Synthesized Block Up- and Downconverter

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

The satellite up- and downconverters developed and manufactured by WORK Microwave are designed to meet the requirements of modern satellite transmission, like TV uplink and high speed data networks. Analogue transmission formats are supported as well as digital transmission formats. For many years these devices have been used worldwide in fixed satellite earth stations as well as in satellite news gathering (SNG) vehicles and Fly-Aways and other mobile or portable applications. These kind of converters have been built for more than 1200 times so far. Customers worldwide appreciate their reliability and high level of quality.

4th Generation – still better

The 4th generation, based on our experience and skill, is still better. The synthesizer and oscillator portion in every satellite converter is the most important component because it decides the converter's reliability. For many years WORK Microwave has been developing and manufacturing high sophisticated microwave oscillators and synthesizers which are used in our converter series as well. The new design allows us to reduce the number of components by more than 30%. In addition, significant improvements have been made on circuit design.

This design results in an AC power consumption of typically 35 VA / 27 W. This leads to an even higher reliability and longer life time.

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 very wide temperature range.

Block Converter with frequency synthesizer

In contrast to block converters with fixed or switch able LO these converters include a tunable LO with 10 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 1 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, which forces an airflow from the right side to left side of the units.

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 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.

Specials and OEM products

WORK Microwave is specialized to offer custom tailored products. More than 40% of our converters are sold as OEM products with our customer's brand name and logo on it.

We offer specials 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, Ka-Band (28GHz) version is under development.
- Customized M&C interface and control syntax.
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity).

Key features

- Extreme low power consumption maximum 35 VA / 27 W (single band unit) 37 VA / 29 W (triple band units)
- Extreme low phase noise (< -50 dBc/Hz @ 10 Hz)
- Long- term stability 10^{-7} / year
- Output power +10 dBm (1dB compression point)
- Low spurious emissions < - 80 dBm at full gain (high performance series)
- Automatic reference recognition (5 and 10 MHz)
- Digital gain compensation
- Operating temperature range either –30 °C to 60 °C (-22 °F to 140 °F) or 0°C to 50 °C (32 °F to 122 °F)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface, SNMP (MIBs are provided).
- Packet command syntax supports RS485 bus systems and allows addressed operation.
- RF test output on the front panel (upconverter only)
- 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**

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). So if you only need units for inside use, the standard unit is perfectly suited for this application and it is significant cheaper.

Open questions, demo units

If you need more information about WORK Microwave's 4th satellite converter generation or if you would like to have demo unit, please contact us via e-mail: sales@work-microwave.de or call us. We are glad to assist you.

Synthesized Block Upconverter
Indoor Version

Single Band Synthesized Block Upconverter, L-Band Input
S-Type (standard version), H-Type (extended temperature range)

Upconverter Type:		HSBU-Ku1 / SSBU-Ku1	HSBU-Ku2 / SSBU-Ku2	HSBU-Ku-2-S002 / SSBU-Ku-2-S002		
RF-Output Frequency:		Ku-Band 12.75…13.25 GHz	Ku-Band 13.75…14.5 GHz	K-Band 10.70 …11.80 GHz 11.65 …12.75 GHz (automatically switched)		
RF-Output Return Loss:		> 20 dB	> 20 dB	> 20 dB		
LO-Frequency:		11.8 ... 11.95 GHz 10 Hz steps	12.3 ... 12.75 GHz 10 Hz steps	9.2 ... 11.1 GHz 10 Hz steps		
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]		
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.			
Input Frequency:		0.95 … 1.45 GHz	1.0 ... 1.75 GHz (1,45 .. 1.75 GHz)	1.5 ... 1.65 GHz		
Conversion Scheme:		Single up-conversion, no frequency inversion				

