

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 switchable 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 a 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.

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, 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 (1 dB 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. 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 (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.

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	HSBU-Ku4 SSBU-Ku4	HSBU2-Ku2Ku4 SSBU2-Ku2Ku4
RF-Output Frequency:	Ku-Band 12.75...13.25 GHz	Ku-Band 13.75...14.5 GHz	Ku-Band 10.70 ...11.80 GHz 11.65 ...12.75 GHz (automatically switched)	Ku-Band 12.9...13.5 GHz	Ku-Band 13.75 ...14.5 GHz (Ku2) 12.9 ...13.5 GHz (Ku4) (automatically switched)
RF-Output Return Loss:	> 20 dB	> 20 dB	> 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	11.95 GHz	12.8 GHz (Ku2) 11.95 GHz (Ku4)
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	-50 -70 -80 -80 -90 -95 ¹⁾ -105 ¹⁾	-50 -70 -80 -80 -90 -95 ¹⁾ -105 ¹⁾	-50 -70 -80 -80 -90 -95 ¹⁾ -105 ¹⁾	-50 -70 -80 -80 -90 -95 ¹⁾ -105 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C ... 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	0.95...1.55 GHz	0.95...1.7 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 -80 -90 -95 ¹⁾ -105 ¹⁾	-50 -70 -80 -80 -90 -95 ¹⁾ -105 ¹⁾		
max. values in dBc/ Hz ¹⁾ 0°C ... 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 -86 -91 -105 ¹⁾	-46 -66 -76 -86 -91 -101	-46 -66 -76 -86 -91 -101	
max. values in dBc/ Hz ¹⁾ 0°C ... 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				

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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 ...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 >18 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...30 dB, 0.1 dB steps (Standard) 0 dB fixed gain (HSBU/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) -36 dBc max (delta f _{in} : 5 MHz, P _{in} : 2 x -10 dBm, P _{out} : 2 x 10 dBm) -36 dBc max (delta f _{in} : 5 MHz, P _{in} : 2 x -7 dBm, P _{out} : 2 x 3 dBm)	(standard) (for HSBU-Ku-2-S002 / SSBU-Ku-2-S002) (for HSBU-Ka-2-S001 / SSBU-Ka-2-S001)
AM / PM conversion:	0.1° / dB (P _{out} = 0 dBm)	
Group Delay (within frequency band):	Ripple, Slope:	< 2 ns peak to peak / 80 MHz
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 ... 50°C ± 2 x 10 ⁻⁸ , 0°C ... 50°C (after 30 min warm up) ± 1.5 x 10 ⁻⁹ per day (fixed temperature after 24 h warm up)	

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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: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Connector: BNC female
Reference Output:	Frequency: 10 MHz Level: 0 ± 3 dBm Connector: BNC female
Monitoring and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Multipoint Connection: 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:	HCU : -30°C ... 60°C operating (10 minutes warm up at -30°C) SCU: 0°C ... 50°C operating, - 30°C ... 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
Mains Power Input:	100 ... 240 V AC nominal, 90...264 V AC max, 50...60 Hz
Mains Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W
Mains Power Input Connector:	IEC C14
Mains Fuse:	2 x 3.15 A (or 2 A) time-lag fuse
Dimension and Weight:	483 x 44 x 505 mm ³ (WxHxD), 1 RU (19") approx. 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	-60	-55	-50	-50
	100 Hz	-75	-75	-70	-70
	1 kHz	-85	-85	-80	-80
	10 kHz	-90	-95	-90	-90
	100 kHz	-100 ¹⁾	-100 ¹⁾	-95 ¹⁾	-95 ¹⁾
1 MHz	-112 ¹⁾	-110 ¹⁾	-105 ¹⁾	-105 ¹⁾	-105 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C ... 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	-47	-46	-46
	100 Hz	-67	-66	-66
	1 kHz	-77	-76	-76
	10 kHz	-87	-86	-86
	100 kHz	-92 ¹⁾	-91	-91
1 MHz	-102 ¹⁾	-101	-101	-101
max. values in dBc/ Hz ¹⁾ 0°C ... 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: 50 Ω Maximum Aggregate Input Level: <-25 dBm (operational) <10 dBm (damage level) LO Leakage: <-80 dBm RF-Connector: SMA female (K-female for HSBD/SSBD Ka7)
IF-Output Characteristics:	Impedance: 50 Ω Return Loss: >20 dB 1 dB Compression Point: >17 dBm (> 10 dBm Ka-band) Output Muting: >60 dB IF-Connectors: SMA female
Transfer Characteristics:	Conversion Gain: 40 dB Standard 30 dB (HSBD/SSBD Ka13) 20 dB (HSBD/SSBD Ka7) Attenuation Range: 0...30 dB, 0.1 dB steps (Standard) Gain Accuracy: ±1.5 dB (± 3 dB Ka-band) (0°C ... 50°C) Gain Flatness over 40 MHz: ± 0.25 dB Image Rejection: >80 dB Noise Figure: <15 dB <11 dB (Conversion Gain 40 dB)
Group Delay:	Ripple, Slope: <2 ns peak to peak / 80 MHz
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 Spurious Reception: <-25 dBc
Frequency Stability:	± 1 x 10 ⁻⁷ 0°C ... 50°C ± 2 x 10 ⁻⁸ 0°C ... 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: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Impedance: 50 Ω Connector: BNC female
Reference Output:	Frequency: 10 MHz Level: 0 ± 3 dBm Impedance: 50 Ω Connector: BNC female
Test Output LO: (Microwave Oscillator)	Level: -7 ± 3 dBm Impedance: 50 Ω Connector: SMA female
Monitoring and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10 or 100 Mbps, auto sensing), connector RJ-45
	Protocol: Multipoint Connection: 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:	HSBD: -30°C ... 60°C operating (10 minutes warm up at -30°C) SSBD: 0°C ... 50°C operating -30°C ... 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
Mains Power Input:	100 ... 240 V AC nominal, 90...264 V AC max, 50...60 Hz
Mains Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W
Mains Power Input Connector:	IEC C14
Mains Fuse:	2 x 3.15 A (or 2 A) time-lag fuse
Dimension and Weight:	483 x 44 x 505 mm ³ (WxHxD), 1 RU (19") approx. 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



