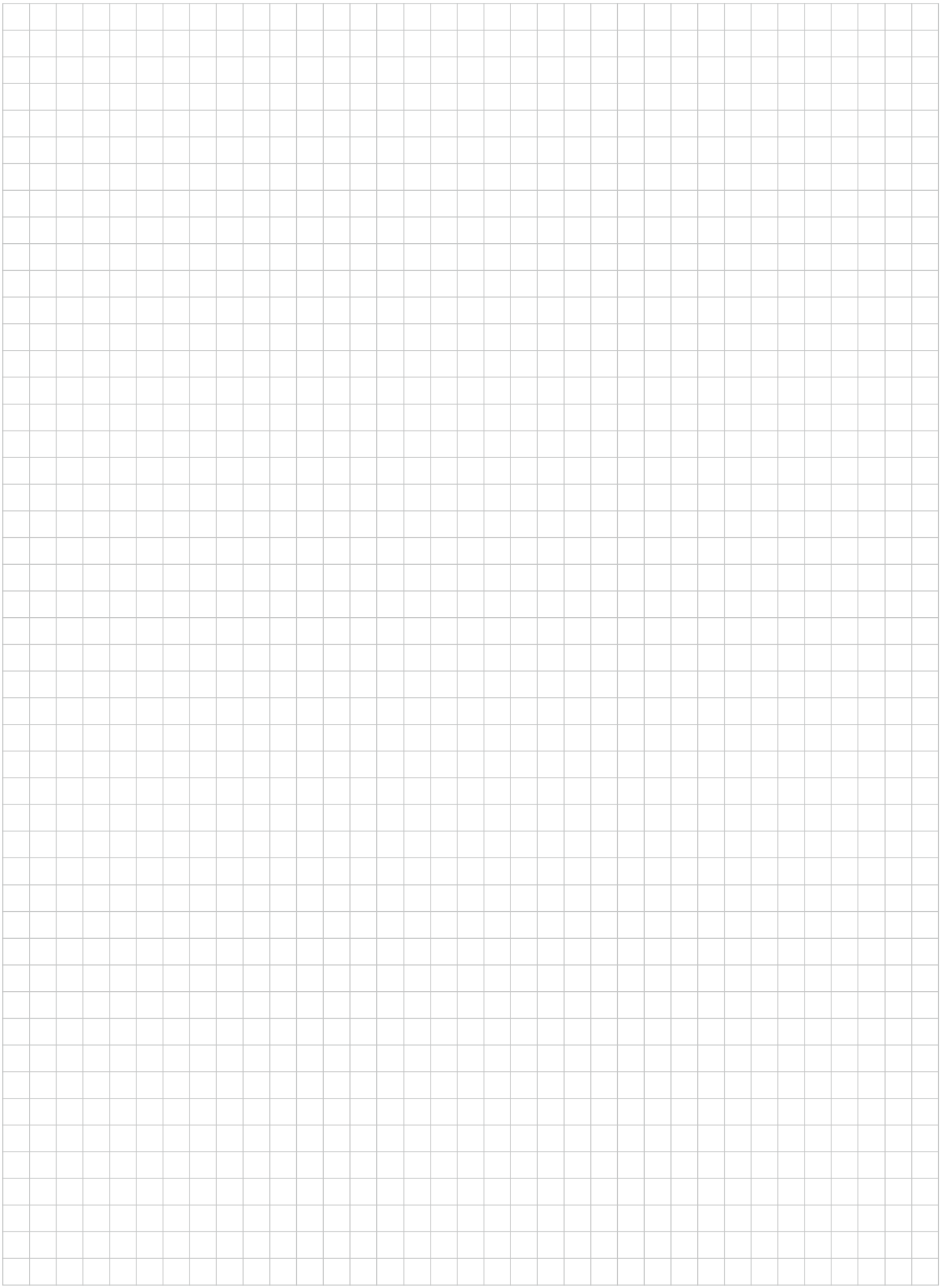
SDD-TS-L75	DVB-S/S2 TS Demodulator with L-band Input 75 Ω
SDD-IP-L75	DVB-S2 IP Demodulator with L-band Input 75 Ω
SDD-IP-V75/L75	DVB-S2 IP Demodulator with VHF-band and L-band Input
SDD-DV-V50/L75-BBO	DVB-S2 DaVid Demodulator with VHF-band 50 Ω and L-band Input 75 Ω, Baseband Frame Output option