Upconverter Type:		HSBU-K / SSBU-K	HSBU-K1 / SSBU-K1	HSBU-K-2 / SSBU-K-2		
RF-Output Frequency:		K-Band 17.3…18.4 GHz	K-Band 17.3…18.1 GHz	K-Band 17.3…18.1 GHz 17.6…18.4 GHz (automatically switched)		
RF-Output Return Loss:		> 17 dB	> 17 dB	> 17 dB		
LO-Frequency:		15.85…16.65 GHz, 10 Hz steps	16.05…16.35 GHz, 10 Hz steps	16,05…16.65 GHz, 10 Hz steps		
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]		
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.			
Input Frequency:		1.45 … 1.75 GHz	1.25 … 1.75 GHz	1.25 … 1.75 GHz		
Conversion Scheme:		Single up-conversion, no frequency inversion				

Upconverter Type:		HSBU-Ka-2-S001 / SSBU-Ka-2-S001	HSBU-Ka8 / SSBU-Ka8	HSBU-Ka9 / SSBU-Ka9	HSBU-Ka12 / SSBU-Ka12	
RF-Output Frequency:		Ka-Band 17.7…19.5 GHz 19.4…21.2 GHz (automatically switched)	Ka-Band 22.55 … 23.15 GHz	Ka-Band 26.3 … 26.7 GHz	Ka-Band 27.5 … 28.25 GHz	
RF-Output Return Loss:		> 17 dB	> 17 dB	> 17 dB	> 17 dB	
LO-Frequency:		15.2…18.7 GHz, 10 Hz steps	21.55 GHz fixed	25.3 GHz fixed	26.5 GHz fixed	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101	
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.			
Input Frequency:		2.45 … 2.55 GHz	1.0 … 1.6 GHz	1.0 … 1.4 GHz	1.0 ... 1.75 GHz	
Conversion Scheme:		Single up-conversion, no frequency inversion				

Specifications continued next page

Synthesized Block Upconverter
Indoor Version

Single Band Synthesized Block Upconverter, L-Band Input
S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Upconverter Type:	HSBU-Ka4 / SSBU-Ka4					
RF-Output Frequency:	Ka-Band 27.5 ... 31.0 GHz					
RF-Output Return Loss:	> 17 dB					
Phase Noise: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 46 - 66 - 76 - 86 - 91 - 101					
	max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
LO2-Frequency:	36.2 .. 39.0 GHz 10 Hz steps					
Intermediate Frequency:	8.0 … 8.7 GHz					
LO1-Frequency::	9.7 GHz					
Input-Frequency:	1.0 … 1.7 GHz					
Conversion Scheme:	Dual up-conversion, no frequency inversion					

IF-Input Characteristics:	Impedance: Return Loss: IF-Connectors:	50 Ω >15 dB SMA female
RF-Output Characteristics:	Impedance: 1 dB Compression Point: Output Muting: RF-Connectors:	50 Ω > 10 dBm (standard) > 20 dBm (for HSBU-Ku-2-S002 / SSBU-Ku-2-S002) > 13 dBm (for HSBU-Ka-2-S001 / SSBU-Ka-2-S001) >70 dB (by command or sense input or by alarm condition) SMA female (Standard) K-female (RF Output > 22 GHz)
Transfer Characteristics:	Conversion Gain: Attenuation Range: Gain Variation over Temp.: Gain Flatness over Freq.: Gain Flatness over 40 MHz: Gain Stability: Image Rejection: Noise Figure:	30 dB (standard) 40 dB (HSBU/SSBU-Ku-2-S002) 20 dB (HSBU/SSBU Ka4, HSBU/SSBU Ka8) 0…20 dB, 0.1 dB steps (0 dB for HSBU-Ka-2-S001 / SSBU-Ka-2-S001) ± 1 dB max ± 1.5 dB max. over band (C, X or Ku) ± 0.5 dB ± 0.25 dB >80 dB <15 dB
Intermodulation (3rd Order):	-36 dBc max (delta f_{in} : 5 MHz, P_{in}: 2 x -20 dBm, P_{out}: 2 x 0 dBm) (standard) -36 dBc max (delta f_{in} : 5 MHz, P_{in}: 2 x -10 dBm, P_{out}: 2 x 10 dBm) (for HSBU-Ku-2-S002 / SSBU-Ku-2-S002) -36 dBc max (delta f_{in} : 5 MHz, P_{in}: 2 x -7 dBm, P_{out}: 2 x 3 dBm) (for HSBU-Ka-2-S001 / SSBU-Ka-2-S001)	
AM / PM conversion:	0.1 ° / dB (P_{out} = 0 dBm)	
Group Delay (within frequency band):	Flat, Ripple:	1 ns peak to peak max.
Spurious Outputs:	Signal related: Signal independent:	< - 60 dBc (Δf < 1 MHz), < -70 dBc (Δf ≥ 1 MHz) < - 70 dBm (standard) < - 60 dBm (for HSBU-Ku-2-S002 / SSBU-Ku-2-S002)
Frequency Stability:	± 1 x 10^{-7}, 0°C to 50°C ± 2 x 10^{-8}, 0°C to 50°C (after 30 min warm up) ± 1.5 x 10^{-9} per day (fixed temperature after 24 h warm up)	