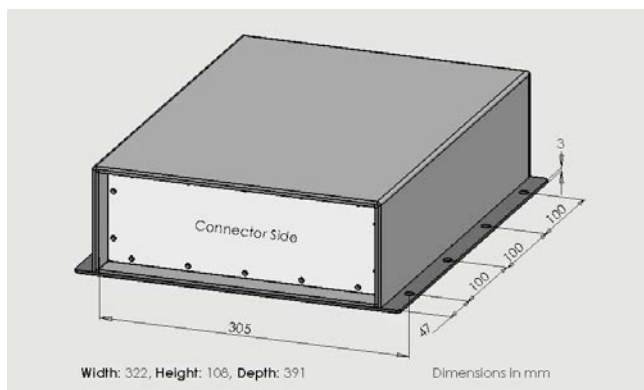
Ka-band model

These upconverters accept input signals at L-band or Ku-band and provide output signals up to Ka-band (27.5 ... 31 GHz). 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 bandwidth 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 10 Hz step size, to adjust the usable output frequency range
- Output power +5 dBm or +10dBm (1 dB compression 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⁾	
max. values in dBc/ Hz ¹⁾ 0°C ... 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	-47 -67 -77 -87 -92 -102
max. values in dBc/ Hz ¹⁾ 0°C ... 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 GHz 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 > 18 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) 0 ... 30 dB, 0.1 dB steps (Standard) 0 dB 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, Slope:	<2 ns peak to peak / 80 MHz
Intermodulation (3 rd 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 ... 50°C ± 2 x 10 ⁻⁸ , 0°C ... 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 ... 60°C operating (10 minutes warm up at -30°C) -30°C ... 80°C storage
Relative Humidity:	<100 %
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) Typ: 30 VA / 20 W (single converters)
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male
Dimension and Weight:	322 x 108 x 391 mm ³ (WxHxD) approx. 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 ... 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 RF-Connector: SMA female (Standard) K female (Input frequency > 18 GHz)			
IF-Output Characteristics:	Impedance: 50 Ω 1 dB Compression Point: >17 dBm Output Muting: >60 dB IF-Connectors: SMA female or N female			
Transfer Characteristics:	Conversion Gain: 40 dB (Standard) 30 dB (HSBD/SSBD Ka13) 20 dB (HSBD/SSBD Ka7) Attenuation Range: 0...30 dB, 0,1 dB steps (Standard) 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:	Ripple, Slope: <2 ns peak to peak / 80 MHz			
Intermodulation (3rd Order):	< -60 dBc (Δf_{in} : 5 MHz, P_{out} : < 2x 0 dBm, Att = 0 dB)			
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 ... 50°C ± 2 x 10 ⁻⁸ , 0°C ... 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 ... 60°C operating (10 minutes warm up at -30°C) -30°C ... 80°C storage			
Relative Humidity:	<100 %			
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) Typ: 30 VA / 20 W (single converters)			
Mains Power Input Connector:	Amphenol C16-1 (3+PE) male			
Dimension and Weight:	322 x 108 x 391 mm ³ (WxHxD) approx. 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