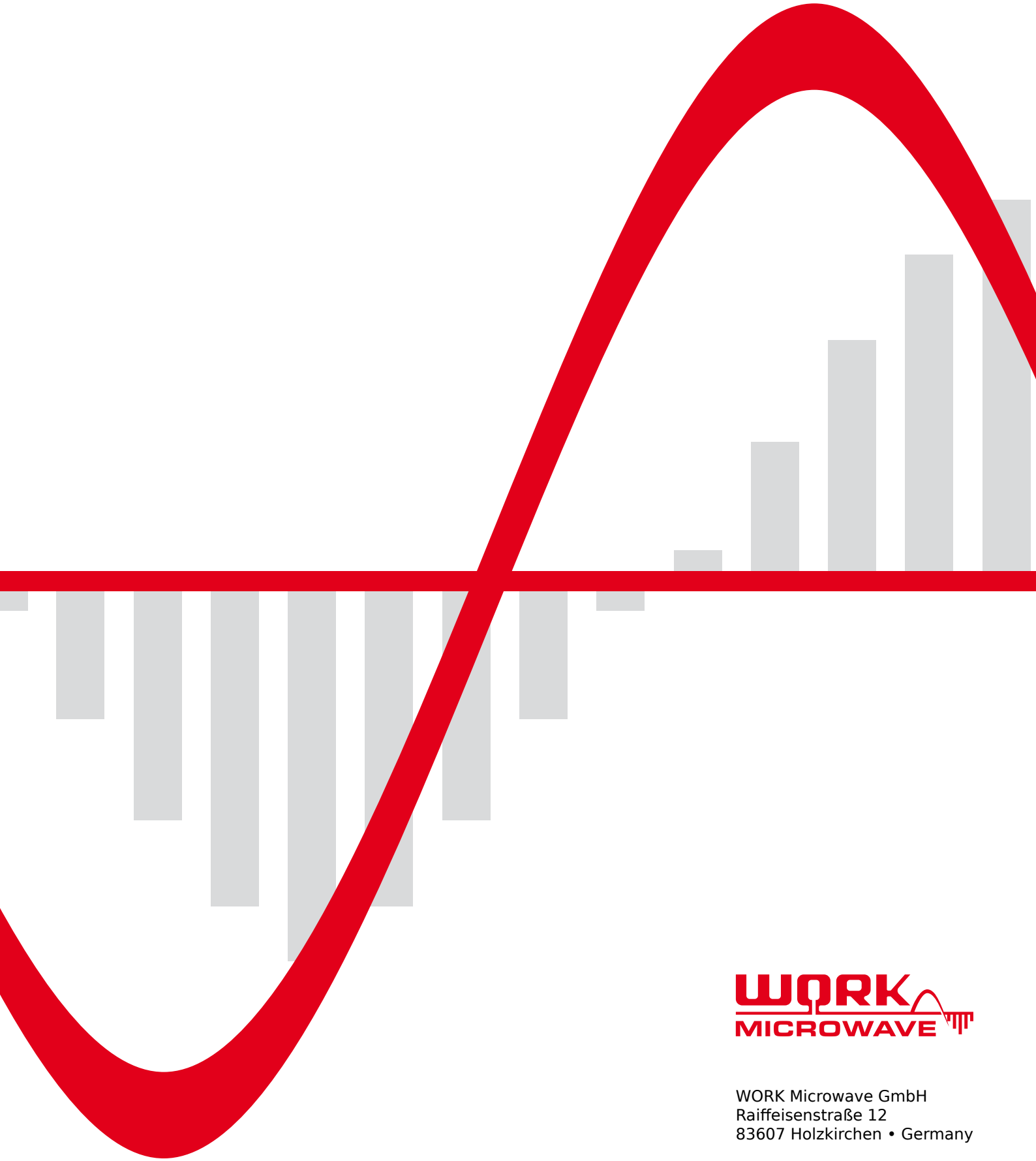
DVB
Digital Video
Broadcasting

Notes



Notes





WORK Microwave GmbH
Raiffeisenstraße 12
83607 Holzkirchen • Germany

Tel. +49 8024 6408 0
Fax +49 8024 6408 40

sales@work-microwave.com
www.work-microwave.com