Specifications continued next page

Synthesized Block Upconverter
Indoor Version

Single Band Synthesized Block Upconverter, L-Band Input
S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Reference Input:	Frequency: Level: Modes: Connector:	10 MHz or 5 MHz -3…10 dBm internal, external, auto (senses reference input) BNC female
Reference Output:	Frequency: Level: Connector:	10 MHz 0 ± 3 dBm BNC female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
Alarm Interface: **Mute Input:**	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09 female	
Temperature Range:	HCU : -30°C to 60°C operating (10 minutes warm up at -30°C) SCU: 0°C to 50°C operating, - 30°C to 80°C storage	
Relative Humidity:	< 95 % non condensing	
User Interface:	SCU: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HCU: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys	
Power Supply:	85…264 V AC, 40…70 Hz	
Power Consumption:	Max: 33 VA / 20 W, Typ: 29 VA / 18 W	
Mains Fuse:	2 x 3.15 A time-lag fuse	
Dimension and Weight:	483 x 44 x 500 mm³, 1 RU (19"), appr. 8.4 kg	

Specifications are subject to change

Order Information:

HSBU-[RF Band]-[Options] or
SSBU-[RF Band]-[Options]
Possible Options are: **FAN** (internal Fan)
VFD (VFD display, standard with HCU-type converters)

Example: SSBU-K-2

Synthesized Block Downconverter
Indoor Version

Single Band Synthesized Block Downconverter, L-Band Output
S-Type (standard version), H-Type (extended temperature range)

Downconverter Type:		HSBD-S / SSBD-S	HSBD-C / SSBD-C	HSBD-X / SSBD-X	HSBD-Ku / SSBD-Ku	HSBD-K / SSBD-K
RF-Input Frequency:		S-Band 2.4 … 2.7 GHz	C-Band 3.4 … 4.2 GHz	X-Band 7.25 … 8.4 GHz	Ku-Band 10.70 … 12.75 GHz	K-Band 17.3 … 18.4 GHz
RF-Input Return Loss:		> 20 dB	> 20 dB	> 20 dB	> 20 dB	> 17 dB
LO-Frequency:		3.65 GHz fixed	4.90 ... 5.15 GHz 10 Hz steps	6.3 ... 6.9 GHz 10 Hz steps	9.75 ... 11,3 GHz 10 Hz steps	16.35 ... 16.90 GHz 10 Hz steps
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 60 - 75 - 85 - 90 - 100 [1] - 112 [1]	- 55 - 75 - 85 - 95 - 100 [1] - 110 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.			
IF-Output Frequency:		0.95 … 1.25 GHz	0.95 … 1.5 GHz			
Conversion Scheme:		Single downconversion frequency inversion		Single downconversion no frequency inversion		

