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

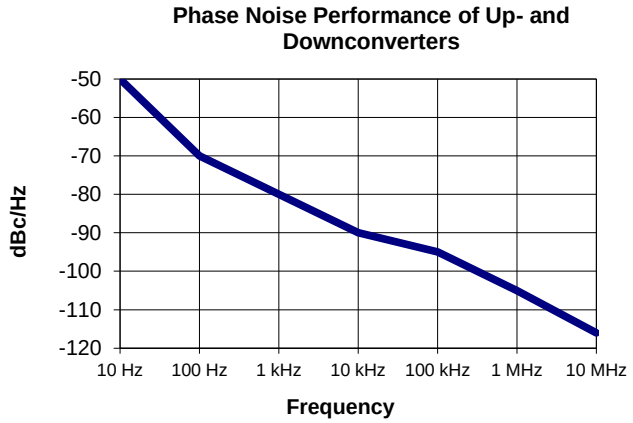
The converters normally are delivered without fans and can be operated in environments, where at minimum one RU space for natural ventilation is available above each unit. This eliminates the fan as potential point of failure. For rack installations without any space in between the units, a fan within 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-Ku4 / VSCU-Ku4	VHCU-Ku1 / VSCU-Ku1	VHCU-K / VSCU-K
RF-Output Frequency:		Ku-Band 12.75 … 14.50 GHz	Ku-Band 13.75 … 14.80 GHz	Ku-Band 10.70 … 12.75 GHz	K-Band 17.3 … 18.4 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	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**	-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	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
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	16.20 … 17.25 GHz (70 MHz IF) 16.19 … 17.24 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

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-Ka / VSCU-Ka	VHCU-Ka1 / VSCU-Ka1	VHCU-Ka2 / VSCU-Ka2	VHCU-Ka3 / VSCU-Ka3
RF-Output Frequency:		Ka-Band 27.5 … 31.0 GHz	Ka-Band 19.2 … 20.2 GHz	Ka-Band 17.7 … 19.5 GHz	Ka-Band 19.4 … 21.2 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	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**	-56 / -53	-61 / -58	-61 / -58	-56 / -53
	100 Hz	-73 / -70	-81 / -78	-81 / -78	-73 / -70
	1 kHz	-84 / -81	-91 / -88	-91 / -88	-84 / -81
	10 kHz	-90 / -87	-96 / -93	-96 / -93	-90 / -87
	100 kHz	-93 / -90[1)]	-98 / -95[1)]	-98 / -95[1)]	-93 / -90[1)]
	1 MHz	-103 / -100[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):		5240 MHz (70 MHz IF) 5240 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	2380 MHz (70 MHz IF) 2300 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)		32.67 … 36.17 GHz (70 MHz IF) 32.60 … 36.10 GHz (140 MHz IF) -7 ±3 dBm SMA female	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

Upconverter Type:		VHCU-Ka5 / VSCU-Ka5	VHCU-Ka21 / VSCU-Ka21		
RF-Output Frequency:		Ka-Band 29.0 … 32.0 GHz	Ka-Band 25.00 … 28.00 GHz		
Intermediate Frequency:		5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input	5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input		
Phase Noise:	**10 Hz**	-56 / -53	-56 / -53		
	100 Hz	-73 / -70	-73 / -70		
	1 kHz	-84 / -81	-84 / -81		
	10 kHz	-90 / -87	-90 / -87		
	100 kHz	-93 / -90[1)]	-93 / -90[1)]		
	1 MHz	-103 / -100[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):		5100 MHz (70 MHz IF) 4960 MHz (140 MHz IF) -6 ±3 dBm SMA female	5100 MHz (70 MHz IF) 4960 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)		19.83 … 22.83 GHz (70 MHz IF) 19.90 … 22.30 GHz (140 MHz IF) -7 ±3 dBm SMA female	19.83 … 22.83 GHz (70 MHz IF) 19.90 … 22.30 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: Impedance: Return loss: Operational input level: Maximum aggregate input level: IF-Connectors:	70 ±20 MHz or 140 ±40 MHz (optional: both → [IF-Band] = 70/140) 50 or 75 Ω > 20 dB -40 dBm[1)] +10 dBm (damage level) BNC female N female (standard with option OD)
RF-Output Characteristics:	Impedance: Return loss: 1 dB compression point: Output muting: RF-signal monitor: RF-connectors:	50 Ω > 20 dB > 10 dBm > 60 dB (by command or sense input or by alarm condition) -20 dB of RF-output (approx.) (indoor only, optional for outdoor) SMA female (standard) K female (-Ka standard) WR28 waveguide (-Ka with option WR28)
Transfer Characteristics:	Max. conversion gain: Attenuation range: Level stability: Gain flatness: Image rejection: Noise figure:	40 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)]
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: 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:	>18 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)] < -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-Ku2 / VSCD-Ku2
RF-Input Frequency:		C-Band 3.4 … 4.8 GHz	X-Band 7.25 … 7.75 GHz	Ku-Band 10.70 … 12.75 GHz	Ku-Band 13.75 … 14.80 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 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):		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	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)		8.57 … 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	16.20 … 17.25 GHz (70 MHz IF) 16.19 … 17.24 GHz (140 MHz IF) -7 ±3 dBm SMA female

Downconverter Type:		VHCD-Ka / VSCD-Ka	VHCD-Ka2 / VSCD-Ka2	VHCD-Ka3 / VSCD-Ka3	VHCD-Ka4 / VSCD-Ka4
RF-Input Frequency:		Ka-Band 18.1 … 21.2 GHz	Ka-Band 17.7 … 19.5 GHz	Ka-Band 19.4 … 21.2 GHz	Ka-Band 27.5 … 31 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	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
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, Connector SMA female	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
Microwave Oscillator with Test Output (indoor only, optional for outdoor): (LO > 20 GHz = LO/2 on Test Output)		15.65 … 18.75 GHz (70 MHz IF) 15.66 … 18.76 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	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 Downconverter

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

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

Downconverter Type:		**VHCD-Ka7 / VSCD-Ka7**	**VHCD-Ka21 / VSCD-Ka21**		
RF-Input Frequency:		Ka-Band 25.5 … 27.5 GHz	Ka-Band 25.00 … 28.00 GHz		
Intermediate Frequency:		2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input		
Phase Noise:	**10 Hz**	-57 / -54	-56 / -53		
	100 Hz	-77 / -74	-73 / -70		
	1 kHz	-87 / -84	-84 / -81		
	10 kHz	-92 / -89	-90 / -87		
	100 kHz	-94 / -91[1)]	-93 / -90[1)]		
	1 MHz	-104 / -101[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 (140MHz IF) -6 ±3 dBm SMA female	5100 MHz (70 MHz IF) 4960 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)		23.05 … 25.05 GHz (70 MHz IF) 23.06 … 25.06 GHz (140 MHz IF) -7 ±3 dBm SMA female	19.83 … 22.83 GHz (70 MHz IF) 19.90 … 22.30 GHz (140 MHz IF) -7 ±3 dBm SMA female		

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