Downconverter Type:		HSBD-Ka / SSBD-Ka	HSBD-Ka6 / SSBD-Ka6	HSBD-Ka7 / SSBD-Ka7	HSBD-Ka13 / SSBD-Ka13
RF-Input Frequency:		Ka-Band 18.3 … 20.6 GHz (lower band) 19.7 … 22.0 GHz (upper band) (automatically switched)	Ka-Band 18.1 … 21.2GHz	Ka-Band 25.5 … 27.5GHz	Ka-Band 21.4 … 22.0GHz
RF-Input Return Loss:		> 17 dB	> 17 dB	> 17 dB	> 17 dB
LO-Frequency:		17.1 ... 20.0 GHz 10 Hz steps	17.15 … 19.45 GHz 10 Hz steps	24.55 … 25.75 GHz 10 Hz steps	20.25 GHz fix
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 47 - 67 - 77 - 87 - 92 [1] - 102 [1]	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.		
IF-Output Frequency:		1.2 … 2 GHz	0.95 .. 1.75 GHz	0.95 .. 1.75 GHz	1.15 .. 1.75 GHz
Conversion Scheme:		Single downconversion, no frequency inversion			

RF-Input Characteristics:	Impedance: Maximum Aggregate Input Level: LO Leakage: RF-Connector:	50 Ω < -25 dBm (operational) < + 10 dBm (damage level) -80 dBm max. SMA female (K-female for HSBD/SSBD Ka7)
IF-Output Characteristics:	Impedance: Return Loss: 1 dB Compression Point: Output Muting: IF-Connectors:	50 Ω > 20 dB > 17 dBm (> 10 dBm Ka-band) > 60 dB SMA female
Transfer Characteristics:	Conversion Gain: Attenuation Range: Gain Accuracy: Gain Flatness over 40 MHz: Image Rejection: Noise Figure:	40 dB (20 dB for HSBD/SSBD Ka7) 0…20 dB, 0.1 dB steps (with option VG) ± 1.5 dB (± 3 dB Ka-band) (0°C .. 50 °C) ± 0.25 dB >80 dB <15 dB <11 dB (Conversion Gain 40 dB)
Group Delay:	Flat, Ripple:	1 ns peak to peak max.
Intermodulation (3rd Order):	< -50 dBc (Δf_{in} : 5 MHz, $P_{out\ ges}$: < +8 dBm) OIP3: +30 dBm (> +20 dBm Ka-band)	
AM / PM conversion:	0.1 ° / dB (P_{out} = 0 dBm)	
Spurious Outputs:	Signal dependant: Signal independent: Spurious Reception:	< - 70 dBc (Pin < -50 dBm, S-Band) < - 55 dBc (< 100 kHz offset) < - 80 dBm < - 25 dBc
Frequency Stability:	± 1 x 10^{-7}, 0°C to 50°C ± 2 x 10^{-8}, 0°C to 50°C (after 10 min warm up) ± 1.5 x 10^{-9} per day (fixed temperature after 24 h warm up)	

Specifications continued next page

Synthesized Block Downconverter
Indoor Version

Single Band Synthesized Block Downconverter, L-Band Output
S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Reference Input:	Frequency: Level: Modes: Impedance: Connector:	10 MHz or 5 MHz -3…10 dBm internal, external, auto (senses reference input) 50 Ω BNC female
Reference Output:	Frequency: Level: Impedance: Connector:	10 MHz 0 ± 3 dBm 50 Ω BNC female
Test Output LO: **(Microwave Oscillator)**	Level: Impedance: Connector:	-7 ± 3 dBm 50 Ω SMA female
Monitoring and Control Interface:	Protocol: Connection:	SNMP UDP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	HTTP (web browser interface) TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
	Protocol: Connection:	Multipoint RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
Alarm Interface: **Mute Input:**	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09 female	
Temperature Range:	HSBD: -30°C to 60°C operating (10 minutes warm up at -30°C) SSBD: 0°C to 50°C operating - 30°C to 80°C storage	
Relative Humidity:	< 95 % non condensing	
User Interface:	SSBD: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HSBD: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys	
Power Input:	85…264 V AC, 40...70 Hz / Max: 33 VA / 20 W, Typ: 29 VA / 18 W	
Dimension and Weight:	483 x 44 x 500 mm³, 1 RU (19"), appr. 8.2 kg	

Specifications are subject to change

Order Information: **HSBD-[RF Band]-[Options] or**
SSBD-[RF Band]-[Options]

Possible Options are:
FAN (internal Fan)
VFD (VFD display, standard with HCU-type converters)
VG (variable Gain)
OD (Outdoor unit)

Example: SSBD-Ku-VG

Synthesized Block Up- and Downconverter Outdoor Version

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

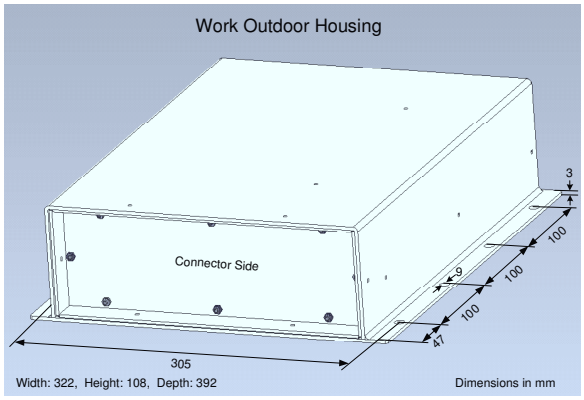
Ka-band model

These upconverters accepts input signals at L-band or Ku-band and provide output signals up to Ka-band (27.5 ... 31 GHz), where the usable bandwidth of up to 1600 MHz can be adjusted by a synthesized LO within the overall wide frequency range.

This design allows high flexibility for multicarrier earth station operation, while supporting an optimized wide bandwith and providing excellent spurious and intermodulation behavior.

The converter units can be mounted close by to outdoor HPAs. A waveguide interface is available for output signals in Ka-band.

For remote control a remote control unit is available.



Key features

- Input frequency: L-band or Ku-band
- Synthesized LO allows band selection with typically 50 MHz step size, to adjust usable output frequency range
- Output power +5 dBm or +10dBm (1dB compress. point)
- L-band, Ku-band input: SMA connector
- Standard output: SMA
- Ka-band output: Waveguide connection or K
- Digital gain compensation
- Reference input 5 or 10 MHz autosensing (Option)
- Operating temperature range –30°C to 60°C (-22°F to 140°F), storage temperature –50°C to 80°C (-58°F to 140°F)
- Remote control through RS232 and RS422/485 (2-wire or 4-wire bus) interfaces
- Packet command syntax supports RS485 bus systems and allows addressed operation
- Summary alarm output (dual change over switch contacts) and transmit mute input
- IP 67 protected housing
- CE compliant
- **3 years warranty**

Synthesized Block Upconverter
Outdoor Version

Single Band Synthesized Block Upconverter, L-Band Input (Ku-band Input)
S-Type (standard version), H-Type (extended temperature range)

Upconverter Type:		HSBU-K-OD / SSBU-K-OD	HSBU-K1-OD / SSBU-K1-OD	HSBU-K-2-OD / SSBU-K-2-OD	**Other bands**
RF-Output Frequency:		K-Band 17.3…18.4 GHz	K-Band 17.3…18.1 GHz	K-Band 17.3…18.1 GHz 17.6…18.4 GHz (automatically switched)	available on request as for HSBU / SSBU Indoor units
RF-Output Return Loss:		> 17 dB	> 17 dB	> 17 dB	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	- 50 - 70 - 80 - 90 - 95 [1] - 105 [1]	
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.		
LO-Frequency:		15.85…16.65 GHz, 10 Hz steps	16.05…16.35 GHz, 10 Hz steps	16,05…16.65 GHz, 10 Hz steps	
Input-Frequency:		1.45 … 1.75 GHz	1.25 … 1.75 GHz	1.25 … 1.75 GHz	
Conversion Scheme:		Single up-conversion, no frequency inversion			

Upconverter Type:		HSBU-Ka4-OD	HSBU-Ka1-OD	HSBU-Ka12-OD / SSBU-Ka12-OD	HSBU-Ka-OD-Ku
RF-Output Frequency:		Ka-Band 27.5 ... 31.0 GHz	Ka-Band 27.5 ... 28.6 GHz	Ka-Band 27.5 … 28.25 GHz	Ka-Band 27.5 ... 30.0 GHz
RF-Output Return Loss:		> 17 dB	> 17 dB	> 17 dB	> 18 dB
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101	- 47 - 67 - 77 - 87 - 92 - 102
		max. values in dBc/ Hz	[1] 0°C to 50°C, outside this temperature range degraded by max 5 dB.		
LO2-Frequency:		36.2 .. 39.0 GHz 10 Hz steps	26.05 .. 26.85 GH 10 Hz steps z	26.5 GHz fixed	15.7 .. 16.6 GHz 10 Hz steps
Intermediate Frequency:		8.0 … 8.7 GHz	-	-	-
LO1-Frequency::		9.7 GHz	-	-	-
Input-Frequency:		1.0 … 1.7 GHz	1.45 …1.75 GHz	1.0 ... 1.75 GHz	11.8 … 13.4 GHz
Conversion Scheme:		Dual up-conversion, no frequency inversion	Single up-conversion, no frequency inversion		

IF-Input Characteristics:	Impedance: Return Loss: Connector Type::	50 Ω > 15 dB SMA female
RF-Output Characteristics:	Connection Type: 1 dB Gain Compression Point: Output Muting:	SMA female (Standard) Waveguide WR28, Flange PBR320, Threads M3 (RF Output > 26.5 GHz) K female (RF Output > 22 GHz, RF Output > 26.5 GHz Option K) > 5 dBm > 10 dBm (HSBU-Ka4-OD) > 60 dB (by command or sense input or by alarm condition)
Transfer Characteristics:	Conversion Gain: Attenuation Range: Gain Accuracy: Level Stability: Amplitude Response: Image Rejection: Noise Figure:	30 dB (Standard) 20 dB (HSBU-Ka-OD-Ku, HSBU-Ka4-OD, HSBU-Ka12-OD) 0 ... 20 dB, 0.1 dB steps (HSBU-Ka-OD, HSBU-Ka1-OD, HSBU-Ka4-OD, HSBU-Ka12-OD) fixed gain (HSBU-Ka-OD-Ku) ± 1.5 dB ± 0.25 dB/day (constant temperature) ± 0.25 dB / ±20 MHz > 80 dB < 15 dB
Group Delay (± 36 MHz):	Ripple:	1 ns peak to peak max. 1.5 ns peak to peak max (HSBU-Ka1-OD, HSBU-Ka12-OD)
Intermodulation (3rd Order):	-36 dBc max (delta f: 5 MHz, P_{out}: 2 x 0 dBm)	
Spurious Outputs:	Signal related: Signal independent:	< - 60 dBc < - 70 dBm
Frequency Stability:	± 1 x 10^{-7}, 0°C to 50°C ± 2 x 10^{-8}, 0°C to 50°C (after 30 min warm up) ± 1.5 x 10^{-9} per day (fixed temperature after 24 h warm up)	

Specifications continued next page

Synthesized Block Upconverter
Outdoor Version

Single Band Synthesized Block Upconverter, L-Band Input (Ku-band Input)
S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Reference Input (Option RIN):	Frequency: 10 MHz or 5 MHz Level: -3 …10 dBm Modes: internal, external, auto (senses reference input) Connector: SMA female
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:	HCU : -30°C to 60°C operating (10 minutes warm up at -30°C) -30°C to 80°C storage
Relative Humidity:	100 %
Power Supply:	85…264 V AC, 40…70 Hz
Power Consumption:	Max: 40 VA / 25 W Typ: 30 VA / 20 W (single converters)
Mains Power Input:	Amphenol: C16-1 male
Dimension and Weight:	390 x 102 x 320 mm³ appr. 8.4 kg
Degree of Protection:	IP 67 (acc. IEC 529)

Specifications are subject to change

Order Information:

HSBU-Ka-OD-[Options] or **HSBU-Ka1-OD-[Options]** L-Ka Band Converter
HSBU-Ka-OD-Ku-[Options] Ku-Ka Band Converter

Possible Options are: **RIN** (external Reference Input)
K (RF Output K Connector instead of Waveguide)

Examples:
HSBU-Ka-OD-Ku-RIN

Synthesized Block Downconverter

Outdoor Version

Single Band Synthesized Block Downconverter, L-Band Output
S-Type (standard version), H-Type (extended temperature range)

Downconverter Type:	HSBD-Ku-OD / SSBD-Ku-OD	**Other bands**	HSBD-Ka7-OD / SSBD-Ka7-OD	HSBD-Ka13-OD / SSBD-Ka13-OD
RF-Input Frequency:	Ku-Band 10.70 … 12.75 GHz	available on request as for HSBU / SSBU Indoor units	Ka-Band 25.5 … 27.5GHz	Ka-Band 21.4 … 22.0GHz
RF-Input Return Loss:	> 20 dB		> 17 dB	> 17 dB
LO-Frequency:	9.75 ... 11,3 GHz 10 Hz steps		24.55 … 25.75 GHz 10 Hz steps	20.25 GHz fixed
Phase Noise: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 [1)] - 105 [1)]		- 46 - 66 - 76 - 86 - 91 - 101	- 46 - 66 - 76 - 86 - 91 - 101
	max. values in dBc/ Hz	[1)] 0°C to 50°C, outside this temperature range degraded by max 5 dB.		
IF-Output Frequency:	0.95 … 1.5 GHz		0.95 .. 1.75 GHz	1.15 .. 1.75 GHz
Conversion Scheme:	Single downconversion, no frequency inversion			
RF-Input Characteristics:	Impedance: 50 Ω Maximum Aggregate Input Level: < -25 dBm (operational) < + 10 dBm (damage level) LO Leakage: -80 dBm max. RF-Connector: SMA female (Standard) K female (Input frequency > 22 GHz)			
IF-Output Characteristics:	Impedance: 50 Ω 1 dB Compression Point: > 10 dBm Output Muting: > 60 dB IF-Connectors: SMA female			
Transfer Characteristics:	Conversion Gain: 40 dB (Standard) 20 dB (HSBD/SSBD Ka7) Attenuation Range: 0…20 dB, 0.1 dB steps Gain Accuracy: ± 2 dB (0°C .. 50 °C) Gain Flatness over 40 MHz: ± 0.25 dB Image Rejection: >80 dB Noise Figure: <15 dB			
Group Delay:	Flat, Ripple: 1.5 ns peak to peak max.			
Intermodulation (3rd Order):	< -50 dBc (Δf_{in} : 5 MHz, $P_{out\ ges}$: < +8 dBm) OIP3: +30 dBm (> +20 dBm Ka-band)			
AM / PM conversion:	0.1 ° / dB (P_{out} = 0 dBm)			
Spurious Outputs:	Signal dependant: < - 70 dBc (Pin < -50 dBm, S-Band) < - 55 dBc (< 100 kHz offset) Signal independent: < - 80 dBm			
Frequency Stability:	± 1 x 10^{-7}, 0°C to 50°C ± 2 x 10^{-8}, 0°C to 50°C (after 10 min warm up) ± 1.5 x 10^{-9} per day (fixed temperature after 24 h warm up)			
Reference Input (Option RIN):	Frequency: 10 MHz or 5 MHz Level: -3…10 dBm Modes: internal, external, auto (senses reference input) Impedance: 50 Ω Connector: SMA female			
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:	HCU : -30°C to 60°C operating (10 minutes warm up at -30°C) -30°C to 80°C storage			
Relative Humidity:	100 %			
Power Supply:	85…264 V AC, 40…70 Hz			
Power Consumption:	Max: 40 VA / 25 W Typ: 30 VA / 20 W (single converters)			
Mains Power Input:	Amphenol: C16-1 male			
Dimension and Weight:	390 x 102 x 320 mm³ appr. 8.4 kg			
Degree of Protection:	IP 67 (acc. IEC 529)			

Specifications are subject to change

Order Information: **HSBD-Ka7-OD-[Options]** or **HSBDU-Ka7-OD-[Options]** Ka-L Band Converter

Possible Options are: **RIN** (external Reference Input)

Examples:
HSBD-Ka13-OD-RIN